

Assessing Teachers Against Teacher Developed Professional Standards for Excellence in Teaching Mathematics¹

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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 a focus on professional development using the Standards. The other — the focus of this paper — is to develop a process for acknowledging outstanding teachers and awarding them the AAMT credential of Highly Accomplished Teacher of Mathematics.

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 has commenced the *AAMT Teaching Standards Assessment Evaluation Project* (TSAEP) in July 2003. The aim of the project is to pilot the assessment of volunteer teachers against the AAMT *Standards*, and awarding those who are successful with the AAMT credential of *Highly Accomplished Teacher of Mathematics*. The research and development undertaken by the TSAEP will assist the AAMT to reach its goal of a highly credible and recognised AAMT acknowledgment for those teachers who choose to present themselves for assessment by their peers and who successfully demonstrate that their work is at the standard set by the AAMT *Standards*.

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).

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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 TSAEP that is the subject of this paper.

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).

Table 1
The AAMT Standards arranged into three domains.

Domain 1 — Professional Knowledge	Domain 2 — Professional Attributes	Domain 3 — Professional Practice
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 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 at <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.

The AAMT Teaching Standards Assessment Evaluation Project

The TSAEP was commenced in August 2003 with funding from the Australian Government. In negotiations with government officials it was apparent that their view is that the AAMT work has the potential to continue to lead the way from the development of

teaching standards to their ultimate implementation to enhance the quality and status of teaching.

The TSAEP is designed to significantly advance knowledge and practical capacity in relation to assessing teachers against professional standards. It will pilot and evaluate the Assessment Model developed during the initial three-year research and development project.

The project will, in its initial phase, see the preparation of further materials that exemplify the AAMT *Standards* for the information, initially at least, of the candidate teachers, and for training assessors. Subsequently in April 2004, at least six volunteer teachers will undertake the full assessment process. These teachers were recruited during the latter part of 2004 and cover a reasonable spectrum of the teaching force in this country. Four are secondary, two primary; four women, two men; four government, two non-government.

The Assessment Model

The Assessment Model is based on a commitment from the AAMT to its members and the mathematics teaching profession more broadly that the assessment process will be:

- rigorous and valid;
- adaptable to and applicable in all teaching contexts;
- fair to all candidates no matter what their teaching situation;
- equally accessible to teachers across the country;
- controlled by the candidate insofar as this is possible; and
- oriented towards contributing to professional growth of the candidate — both the process itself and the feedback provided to all candidates.

Candidates will be required to:

- respond to unseen questions that simulate teaching decisions through an Assessment Centre;
- submit a portfolio of their work and achievements as a teacher; and
- take part in an interview.

These are discussed in some detail — with illustrative examples — in the sections that follow a discussion of the overall approach to assessment in TSAEP.

Overall approach

The teachers involved in developing the details of how the assessment process will actually be conducted in the TSAEP have sought to implement the principles outlined above in what they do. There are some compromises, of course, and part of the evaluation to be undertaken will identify these and their effects. However, two fall back questions have been used to resolve issues — “Would this be something I would see as reasonable for myself?” and “What would we do if we were trying to assess students in this way?”.

As a result of fairly protracted discussion and debate, the following approach has been decided for the TSAEP and a group of assessors trained accordingly.

- Assessment will be directly against the *Standards*. The evidence presented by the candidate will be accumulated against each standard. Assessors (at least two) will reach a consensus decision as to whether the candidate has, on balance, presented sufficient evidence to convince them that they have reached the standard.

- There are no formal rubrics, checklists, scoring guides or whatever. Assessors are able, however, to use these mechanisms if they assist their gathering of information.
- The links between the materials presented in the Portfolio and the *Standards* as identified by the candidate have primacy. Assessors intend to note instances where what appears to be positive evidence that could be cited is not referred to by the candidate. This information may arise in the Interview where, for example, the candidate is prompted to further discuss this “missed” evidence in order for it to enter the actual record and thereby strengthen the candidate’s cause. Assessors will also ignore any evidence that they feel could be seen as negative. This last has been controversial — monitoring it in practice will be very informative.
- All candidates will receive constructive written feedback prepared and agreed by the relevant assessors. This will help candidates — both successful and unsuccessful — to set further learning and development goals.

This is ambitious and challenging work. It will be possible to report verbally on the outcomes and findings of TSAEP at ICME10, and extremely useful for participants at the Congress to provide their comments on the work and achievements of this project.

The Assessment Centre

The Assessment Centre will consist of a series of questions seeking candidates’ responses. The time allowed for responses will be limited. The questions will simulate teaching decisions and will include commenting on student work, responding to hypothetical situations and “inbox” questions. The context and content of the questions will be linked to the candidate’s level of schooling.

Items will often involve analysis of a piece of student work, with generic prompts along the lines of

- What is interesting/worrying/unusual mathematically in what the student has done?
- Why might s/he have done this? (e.g., what might be the misconception(s)?)
- How might the teacher respond? What next steps could be useful?

Other types of item also expect candidates to draw on their knowledge of mathematics and its learning, but in a context that allows them to demonstrate how they would work with others. For example Figure 1 simulates an interaction with a parent on a topic that remains somewhat controversial in Australia.

At the orientation parent meeting at the beginning of a new school year a parent says that she does not want her child in middle primary to use a calculator until “he knows all his times tables off by heart”. How might you respond?

