PROFESSIONAL LEARNING USING THE MATHEMATICS STANDARDS

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Executive Summary

Background

The *Professional Learning Using the Mathematics Standards* project is the third major project undertaken by the Australian Association of Mathematics Teachers Inc. in its program to develop and implement a set of standards for 'excellence' in mathematics teaching. The first was a research and development project entitled *Excellence in Teaching Mathematics: Professional Standards Project* over the triennium 1999–2001 that saw the development of *Standards for Excellence in Teaching Mathematics in Australian Schools.* These *Standards* were adopted by the AAMT Council in 2002.

Teaching standards are seen to have two broad uses. Sachs (2005)[1] describes these as 'regulatory' and 'developmental'. The second of the AAMT's projects — the *Teaching Standards Assessment Evaluation Project* (TSAEP) — explored the 'regulatory' use of the AAMT *Standards* by piloting and evaluating an assessment and credentialing process with some volunteer teachers. The TSAEP found (Brinkworth, 2005)[2] that the AAMT *Standards* could be used as the basis for identifying Highly Accomplished Teachers of Mathematics. In undertaking this work the AAMT recognised that format credentialing as a 'HAToM' would be likely to involve only small numbers of the profession.

The Association has worked to use the AAMT *Standards* to assist teachers of mathematics' ongoing professional learning in the Association's own professional development activities, and those of state and territory affiliates. The *Professional Learning Using the Mathematics Standards* Project was designed as a systematic exploration of Sachs' second category of uses, in the context of in-school professional learning programs.

The project

The AAMT *Standards* were developed to define the 'high end' of teacher performance through a focus on describing 'excellence'. On the other hand, for the *Standards* to be useful in general professional learning programs they need to be applicable to the wide range of teachers of mathematics in our schools. Another issue is whether the *Standards* which were written to describe individual 'excellence' can play a role in group approaches to professional learning.

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[1] Professional standards: quality teachers for the future. Paper presented at *Ways forward with standards*, a conference conducted by the National Institute for Quality Teaching and School Leadership (now Teaching Australia). Melbourne, October.
http://www.teachingaustralia.edu.au/home/LatestNews/judythsachs-keynote.pdf

[2] Final Evaluation Report of the AAMT Teaching Standards Assessment Evaluation Project.
http://www.dest.gov.au/sectors/school_education/publications_resources/profiles/AAMT_TSAEP_Evaluation_Report_Oct2004.htm

The *Professional Learning Using the Mathematics Standards* Project was designed to test these issues by exploring the question:

> To what extent are the AAMT *Standards for Excellence in Teaching Mathematics in Australian Schools* able to be used to support the professional learning of teachers of mathematics in the context of in-school, collaborative professional learning programs?

Two groups of government and non-government primary and secondary schools were involved in the project. One cluster centred on a regional city and involved some rural schools, while the other was in the capital city of a different state. The clusters were supported to undertake a professional learning program by provision of:

- a small cash grant for project related expenses;
- access to an Academic Partner to assist them in their work;
- an initial orientation workshop for key teaching staff from the school; and
- visits from, and other access to, the Project Manager for advice and guidance.

The schools' professional learning programs were designed by themselves to meet their local needs. The *Standards* were to be used to support teachers in the school to achieve their goals in terms of professional learning, not as the focus of their work.

A thorough evaluation plan was designed and implemented to enable the research question above to be addressed. This involved collection of quantitative and qualitative data at the beginning and end of the project through surveys, interviews and observations.

Work in the schools

As would be expected in a project that asked schools to design and undertake their own professional learning program, the projects in the schools varied significantly in terms of their particular foci, the way the learning took place and how the *Standards* were used. Some projects involved the whole staff in a primary school; others engaged all the teachers at a particular year level(s); while others involved a small group of teachers on a particular topic.

The programs undertaken in each of the schools are described in the report — some summary observations include:

- The majority of projects in the regional cluster focussed on assessment, while many of the city schools focussed on pedagogy and teaching practice — this reflects current emphases in the two states and suggests that school-based

decisions about professional learning are taken in these broader contexts, even when they have a 'free choice'.

- A common theme across the schools' projects is that they provided opportunities for teachers to work together on planning, development and reflection, thus reinforcing the importance of collaborative work in teacher professional learning in these schools.

- The approach of asking schools to design their own project has been a strong contributor to the high levels of teacher ownership of the work being done.

