

# Professional Development Potential of Teacher Developed Professional Standards for Excellence in Teaching Mathematics

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The national association of teachers of mathematics in Australia has embarked on a journey to enhance professional status, and to help re-engineer teacher education to enable purposeful and owned professional growth throughout teachers' careers. The vehicle for this journey is the development of nationally agreed professional standards and assessing volunteer teachers against these standards. The first phase, involved research and development of materials to 'define' quality teaching of mathematics — the AAMT *Standards*. The second phase of implementation is in two parts. One is to develop a process for acknowledging outstanding teachers and awarding them the AAMT credential of Highly Accomplished Teacher of Mathematics. The other — the focus of this paper — is a focus on professional development using the *Standards*.

## Focus of the paper

This paper outlines work in progress on the implementation of the Australian Association of Mathematics Teachers (AAMT) *Standards for Excellence in Teaching Mathematics in Australian Schools* (2002). The AAMT professional teaching standards are a kind of road-map for professional growth. They enable people to set trajectories so they can develop in areas they identify as relevant in their context and stage of development in their teaching of mathematics, and know they are heading in the directions defined as important by the profession. Ingvarson (1997) argues for the establishment of this kind of “standards driven professional development system”. Now that the AAMT professional teaching standards exist, the logic of their use as the framework for professional development is compelling. Why would associations, education systems, universities — any group seeking to engage teachers of mathematics in professional growth — provide professional development programs that do not help people move in the directions the profession has identified? In the time since the adoption and publication of its Standards, the AAMT has initiated a range of activities that seek to exploit the Standards in the professional development of mathematics teachers.

It is necessary in the first instance to outline the background and educational context of the work. This takes some explaining as it is bound up with the status and capabilities of an association of teachers such as the AAMT in the Australian educational context, and the opportunities that currently exist.

## Background and educational context

In 1998 the Australian Senate Employment, Education and Training References Committee released a report on an inquiry into the status of teaching (*A Class Act*). In commenting on the issue of standards of professional teaching practice, “the Committee insists that establishing ... standards of professional teaching practice is possible, unavoidable and absolutely necessary” (p. 16).

Since that time there has been a growing commitment to “standards” in teaching in many quarters in Australia. Importantly there is universal commitment “that [the standards] are determined by the profession itself” (p. 17; see also Commonwealth of Australia, 2003).

The Australian Association of Mathematics Teachers resolved to take some constructive action in the area, namely to develop a description of good teaching and a means for acknowledging the work of those teachers who achieve this standard.

The Association’s resolve was strengthened by two further contextual factors. Firstly, the National Council of Teachers of Mathematics in the USA had published its Professional Standards for Teaching Mathematics (1991). This work of the NCTM has been further developed by the National Board of Professional Teaching Standards, the body in the USA that has developed and implemented a system of credentialing high-achieving teachers in a comprehensive set of discipline and age related areas (1989; 1996).

Also, the Australian Science Teachers Association had been keen to work in this area for a several years (Ingvarson, 1997) and this helped persuade the AAMT that work in the area by professional associations was both feasible and essential in the growing climate of interest from employers and others in the development of professional teaching standards.

The AAMT and colleagues from the Education Faculty at Monash University (Melbourne) conducted a research and development project entitled Excellence in Teaching Mathematics: Professional Standards Project over the triennium 1999-2001.

The aims of the research project were to:

- to determine consensual views on national professional standards for excellence in teaching mathematics in Australian schools (henceforth called the *Standards*), and
- to develop an assessment scheme and protocols for certifying this excellence.

The project used a process that continually sought the views of teachers, synthesised these and reflected the synthesis back to the teachers for confirmation and/or modification.

The AAMT’s *Standards for Excellence in Teaching Mathematics in Australian Schools* was adopted by the Association’s Council in January 2002 and subsequently published and has been widely distributed. While significant progress was made on the second aim of the project, completion of this work awaits the completion of the AAMT Teaching Standards Assessment Evaluation Project that is the subject of a separate paper (Fraser & Morony).

Table 1

*The AAMT Standards arranged into three domains.*

<b>Domain 1 — Professional Knowledge</b>	<b>Domain 2 — Professional Attributes</b>	<b>Domain 3 — Professional Practice</b>
1.1 Knowledge of students	2.1 Personal attributes	3.1 The learning environment
1.2 Knowledge of mathematics	2.2 Personal professional development	3.2 Planning for learning
1.3 Knowledge of students’ learning of mathematics	2.3 Community responsibility	3.3 Teaching in action
		3.4 Assessment

The AAMT *Standards* are:

- nationally agreed;
- applicable K–12, and in all teaching contexts in Australia;

- brief (an A3 folded sheet), but there is extensive web-based supporting material that helps the “live” in readers’ minds.

