Submission to the Productivity Commission Schools Workforce Study

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Preamble

The Australian Association of Mathematics Teachers Inc., as the premier national organisation representing the interests of teachers of mathematics at all levels, from all sectors and jurisdictions, welcomes the opportunity to make a submission to this study. Our focus is on workforce issues as they relate to teachers and teaching of mathematics in schools. This is a small but important component of the overall study.

We argue that school mathematics has significant economic and social impact. At the macro level mathematics is seen to underpin global competitiveness; for individuals, numeracy levels at the end of schooling have been found to have major impact on future prosperity and well-being for individuals:

"(f)inding that young people who, as students, recognise the value of mathematics for their future success are more likely to achieve this success, and that includes being happy with many aspects of their personal lives as well as their futures and careers" (Thomson, S. and Hillman, K., p. 31[1])

It is anticipated that the Commission will encounter statements like "we need more qualified maths teachers in junior secondary and to get rid of out-of-field teachers[2]" and "primary teachers need to know more maths". Whilst both points of view have merit, AAMT would argue that effective responses need to be both realistic and sophisticated. Realism is needed because the first – shortage of secondary mathematics teachers – is unlikely to change in even the medium term. For the second – primary teachers, and, we would argue, out-of-field secondary teachers of mathematics – only a sophisticated response that goes beyond just 'quantity' of mathematics content is required.

AAMT's response considers particular questions posed in the Issues Paper.

From page 12 (re the COAG reform agenda)

Do the reforms, in train or in prospect, address the right issues?

The outline of the COAG education reform agenda highlights three areas on which AAMT comments:

National Curriculum

The AAMT has been and remains a strong supporter of the development and effective implementation of the *Australian Curriculum: Mathematics*. The logic for such a move at this time is overwhelming. In particular, for teachers of mathematics (and other subjects) the capacity to communicate with, learn from, share practices with colleagues around the country that is enabled by having a single curriculum has great potential to significantly enhance the teaching and learning of mathematics in Australia's schools.

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1 Thomson, S. & Hillman, K. (2010) *Against the odds: influences on the post-school success of 'low performers'* Report of the Longitudinal Studies of Australian Youth. Downloaded on 17 August 20011 from http://www.lsay.edu.au/publications/2285.html

2 This is the term used to describe teachers of subjects other than mathematics who are teaching the subject, without qualifications in mathematics appropriate to that task.

National teaching standards and AITSL

The AAMT has significant experience in the field of professional standards as a vehicle for codifying and measuring high quality performance[3]. Whilst it is early days for AITSL as the organisation set up to have carriage of professional standards, AAMT has expressed its reservations about the framework of the AITSL *National Standards for Teaching*. These include the:

- notion that there are four discrete career levels at which standards of teachers' knowledge and performance can be identified;
- inclusion of the 'lead' level in *teaching* standards – the characteristics are only likely to be able to be demonstrated by a person with a positional *leadership* role in the school, making the characteristics about leadership, not teaching.
- atomisation into 37 descriptions within the seven standards – this is a too fine-grained approach; and
- expectation that each of these 37 descriptions can sensibly be delineated at the four levels in ways that map progress.

In addition, AITSL's board is dominated by representatives of employers of teachers, with a danger that the implementation of the standards will be about compliance and regulation. These two factors lead to the possibility that the potential of professional teaching standards to guide and drive increased professionalism of teachers – and therefore their performance and that of their students – will not be realised.

Both these matters – the standards themselves and their implementation – are serious concerns for AAMT.

National Partnership Agreements

AAMT believes that the effect of this approach to funding for specific objectives has resulted in the funding 'pendulum' swinging too far towards the jurisdictions. There has been little money retained by the Commonwealth to fund initiatives that can provide national leadership of innovation in ways that complement the work of the jurisdictions.

From page 12 (re balancing supply and demand)

What are the key factors, whether across the board or specific to particular areas, that may contribute to current or future workforce shortages? Are all of these factors amenable to policy action?

AAMT's interest and concern relates to the shortages of appropriately qualified secondary mathematics teachers. AAMT first raised this matter with the Australian Education Council (Directors General of Education) in 1995. Some initiatives have been developed since then, but the sustained nature of the shortages suggests that these have been less than successful. Further, there seems to be nothing on the horizon that would suggest this situation will change in even the medium term.