- The scope of many of the projects went well beyond the funding and other support that was provided, and this was complemented by reports of high levels of enthusiasm among teachers for the work and their learning.

Findings

The project has demonstrated that the AAMT *Standards* can be used effectively to support a range of types of school-initiated professional learning programs in a range of schools. The *Standards* have been used in these schools for:

- articulating professional needs;

- helping set directions and targets; and

- establishing 'distance travelled' by teachers in their learning.

The *Standards* have been used at the start of the process to provide initial direction and foci for professional learning and at the end to see what had been achieved.

Two other uses were anticipated in the project design. These were using the *Standards* to design actual professional learning activities and using them to guide progress during the course of a professional learning program through regular reviews against the *Standards*. The project did not find that the *Standards* were used in these ways to any great extent. It may be that these uses emerge as teachers become more familiar with the *Standards*, or in teacher learning programs on a more extended timeframe.

Questionnaires were completed by teachers at the beginning and end of the project. Using the AAMT *Standards* as the framework, these data have enabled reporting on individual teachers' *priorities* for their professional learning (pre-survey) and the *improvement* they identified as a result of the project (post-survey).

Many teachers indicated that several of the individual *Standards* were *Very high* or *High* priorities at the start of the project. This is consistent with findings that professional learning needs to be a priority for teachers of mathematics at all levels

(DEST, 2003)[3] and suggests that the AAMT *Standards* express those needs in ways that connect with teachers' thoughts. The worth of the in-school projects in enabling improvement in these areas was clear from the teacher responses to the questionnaire at the end of the project, with many reporting *Very high* or *High* levels of improvement.

Comparing the data for priorities and improvements for individuals gives an indication of the perceived efficacy of the project overall. This analysis indicates that the project has resulted in teachers' hopes and expectations being met or exceeded in the vast majority of cases.

Teachers' written comments on questionnaires and surveys, comments in interviews, and through observation have provided a rich set of anecdotal evidence that the *Standards* had been very useful in supporting these teachers' professional learning.

Conclusions

The following major benefits from using the *Standards* have been synthesised from the evidence provided by these teachers, teacher-leaders and the professional learning plans and programs:

- **structure**: Schools found the *Standards* 'help with planning' and 'enable systematic organization of activities'. Several benefits were reported from using the *Standards* as a means for teachers to reflect on their practice —'affirm what is being done well, point to deficiencies, help administrators (in planning)'.

- **language**: There were a number of instances in which teachers explicitly adopted the language of the AAMT *Standards* as their language for discussing teaching practices. A number of teacher-leaders highlighted that the language of the *Standards* 'helps sharing meanings about intentions and activities, enriches discussions and debates, clarifies relevance of ideas'.

- **priorities**: The broad foci for the schools' professional learning programs were determined from a range of influences that were both internal and external to the schools and teachers. In this context the AAMT *Standards* helped 'priorities to be determined, in a specific subject area'. The fact that these priorities were directly linked to a set of national teaching standards gave a number of the teacher-leaders and their colleagues confidence that they were 'on the right track'.

- **subject specificity**: Several of the teacher-leaders found that it was valuable to have a focus on one subject (i.e. mathematics). This was especially the case for primary teachers. Teachers were not asked to work with 'just vague

[3] *Australia's Teachers: Australia's Future*. Main Report of the Committee for the Review of Teaching and Teacher Education. October. Canberra: DEST.

generalities'. The AAMT *Standards* were found to 'recognise and name teachers' particular needs and deficiencies in mathematics'.

- **assessment**: Standard 3.4 ('Assessment') was found to be a very useful — if challenging — component of the Standard, with several groups focussing on it.

The project has demonstrated that the AAMT *Standards* can be used for developmental purposes with groups of teachers. This complements their efficacy in 'regulatory' use, as demonstrated in the TSAEP.

It is also likely that the project has identified uses of professional teaching standards in ways that can be useful to other workers in the field. The project has also continued the exploration of several creative tensions that emerged in the AAMT's original work on professional standards. These tensions are likely to emerge for others working to develop and implement professional teaching standards and include the tensions between:

- standards and standardisation;
- manageability and substantive evidence;
- creativity and consistency; and
- accessibility and high standards.

But perhaps the evidence that both justifies the efforts of the AAMT to develop and implement its *Standards* over many years as well as encourages further effort is contained in some responses from teacher-leaders involved in the project, including:

Professional development using the AAMT *Standards*…a new challenge with a specific direction/target…and therefore a baseline to come back to and compare...