There are ten *Standards*, arranged in three domains (see Table 1).

The following example is used to illustrate the style of the AAMT *Standards*. It shows that this work — by teachers, for teachers — goes to the very heart of what it means to be a teacher of mathematics.

### **2.1 Personal attributes**

The work of excellent teachers of mathematics reflects a range of personal attributes that assists them to engage students in their learning. Their enthusiasm for mathematics and its learning characterises their work. These teachers have a conviction that all students can learn mathematics. They are committed to maximising students’ opportunities to learn mathematics and set high achievable standards for the learning of each student. They aim for students to become autonomous and self directed learners who enjoy mathematics. These teachers exhibit care and respect for their students.

As can be seen, the *Standards* consist of high order statements with dense text. An extensive and growing quantity of material will progressively become available and accessible online in ways that best suit readers’ needs.

The full AAMT *Standards* and more detail about the AAMT’s work can be downloaded from <http://www.aamt.edu.au/standards/standxtm.pdf>.

In parallel with the AAMT’s work on professional standards there has been a great deal of other activity in the area of professional standards in education generally. Education systems, hastily created “institutes of teachers” in a number of states and a wide range of professional associations and organisations have become interested in professional standards. The issue of codified teaching standards has become extremely political. In this context the AAMT has pursued its goal of creating a resource that is useful to teachers in ways that promotes their professionalism.

What has distinguished the AAMT work from much of the rest of this activity is the fact that the Association has demonstrably maintained commitment to the principle of “by the profession, for the profession” and that there has been real developmental effort and there are tangible results — many others appear to have satisfied themselves with merely talking about standards. As a consequence, the AAMT work has high status across the board, and the Association has access to and respect from political and bureaucratic decision-makers.

## **Some Uses of the AAMT Teaching Standards for Professional Development of Teachers of Mathematics**

The *Standards* are the profession’s statement of what high quality teaching of mathematics looks like, what highly accomplished teachers know and do, and what they are like. They provide a framework and a common language for talking and thinking about high quality teaching in the Australian context.

The following is an example that serves to illustrate this potential. During the development of the *Standards*, the teachers involved prepared short narratives as examples from their own experience. These were used to help crystallise ideas and consensus around high quality teaching of mathematics.

### **What Does Eric Know?**

*A narrative about a Grade 5 student’s learning skills and his teacher’s responses*

During the first two weeks of the year I have a diverse range of maths activities and investigations for the purposes of finding out what the students know and can do in mathematics. This year by the end of the first week I knew nothing about what Eric knew or could do. Eric was in Year 5 in a Year 5/6 composite. Every time I observed him he was “preparing” to start. All of his work was incomplete. I decided to frequently observe and note Eric’s behaviour for a lesson. My observations confirmed that Eric never actually engaged in the mathematics activity. I was relatively new to the school and asked some other teachers about Eric. Their comments described Eric as “lazy”, “not very bright”, “slow”, and “unobtrusive”. During a relief from teaching time, I decided to interview Eric as we worked collaboratively on a construction task. He revealed to me that he could not do very much mathematics and was very slow to do it. Also he preferred to be thought of as “lazy” rather than “stupid”. Therefore, he had developed a whole range of strategies so that he never disrupted the class but was always “getting ready” to start whenever the teacher might question him. If he didn’t start, he couldn’t be called dumb for not finishing. I changed my tasks for the following two weeks. Rather than give the students a set of investigations of which they could select to do some, I organised for every student to start every investigation. They were given insufficient time for any of them to finish. I also explained to them that we would be focussing on how we start solving problems, and at the end of the first week each student would choose one investigation to undertake for a week. As that next week progressed and Eric noticed that no one was finished, I noticed that he was getting more involved in the investigations and doing more mathematics.

Now that the *Standards* have been finalised, these narratives are used as exemplifications of what they (the *Standards*) mean “in practice”. In this way they provide models to show how teaching can be analysed in terms of the framework provided by the *Standards*. Table 2 identifies some key components of the “story”. These are easily linked to statements from the *Standards*.