There are two related issues that make it difficult to quantify the shortages of qualified mathematics teachers with the necessary certainty. The first is the lack of an agreed, national 'definition' of what are the appropriate qualifications for a mathematics teacher – an AAMT position on this matter, albeit developed and used for a different purpose, included at Appendix 1, may inform developments in this area. The second issue is obtaining clear and trustworthy data from education employers about who is teaching mathematics in our schools. AAMT, and our state and territory affiliates, often hear 'horror stories' along the lines that more than 50% of junior secondary classes in one state are being taken by people who are seen as other than a 'maths teacher'; and whole schools with only one or two appropriately qualified mathematics teachers. Yet these are at odds with statements from systems that virtually all classes are being taught by people 'who are qualified to teach mathematics.' AAMT believes these disconnections would be overcome by a common and agreed definition of what 'qualified' means, and systematic and impartial gathering of data on who is teaching mathematics. This should be able to be achieved through the national approach to teacher registration that is part of the AITSL agenda.

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[3] See, for example, Morony, W. (2009) "Effective Teachers of Mathematics" by Teachers, for Teachers. In Cai,J., Kaiser, G., Perry, B. & Wong, N. (Eds), *Effective Mathematics Teaching from Teachers' Perspectives: National and Cross-National Studies*. Sense: Rotterdam. Copy provided under separate cover.

Some of the factors that impinge on this shortage are generic in nature. These are the generally negative community attitudes to teaching and teachers. These are often fed by media treatment of education. Community attitudes to mathematics add another dimension in terms of supply of mathematics teachers. Whilst the subject is seen as 'important', many people, including parents, view it as acceptable to be 'no good at mathematics'. The issue of changing community attitudes to teaching, and to mathematics both require sustained, coordinated programs directed at different target audiences – students, parents and the wider community.

Some other factors are also evident. School guidance officers /course advisors can lack the knowledge or orientation that would encourage students to continue with mathematics studies suitable to their potential educational and vocational pathways. Some jurisdictions (e.g. ACT, SA) do not require students to study mathematics to year 12. University courses do not clearly specify mathematics pre-requisites. Provision of accurate pre-requisite information is fraught with difficulty. Following the Bradley review, universities are moving to a highly competitive model for student enrolment. Specifying pre-requisites reduces the pool of eligible students, but students are at a great disadvantage when they enrol in courses such as pre-service primary education without year 12 mathematics. At the very least, this will improve the overall quantitative understanding in the general community.

This set of attitudes has the effect of discouraging many otherwise able students from continuing in the higher level mathematics courses in the senior years of high school – as a result there is a decreased pool of students able to go on to further study in mathematics and related fields. The AAMT study *Maths? Why not?* (McPhan et al, 2006[4]) provides an analysis of these issues and recommendations to increase student uptake of higher level mathematics in the senior school. Graduates with sound mathematical skills are in demand, and this further diminishes the appeal of teaching as a career pathway.

Those graduates who do become qualified mathematics teachers often suffer from a lack of systematic effort to retain them in the profession. There has been a somewhat increased emphasis on mentoring early career teachers in recent years, but much more needs to be done in a systematic and coordinated way. Mentoring should not be seen as a cost, but rather as an investment in the future of the profession. Once teachers are established in the profession, rewards for teachers are generally focussed on salaries alone – a wider and more imaginative view of rewards such as professional opportunities, study leave and the like should also be considered as part of a package to keep mathematics teaching as an attractive career.

From page 14-15 (re training and professional development)

How effectively do pre-service training courses (and the national accreditation standards for such courses) meet the current and prospective needs of the education system and teachers? Do courses place sufficient emphasis on practicum?

AAMT believes that policy-makers need to be realistic about what pre-service teacher education can do well and what it cannot. The expectation that universities can graduate 'fully formed professional teachers' is simply unattainable, just as it is impossible to imagine that preservice primary teachers – who often do not have strong backgrounds in the subject from their secondary schooling – can learn all the mathematics they may be required to teach.

Universities can provide graduate teachers of mathematics (primary and secondary) with an appreciation of the field of teaching and its complexities; a basic 'pedagogical toolkit' that is linked to the ages of the students and the mathematics they will be teaching; frameworks for teaching and learning, and how to evaluate their own work and that of their students etc. But above all, teacher education courses should equip graduates with the capacity and the desire to continue to learn any mathematics they need to know (content knowledge), and develop their craft as a teacher of mathematics (mathematics-specific pedagogical knowledge). This may be the intention of the new national accreditation standards, but in practice these seem to carry expectations well beyond these basic building blocks.