The vision of a nationally recognised standards framework that was not just thrust upon us, but (the standards were) given an opportunity to be embraced as part of our planning.

The AAMT *Standards* gave us direction and helped the program move quickly to areas that needed improvement.

The program enabled our whole school to take a similar journey and work as a team to improve outcomes for our students.

Background

The AAMT and colleagues from the Education Faculty at Monash University 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:

- determine consensual views on national professional standards for excellence in teaching mathematics in the Australian context, and

- develop an assessment scheme and protocols for certifying this excellence.

As a result of this work, the governing Council of the AAMT adopted the *Standards for Excellence in Teaching Mathematics in Australian Schools* in 2002. The AAMT *Standards* are a nationally agreed statement of the knowledge, skills and attributes of an excellent teacher of mathematics. They were designed to be applicable from Kindergarten to Year 12, and in all teaching contexts in Australia.

Since 2002 the association has been working to use the *Standards* in two main ways:

- As the basis for a process of peer acknowledgment of high accomplishment of teachers of mathematics; and

- As a tool to assist teachers' professional learning in mathematics, both for individual teachers and for groups of teachers.

Both of these are seen as important ways in which the *Standards* can contribute to the professional lives of teachers of mathematics.

The means associated with the first of these uses were developed and successfully piloted in the AAMT's *Teaching Standards Assessment Project* (TSAEP) in 2003-4. The Council of the AAMT subsequently adopted protocols and a process for assessing teachers against the *Standards*, and credentialing those who demonstrate that they meet the *Standards* as Highly Accomplished Teachers of Mathematics (HAToMs). In a previous project, the national subject associations in English/Literacy — ALEA and AATE — also developed professional standards for teaching in a particular curriculum area. An ARC Linkage project, Portfolio Research in Mathematics and English (PRIME) was undertaken by Monash University with the Victorian Institute of Teaching as the principal industry partner. It studied both the preparation of portfolios, using the *Standards*, by groups of 'outsider' teachers who played no part in the development of the *Standards*, together with the evaluation of their portfolios by groups of 'insider' assessors from the respective subject associations who helped develop the *Standards*.

Some progress has also been made on the second of these uses (as a tool in professional learning programs) since 2002. Sessions at AAMT national conferences and conferences in a number of states and territories have been linked to the AAMT *Standards* since that time. The *Standards* also played a role in a project with the Australian Council for Educational Research (ACER) in 2004 (Peck et al., 2004).

Two questions of 'applicability' arise in this context. The first of these relates to audience. The AAMT *Standards* were developed to define the 'high end' of teacher performance through their focus on describing 'excellence'. This is not an issue in

the HAToM process as it is only applicable to teachers whose work is of a very high standard ('excellent'). On the other hand, the *Standards* as a tool to assist teachers' professional development require them to be applicable to the wide range of teachers of mathematics in our schools[4]. The second issue of applicability is whether the AAMT *Standards* which were written to describe individual 'excellence' can play an effective role in group professional learning programs.

The *Professional Learning Using the Mathematics Standards* Project was designed to test these issues by exploring the question:

> To what extent are the AAMT *Standards for Excellence in Teaching Mathematics in Australian Schools* able to be used to support the professional learning of teachers of mathematics in the context of in-school, collaborative professional learning programs?

Before discussing the project and its findings in relation to this question, it is necessary to provide a brief description of the AAMT *Standards* themselves, since it is the applicability of these that is under investigation.

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

Table 1

The AAMT *Standards* — ten Standards in 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

[4] In any group at the school level there will be variation across a range of aspects including experience; pre-service preparation, interest and commitment to teaching mathematics (some of those teaching mathematics will have strength and interest in other curriculum areas) etc.

The following example is used to illustrate the style of the AAMT *Standards*. It shows that the work to develop the *Standards* — 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.

The AAMT *Standards* can be downloaded from www.aamt.edu.au/standards, along with a range of support materials and a full description of the work undertaken by the AAMT on them.

Overview of the *Professional Learning Using the Mathematics Standards* Project

Objectives

The *Professional Learning Using the Mathematics Standards* Project was designed to test the usefulness of the *Standards* in a range of domains including needs analysis, setting directions and targets, designing actual activities, guiding progress and establishing 'distance travelled' by teachers in their learning.