Table 2  
*Key story components linked to the Standards*

<b>Comments</b>	<b>Relevant Standards</b> <b>Excellent teachers...</b>
This teacher spends two weeks at the start of the year finding out what students can already do. She also talks to previous teachers, and she recognises and attends to lack of confidence.	<i>...have a thorough knowledge of the students they teach. This includes knowledge of how confident students feel about learning mathematics.</i>
She demonstrates that she has a range of techniques by arranging for every student to start (and not finish) every investigation, so that Eric becomes one of the group. Consequently his attitude to mathematics began to improve.	<i>1.3 ...aware of a range of effective strategies and techniques for teaching and learning mathematics and promoting enjoyment of learning and positive attitudes to mathematics</i>
She exhibited care and respect by attending to Eric’s situation, rather than judging him as some previous teachers had done.	<i>2.1 ...exhibit care and respect for their students</i> <i>2.1 ... a conviction that all students can learn mathematics</i>
Eric’s difficulty was more psychological/emotional than mathematical. It prevented him from learning mathematics.	<i>3.1 ...maximise students’ learning opportunities</i>
Eric might have learned nothing if this teacher had not intervened to change his behaviour.	<i>3.3 ...their teaching involves strategic intervention</i>

It is instructive that this analysis identifies that even this small example can be linked to several standards across the three domains. This underlines the complexity of good

practice — having a common language to discuss it can only be positive in the face of such complexity.

Teachers share and analyse practice as part of their professional commitment to understanding and improving their craft. Examples will be extremely varied, of course — what the *Standards* provide is this kind of structure and language. It is not too hard to imagine conversations (real or virtual) that go along the lines of, “I might also try another kind of *strategic intervention* by...” or, “My teaching situation is very different, and one of the best ways I have to *exhibit care and respect for (my) students* is by...”.

The AAMT *Standards* can be used by individuals and groups of teachers to analyse strengths and weaknesses as a key component of needs analysis. A form of the *Standards* that asks individuals to rate their self-assessment in terms of “importance”, “current personal status” and “willingness to further develop” in relation to the key components of each of the *Standards*. Some of the part of the self-analysis instrument related to Standard 2.2 Personal professional development is shown as an example (Figure 1).

2.2 In your own professional development, you...(PD)	Importance				Your rating					Priority for improvement			
	1	2	3	4	1	2	3	4	n/a	1	2	3	4
...													
try to develop informed views about relevant current trends (including teaching and learning resources, technologies, and changes to the curriculum)													
work to build your teaching expertise													
interact purposefully with colleagues													
undertake professional reading													
undertake active exploration of new teaching ideas, practices and resources in the classroom													
reflect on your practice and the new knowledge you gain													
...													

Figure 1. Self-analysis instrument related to Standard 2.2.

This approach has been trialled informally in a number of schools with encouraging responses. Once a program of professional development for the individual or group has been identified and targets set, the *Standards* can be used by participant(s) to monitor progress and celebrate successes.

For those whose role is to provide professional development programs, it is the AAMT’s hope that the *Standards* will come to be used to frame and describe their offerings. At a practical level, the Association has begun to link its professional development programs to the areas of the *Standards* that presenters/facilitators expect to address. At the AAMT *Mathematics~Making Waves* Conference in January 2003 each of the parallel sessions (papers, workshops, roundtables) was coded in the program to identify

the linked *Standards*. This was a fairly coarse activity. For the next conference in 2005 (*Making Mathematics Vital*<sup>1</sup>) presenters of the over 100 parallel sessions will include more specific reference to the *Standards* in their descriptions of their offering. It has been agreed that state and territory associations will also progressively implement such a scheme for their conferences and other professional development activities.

This use of the *Standards* as a framework for professional development offerings will, in the AAMT's view, need to extend beyond the professional development programs of teacher associations to those of education authorities and higher education institutions. While this has yet to occur, there is strong support from the *Report of the Review of Teaching and Teacher Education*<sup>2</sup> in its Agenda for Action (Commonwealth of Australia, 2003). This report will be very influential in the next few years in Australian education. Action 39 is the most pertinent: "The professional learning opportunities provided by employers of teachers, higher education institutions and teacher professional associations be directed to the achievement of the standards to be established for advanced teaching competence..." (p. 39).

An example of this is a program entitled *Engaging with Excellence in Mathematics Teaching: Creating Excellence in the Learning Environment*. This is a series of teacher professional development workshops to be held during the middle part of 2004. This pilot program has been developed and will be conducted jointly by the Australian Council for Education Research (ACER) and the AAMT<sup>3</sup>.