[4] McPhan, G., Morony, W., Pegg, J., Cooksey, R., & Lynch, T. (2008). Maths? Why Not? Department of Education, Employment and Workplace Relations, Canberra.
http://www.dest.gov.au/sectors/school_education/publications_resources/profiles/maths_why_not

However, assuming that teacher education can be refocused in this way, it is important to re-engineer the whole system to support the ever-increasing knowledge and skills of teachers. This begins with a high quality initial mentoring program and continues with effective approaches to professional development both inside the school and beyond. Professional standards can play a pivotal role in the establishing these mechanisms that both support and challenge teachers throughout their careers. However, AAMT has reservations about the current approaches to teaching standards, as discussed above.

From page 14-15 (re training and professional development)

To what extent are employment-based pathways a complement to standard teaching courses? Are such pathways likely to be of a niche nature, or might they have wider applicability in the future?

AAMT notes that establishing employment-based pathways into teaching is industrially contentious. These pathways are established to provide alternative entry into teaching; therefore logic would suggest that the intention is to attract people who have not otherwise considered mathematics teaching as a career option by making the transition into teaching financially feasible.

Some of the people targeted in the Australian Government's *Teach Next* and other similar schemes will be so-called 'career changers'. Whether they come to teaching through an employment-based pathway or a traditional pre-service course, career-changing entrants to mathematics teaching such as engineers and scientists can bring valuable work and industry experience to their work in schools. This can enrich their teaching and that of their colleagues by enabling them to draw on more 'real world' applications of mathematics in their efforts to demonstrate to their students the usefulness and applicability of mathematics – this is established as an important motivator to many students' learning of the subject. Hence AAMT views career change entrants to mathematics teaching as a valuable addition to the workforce.

From page 14-15 (re training and professional development)

Is sufficient attention paid to professional development — not only for classroom teachers, but also principals and other school workers? What specific changes, beyond those already in prospect, would be appropriate?

Earlier comments highlight specific concerns about what 'is already in prospect' in relation to sufficient and effective professional development for teachers of mathematics. These are:

- Concerns about the usefulness and usability of the AITSL national teaching standards and the means for their implementation – AAMT is concerned that sub-optimal support and guidance of professional development of teachers of mathematics will be the outcome.
- The National Partnerships funding agreements mean that provision, either by the Australian Government or the jurisdictions, of effective professional development to support the implementation of the *Australian Curriculum: Mathematics* seems not to be able to be the priority the AAMT believes it should be. 'Lack of funding' is consistently given as the response to queries about the adequacy of provision.

AAMT believes that it is helpful to describe three broad groups of teachers of mathematics for the purposes of professional development – primary teachers; junior secondary (or middle years) teachers without a strong background in mathematics (the 'out-of-field' teachers); and qualified (senior)[5] secondary mathematics teachers.

The first and second groups are essentially on the same 'footing' in mathematics. They therefore have similar needs, and the ways of addressing these need to be similar, although their different teaching contexts need to be acknowledged. In very much the same ways as prospective teachers as described above, they need the skills and support to learn and understand the mathematics they need to know in order to teach it. The emphasis in professional development in mathematics needs to be on depth of understanding, with a focus on these teachers making connections between the

[5] Whilst some of these people work exclusively in junior secondary or middle schools due to arrangements of schooling in some jurisdictions (ACT, Tasmania, NT) or by choice, they are among the group with sufficiently strong backgrounds in mathematics that make them qualified to teach in the senior years.

mathematical ideas. They need to know and understand the underpinning principles as this is what provides a solid grounding for their teaching. Thinking about mathematics and their own learning in this way inevitably challenges many teachers' beliefs that mathematics is merely about 'doing sums' – teachers' capacity and confidence in teaching mathematics improve as they develop this richer view of the subject itself.

This approach to these teachers inservice professional learning is substantially different from one of providing them with more content knowledge that is largely disconnected from their work as teachers, in the hope that they will build for themselves the sorts of sustaining frameworks for teaching outlined above.