Subsidiary objectives were to:

- Identify and document ways in which the AAMT *Standards* can add value to in-school professional learning programs.
- Monitor and evaluate the effects of the in-school professional learning projects on teachers and their students.
- Report the work of the project in ways that inform in-school professional learning programs in mathematics and other areas covered by high-level professional standards.

Methodology

Through local affiliates of the AAMT the project recruited broadly representative clusters of schools in Brisbane and New England. The Brisbane cluster involved 10

schools while the New England cluster consisted of 7 schools[5]. Due to staffing and other difficulties at the school, one of the primary schools in the New England cluster was unable to complete its project.

The nature of the schools in the project overall is summarised in Table 2.

Table 2

Breakdown of schools by level of schooling and sector.

Primary		Secondary		K-12		Middle	
Govt	Non-govt	Govt	Non-govt	Govt	Non-govt	Govt	Non-govt
7	-	4	2	1	1	1	-

While the non-government sector was somewhat under-represented, there was no evidence from the project that there were differences in responses to the *Standards* and their use between the sectors. This is consistent with the long-term experience of the AAMT that its emphasis on professional needs and aspirations of teachers transcends sectoral differences — the *Standards* themselves were developed by people from all sectors and are the consensus position for the profession of teachers of mathematics.

The project design saw Academic Partners — local teacher educators or researchers — attached to each school. Their role was to work with school personnel on the professional learning program, not as experts on the AAMT *Standards*, but to provide process and other support. Two staff from the University of New England fulfilled the Academic Partner role as envisaged for the New England cluster. A range of factors resulted in this working considerably less well in the Brisbane cluster, with only a few schools being linked to an Academic Partner. Those without this relationship mostly engaged outside consultants to provide support with the 'content' of their programs without the other components of the Academic Partner role.

The project commenced with initial conferences of school and outside personnel (including the Academic Partners in New England) involved in each of the clusters.

These conferences covered:

- General introduction to the AAMT *Standards* and the support materials developed by the AAMT through previous projects[6].

[5] The primary and secondary components of a Central school were included as two separate but linked projects.

- Outline of responsibilities of project participants and support being provided.

- Information about the evaluation strategy and initial data gathering.

- Workshop activities to introduce and discuss some potential uses of the AAMT *Standards* in professional learning programs.

- Initial school-based planning.

Schools then planned their professional learning program in mathematics (goals, strategies, resources needed, and evaluation) and documented these. These plans were quite diverse. The deliberate intention was to allow each school to identify the area of mathematics teaching that they were going to work on, and how. The project was about how the AAMT *Standards* could support that professional learning work; it was ***not*** about professional learning about the *Standards* themselves.

One of the activities used in the initial conferences in both sites was also used in many of the schools. The Self-assessment form of the AAMT *Standards* (see Appendix 3) asks teachers to respond to a series of key statements from each Standard. Their ratings for:

- *Importance* of the statement in their setting and/or to them;

- *Personal performance* in relation to the statement; and

- Their *priority for improving* in what is described in the statement

are recorded on the Self-assessment form. At the conferences — and in many of the schools — the process prompted useful reflection on practice and knowledge. The information was also available to inform planning. The use of the Self-assessment form in this project was not a full 'needs analysis' in the sense that teachers began with a 'blank slate' and used the *Standards* to deeply explore and reflect on their practice to identify their professional learning needs. Rather, the use of the *Standards* in this way served to refine the expression of the teachers' needs in the context of broad directions that were already identified and set (often as part of school or system priorities).

The Pro-forma for the schools' plans is included at Appendix 1. The approval of these plans by the Project Manager was the 'trigger' for the schools to receive their funding. This formally marked the school's agreement to conduct and report on their project, to present a short report of the work and to provide data for the

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[6] These include publicly available materials such as elaborations and examples designed to aid understanding of the *Standards* themselves; materials relating to assessing teachers against the *Standards* such as guidelines for preparing portfolio items, actual examples of these items and tasks from the written assessments (these are hypothetical teaching situations that can be used to prompt professional dialogue about issues).

evaluation. All the funds for the school's project — $2 500 for schools in New England and $2 000 for Brisbane schools (the 'Pebble Beach cluster'[7] was treated as two schools and received $4 000) — was paid to the school on invoice when the plan was accepted. Other approved school costs, in particular teacher release for participation in activities required in the project such as the conferences, were paid as they arose.