1. You start by outlining some of the ways you might use calculators in your teaching during the year...
2. For one or two of these you go into a bit more detail by identifying why each of the approach is an advantage for the students’ learning of mathematics, how it enhances their learning, etc.
3. The parent has raised the issue of “times tables” and you feel you need to make some comments on the strategies you will be using in this area during the year. (You may or may not talk about strategies that use calculators — it depends on what you actually do.)
4. Are there any other comments you would make, either directly to the parent or as notes to yourself?

Figure 1. An example from the Assessment Centre.

In the TSAEP candidates will have four questions during a two hour period. Assessors will be expecting responses that demonstrate the breadth and depth of candidates’ knowledge and experience bases, and their capacity to access these in order to inform their decision-making. That is, it is expected that the evidence drawn from the responses to the Assessment Centre items will relate mostly to Domain 1 Professional Knowledge from the AAMT Standards²

The Portfolio

There are five compulsory items that need to be included in the Portfolio. This is the most time consuming component of the assessment process and will provide the bulk of the evidence.

- **Professional Journey** — a brief (≤ 2500 words) reflection on the candidate’s professional life as a teacher of mathematics.
- **Current Teaching and Learning Practices** — an example of current/recent classroom work.
- **Case Study** — an example of the candidate’s efforts over time to address a particular issue(s) with one or a few students.
- **Validation** — some ‘objective’ material that attests to the real candidate as a teacher (video or audio tape of you teaching; a report on a structured observation by a peer³)
- **Documentation** — material collected over the years that shows some more of what the candidate has done.

Table 2 identifies the *most likely* links between the components of your portfolio and the ten *Standards*. This is intended to be used as a guide to assist candidates in the preparation of the items.

² In fact, it is likely that the evidence will be mostly about standards 1.2 Knowledge of mathematics and 1.3 Knowledge of students’ learning of mathematics.

³ Practical difficulties relating to privacy have meant that, in practice, candidates in TSAEP have all chosen to submit an observation report for this item.

Table 2
Likely links between portfolio components and Standards.

	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4
Professional Journey				*	*	*				
Teaching and Learning	*	*	*				*	*	*	*
Case study	*		*	*				*	*	*
Validation			*				*		*	
Documentation				*	*	*				

Additional items may be submitted, but these must be accompanied by a rationale that justifies that inclusion. Extra items are likely to be worth the extra time and effort only if they relate to an unusual aspect of their teaching that the candidate feels is important to highlight.

The advice to candidates insists that they identify both the actual *Standards* to which they believe the material is relevant and how the evidence provided demonstrates your achievement of the *Standards*.

For example, the following is a small extract from a sample Case Study that describes a teacher who has found that a student has serious deficiencies in relation to graphs and the equation of a straight line:

I believed that Anthony needed to develop a link between equations, tables of values and their graphs. This type of work would have been encountered in earlier years but for some reason or other this has not been successful for Anthony. I believed that a fresh approach was necessary so I decided to make use of the graphical calculator that Anthony owns to do some work that required him to enter an equation, look at the graph and look at the table of values generated to establish the relationships. This work was done prior to commencing the work on Bivariate data as it is necessary background to be able to calculate equations of lines of best fit. This was also good revision for the rest of the class so it was done as a part of the teaching and learning sequence. When ever possible I allowed Anthony to print his graphs from his calculator rather than producing them by hand as I thought that this may appeal to him as he would not have to produce neat work by hand- something that he finds difficult.

I believe that this demonstrate Standard 1.3 and Standard 3.2 as it establishes an appropriate sequence of learning for this student based on the skills they already have established and the technology available to them. It is important to establish which skills the student already has in order to be able to develop further skills.

Expecting this kind of linking will force the Candidates to reflect on and discuss their work in terms of the AAMT *Standards* — the *Standards* as “a framework and a common language for talking and thinking about high quality teaching in the Australian context” (Morony, 2004). At a practical level it will assist those assessing the portfolios to identify where the evidence is located, leaving them with the task of accumulating and weighing the evidence.

At the time of writing (mid-April 2004) all candidates who are part of the TSAEP are on track for submitting their portfolios in time for assessment at the end of that month. It is clear that there is a diversity of approaches and emphases among the candidates in terms of what and how they are pressing their case through their portfolios.

The Interview

The interview will provide further confirmation of evidence. Prior to the interview the candidate will be advised of any particular areas (if any) about which further information and evidence is being sought. The interview will normally be held by teleconference.

Implications for Australian teachers of mathematics and more broadly

The successful completion of the TSAEP will see the AAMT as the first specialist teacher association in Australia to be able to award a standards-based credential for teaching achievement that is directly evidenced in the teachers' work and assessed through a rigorous assessment process. These Highly Accomplished Teachers of Mathematics will be "champions" in the profession, and ambassadors for the profession. That they will be "people like me" will encourage others to embark on the assessment process. The importance of this development in the Australian context should not be underestimated. The AAMT is a reputable professional organisation that will be in the position of giving peer professional recognition, based on a thorough assessment process. This is analogous to what happens in other established professions.

The implications for the professional development of teachers of mathematics for those who engage with the assessment process will be profound, but the impact will extend beyond this initially probably small cohort. There will be materials and processes that will easily translate into professional development settings, and this will complement the AAMT's parallel work to promote the uses of the AAMT *Standards* in teacher professional development.

More broadly the continuing achievements of the AAMT will reinforce its influence on the general educational agenda around professional standards, quality and professionalism.

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