The catalyst for the partnership was the release of some classroom videos from the *1999 Third International Mathematics and Science Study (TIMSS) Video Study (2003)*. ACER was the Australian partner in this project and, as a consequence, has a commitment to the uptake of its findings and resources. The videos now available are acknowledged as an outstanding resource for teacher development, especially when the software tools and other resources that are associated with them are taken into account. Given the finalisation of the AAMT *Standards* it was agreed that these would be used as the framework for the teachers' investigations. Standard 3.1 deals with the learning environment, and this is the focus area for this professional development program, given that the videos capture learning environments (physical, intellectual, emotional) in mathematics classrooms in a variety of countries. In the *Engaging with Excellence in Mathematics Teaching: Creating Excellence in the Learning Environment* professional development program, participants will use the AAMT *Standards* to:

- self identify their learning needs in mathematics (using the instrument outlined above).
- analyse, describe and discuss the learning environments represented in selected videos.
- express their particular learning goals for this program in terms of the learning environment of their classroom.
- monitor progress and celebrate success.

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<sup>1</sup> See <http://www.aamt.edu.au/mmv/>

<sup>2</sup> The Review's foci were teachers and teaching of mathematics, science and technology, and creating a 'culture of innovation' in Australian schools.

<sup>3</sup> The partnership with ACER is significant, given that organisation's status as an internationally respected research and development institute. It is also significant that the project links to a major professional development resource (the TIMSS videos). The example demonstrates how the AAMT Standards can support and strengthen professional development provision and is therefore outlined in some detail.

In line with the comments above about the complexity of good practice it is expected that the teachers involved will want to address issues covered by standards other than 3.1, particularly but not exclusively those that make up the rest of Domain 3 Professional Practice. The current program is designed as a pilot. Based on an evaluation it is hoped that the program can become national. Further topic areas for teacher investigations are also planned.

As indicated above, the AAMT will implement a process for assessing teachers against the *Standards* and awarding the credential of Highly Accomplished Teacher of Mathematics to those who are successful in this rigorous peer assessment. There is anecdotal evidence from the developmental work already undertaken by the Association that those who engage with these tasks find them to be outstanding professional development activities. This reinforces the experience of teachers in the USA involved in the assessments of the National Board of Professional Teaching Standards.

During the development of exemplars in this project, one teacher who prepared a sample case study (one of the required components of the assessment portfolio) made the following comment in the covering email when she sent in her sample: “The process (of thinking about the issues, focussing in on a single student, collecting the bits and pieces) is fabulous PD and I had no trouble in carrying out that part (other than finding the time!)”

She went on, however, to highlight a dilemma for teachers dedicated to their students:

...but when you get to the write up you feel that you are doing something for yourself rather than for the students which is probably a contradiction for the type of teacher that you are trying to attract.

Somehow we have to make this part of it have a more tangible benefit for either the teacher or their students. Sorry, don't have the answer only the question!

Questions such as this one abound in the practicalities of setting up an assessment system. Assuming they can be resolved, however, there is every expectation that the process itself, once established as a result of the *AAMT Teaching Standards Assessment Evaluation Project* will be a highly valuable professional development experience for those who engage with it.

As a result of the implementation of the assessment process there will be a range of ways in which that work will be useful to teachers who are not engaged with being assessed. For example, one of the portfolio items in the assessment process is a case study of a couple of students over an extended period of time. For those preparing a portfolio there are examples and guidelines (web reference to come), but these could easily be used by a teacher or group of teachers as a professional development exercise to explore particular issues in teaching mathematics. The public release sample assessment centre items will similarly be a resource for teacher professional development as they are quite like the cases used in the Case Methods approach to teacher professional development in mathematics (Barnett et al., 1994).

### Implications for Australian teachers of mathematics and more broadly

The *Agenda for Action* from the *Review of Teaching and Teacher Education* identifies a number of areas for professional development of teachers of mathematics at both primary and secondary levels. There is an expectation that significant effort will flow — the AAMT's *Standards for Excellence in Teaching Mathematics in Australian Schools* has the potential to drive the policies and programs that are developed in the directions identified by the profession. The hope is for coherent and purposeful effort to enable teachers'

learning and development under the banner of initiatives that flow from the Review and the funding that will be associated with its implementation. The Association's current efforts to implement the *Standards* for professional development will provide 'proof of concept' and examples for professional associations, schools and groups of schools, educational authorities and tertiary institutions to use in creating a program of professional learning that really makes a difference.

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