Once their plan was approved, the people in the schools undertook their professional learning program in mathematics in collaboration with their Academic Partners or, in the case of several of the Brisbane schools, other outside consultants. AAMT project personnel were available to provide additional support as required. The funding provided to each school was used for such things as engaging outside consultants to support mathematics-specific professional learning relevant to the school's program, supporting mentoring programs, obtaining professional resources, attending professional development activities etc.

Schools completed their projects by providing a collection of classroom and other materials that told the story of their project. They also undertook to prepare a short report of a particularly interesting or illuminating aspect of their work, in the form of articles for professional journals. The New England cluster held a final workshop involving representatives of all schools to share their work and reflect on the uses of the *Standards*. A final event of this nature was not able to be held in Brisbane.

Evaluation

The focus of this project meant that it was important to gather relevant data at the beginning and end of the project. Evaluators were appointed and an evaluation design adopted in the early stages of the project (see Appendix 2). The fundamental purpose of the evaluation was to provide an overall assessment of two core issues:

- Has the project been effective in establishing the efficacy of the AAMT *Standards* for in-school professional learning programs?

- To what extent can the strategies developed in this project be useful in other professional development programs in schools with diverse locations, settings and contexts?

The Evaluation Design had the following features:

- Qualitative and quantitative data were collected.

- Data were collected in writing and through individual and group interviews.

[7] This cluster comprised a high school and its three main feeder primary schools.

- The main times for collection of data were at the beginning and end of the project to allow for identification of changes over time.

The data and analyses from the evaluation are integrated as the findings in this report. One of the challenges for the evaluation was to maintain focus on the efficacy of the *Standards* in relation to the school-based professional learning programs, rather than the other features of the programs.

Description of the work in the schools

New England Cluster

School	Personnel involved	Focus	Outcomes	Uses of *Standards*
Park Vista Primary— large K-6 public school in a regional centre.	All staff working in year level teams	Developing, trialling and reflecting on 'performance-assessment' in mathematics; specifically in the Measurement strand	Approach more engaging for more students, but teachers need to monitor expectations and language demands; increased knowledge, confidence and skill with 'performance-based' assessment; staff willing to further explore this pedagogical territory.	Self-assessment; Standard 3.4 ('Assessment') used to refine and name the desired features in the tasks developed; teacher reflection.
Leafy Street Primary School — Large K-6 school in a regional centre	All staff working in Band level (i.e. two year levels) teams	Develop, trial and reflect on a teaching unit and assessment task to emphasise 'working mathematically' approaches.	Improved student engagement; moderation of student work was particularly valuable as teachers much more 'all on the same wavelength'; more focussed approach to teaching and assessing student knowledge, skills and capacity to 'work mathematically'.	Self-assessment (pre and post); Standards in Domain 3 provided consistency between the teaching, learning and assessment in the different units and tasks developed.
Wombat Creek Primary	Teaching principal and one	Develop and utilise a	None — project did not	Planned to use *Standards* as

School	Personnel involved	Focus	Outcomes	Uses of *Standards*
School — very small rural school near regional centre with high proportion of Indigenous students, and students with learning difficulties	of the two other teachers	system of recording assessment data for use at student transition points (especially into secondary school)	proceed	means for defining the assessment data for recording and to 'open up' pedagogical conversations with local Central School (re transition issues)
Girls Own College — independent secondary girls' school in a regional city	The five mathematics teachers — the 'core' of the faculty	Explore and share assessment alternatives to pencil-and-paper testing in mathematics.	Several 'authentic' assessment tasks developed and trialled with varying 'success'; journal assessment established in one class; reflection and sharing.	Standard 3.4 ('Assessment') used to define the parameters of the tasks to be developed; Self-assessment as part of the reflection/further planning at the end of the program
Any Saint College — co-educational Catholic secondary school in a large regional centre.	Major focus was the teachers of year 11 mathematics, but others included in formal professional learning sessions.	Teachers learning to use ICTs more extensively and effectively, particularly to introduce Calculus topics in year 11 with a focus on student investigation of concepts ('student inquiry') rather than teacher delivery.	Improved student engagement and understanding noted by teachers; enthusiasm to further extend pedagogical approach to other year levels and areas of mathematics	Standards 3.2 ('Planning for learning') and 3.3 ('Teaching in action') used to identify the desired pedagogical features; Self-assessment as part of the reflection.
Leafy College — K-12 co-	Mathematics teaching and	Long-term aim is K-12	Incorporation of more	Initial use of the *Standards* as