Many teachers in the first and second groups also need professional development to expand their repertoires of teaching practices. In part, their expanded views of the subject and how it is learnt will often enable them to draw on their teaching skills in other subjects and adapt these to their teaching of mathematics. However, pedagogies specific to mathematics such as those enabled using Information and Communication Technologies, use of real world contexts and connections, and the strengths and limitations of using 'hands on' approaches need also to be the subject of professional development and exploration by these teachers.

The third group of teachers generally already has a sound knowledge and understanding of the mathematics they are teaching. Demographically, many of these teachers are in the latter stages of their careers, and therefore quite removed from their initial teacher education programs. Updating their knowledge base, particularly in relation to contemporary uses of mathematics, is often identified as a need. Programs that enable teachers to spend time with industry practitioners who use mathematics in their everyday work can help address these needs, and re-energise these teachers. Many teachers in this group also need access to professional development that enables them to learn about newer techniques in the teaching of mathematics, including those outlined above. Established teachers of mathematics could also benefit from being encouraged to engage with some form of academic study. A number of teachers who have been in the classroom for many years can become stagnant in their understanding of educational theories and practices, thus widening the so-called 'theory-practice gap'. Formal courses can help close this gap.

Across all programs of professional development there needs to be an investment in the leaders of that work, whether they are based in a school (Head of Department, Mathematics Coordinator etc.) or with a role to support several schools. Whether in primary or secondary schools, AAMT believes that professional development can only be effective if there is sustained support and leadership – hence there is a case for establishing a leadership position for all schools with direct responsibility for leading professional development in the subject. These people should have demonstrated knowledge and skills in both mathematics and its teaching, and need recognition and support for the specialised work of leading other teachers' professional development in mathematics.

From page 14-15 (re training and professional development)

Are adequate resources available to mentor new teachers? Is there a need for formalised system-wide mentoring structures, or should the processes for inducting[6] new teachers be left to each school?

As discussed earlier, effective mentoring is an essential component of the 're-engineering' of pre-service and in-service education and support for teachers of mathematics referred to earlier. Mentoring programs have to be appropriately funded. They have to be sustained and driven by their purpose of welcoming graduates into the profession, and providing professional support. AAMT believes that there need to be system-wide (perhaps even national) approaches that link with professional associations. Mentoring programs should aim to have new teachers become engaged with (and contribute to) the work of professional associations as these organisations are a key mechanism for sustainable support and networking for teachers of mathematics. For

[6] AAMT draws a distinction between between "induction" of new teachers in a school and "mentoring". *Induction* is about settling new teachers into the ways and procedures of the school (administrative procedures, following behavioural management policies and procedures and other 'procedural' matters) whereas *mentoring* has a professional focus – it occurs through a structured relationship between mentor and mentee, based on extensive discussions through classroom observations, leading the mentee through thoughtful planning for conceptual understanding and so on.

mentoring to be effective it requires recognition and compensation of time for mentors, and training on being a mentor. The model of mentoring used in the *Teach for Australia* program has been carefully developed and is an example of good practice in this area.

Successful mentoring programs respect the contributions of mentors, and provide recognition for them. On their part, established teachers should see acting as a mentor to a colleague new to the field as a professional responsibility, albeit one that can have many professional benefits for them as the mentor.

Appendix 1 – AAMT statement of minimum qualifications in mathematics and mathematics education for teachers in Australian schools (2002)

	Mathematics	Mathematics education
All teachers	Satisfactory score in a year 12 mathematics subject that contributes to Tertiary Entrance Rank.[7]	Nil
Teachers of Mathematics – Pre-K to 6 (or 7 if secondary school begins at year 8)	At least 5% of initial teacher education course concerned with personal knowledge of mathematics OR RPL equivalent	At least 5% of initial teacher education course concerned with the teaching and learning of mathematics (pedagogy) OR RPL equivalent
Teachers of Mathematics – 7 (or 8) to 10 (ie junior secondary)	A mathematics minor (University level mathematics equivalent to at least 15% of a recognised degree) OR RPL equivalent	At least 15% of initial teacher education course concerned with the teaching and learning of mathematics OR RPL equivalent
Teachers of Mathematics – 11-12	A mathematics major (University level mathematics equivalent to at least 25% of a recognised degree) OR RPL equivalent	At least 25% of initial teacher education course concerned with the teaching and learning of mathematics OR RPL equivalent

[7] These teachers have responsibilities for numeracy development within the subjects they teach and therefore need adequate quantitative skills.