School	Personnel involved	Focus	Outcomes	Uses of *Standards*
educational school in a regional city.	leadership staff in the secondary section.	coherence in mathematics (the school's mathematical 'identity'); this stage was about elaboration, documentation and sharing of 'technology-rich' teaching and learning programs.	student-centred pedagogies — many through the use of ICTs — in well-documented programs for years 7-10; plans for trialling and evaluation of these programs in 2006.	the 'touchstone' for consensus-building around what is important in mathematics in the school; Self-assessment as part of the reflection at end of program.
Rocky River Central School (primary) — central school in a small centre	All seven teachers in the primary section	Each teacher prepared and trialled a week-long unit centred on students' needs and not on textbook contents; significant assessment task was the culmination of each unit.	Greater student participation in the learning noted; teachers better able to link teaching and assessment; planned observation visits extremely valuable in generating professional dialogue and sharing	Self-assessment to bring particular focus to Standards 3.2 ('Planning for learning') and 3.4 ('Assessment'); these particular Standards used to provide parameters for unit and task development
Rocky River Central School (secondary) — central school in a small centre	Three teachers on mathematics faculty	Develop a bank of student-centred activities for linking to relevant topics in the programs for years 7-10.	Much professional dialogue re characteristics 'good' activities lead to eventual consensus; appropriate activities available for teachers to use in 2006 and beyond.	Teachers used the *Standards* in Domain 3 ('Professional practice') to refine the elements they were looking for in potential learning activities and to tag those collected or developed with their 'pedagogical features'.

Brisbane Cluster

School	**Personnel involved**	**Focus**	**Outcomes**	**Uses of *Standards***
Dusty Hollow Middle School — a new middle school (years 7-9) on the edge of suburban development	Nearly all teachers taking a class for mathematics (4 teachers each in years 7 & 8; only two were able to be involved in year 9). Teachers take classes for several subjects. Hence a number of the teachers do not have strong backgrounds in mathematics.	Development and trialling of tasks with a focus on teaching mathematics in an open-ended and 'integrated' way. The aim was to build the skills (in of teachers from a wide variety of backgrounds in assessment in mathematics, specifically in the Measurement strand.	Development, trialling and reflection on several substantial (2-3 week) units. Three were mathematics-specific; two fitted the school's integrated studies format. Key learnings for teachers were identified as being strategies to promote thinking; refining assessment clarity and monitoring literacy demands in tasks.	The Self-assessment form was used to open up to the range of descriptors for practice. *Standards* used later to direct and in some cases justify pedagogical inclusions in the tasks, and in the reflection process.
River Glen State School — a large suburban primary school	General professional development input sessions included all staff (approx 15) from years 1-3; three early career teachers undertook the trialling of special problem-solving classes for talented children.	General professional input related to pre-algebra ideas and teaching of 'patterns'. A series of four weekly lessons for selected students in each grade sought to challenge and extend selected students. Building their willingness	The 'special' lessons were collaboratively developed (with the Assistant Principal leading the project) and made available to all teachers in the grade level. Many of the students remained reticent to 'have a go'	The focus on pre-algebra had already been set in the school. The core team involved used the *Standards* to help identify pedagogies that encourage risk taking and to reflect on their and students' gains.

School	Personnel involved	Focus	Outcomes	Uses of *Standards*
		to be risk-takers was a core aim.	and make mistakes in order to learn, although some progress was noted. The pace of introducing new work and setting of expectations were found to be too ambitious. The inexperienced teachers grew significantly from their leadership roles.	
Harding State School — a small suburban primary school.	All teaching staff (approx 10-12)	The project was designed to address implementation of Working Mathematically emphasis in the new syllabus. There was also a focus on strategies to develop positive attitudes to learning mathematics among the students. An Academic Partner worked with individual teachers in a modelling and mentoring role to demonstrate new	Teachers were 'inspired' — they found the interactions with the Academic Partner very valuable ('she "walked the talk"'; I could 'see' it in action) and have had some very positive experiences with Working Mathematically approaches. Teachers reported that students had improved engagement, enthusiasm and enjoyment in their	The Self-assessment form of the *Standards* was very positively received as a balance between affirming some things individuals saw as strengths and pointing to areas for improvement. The ongoing teacher reflection in collaboration with Academic Partner was undertaken against the *Standards*, and, as a result, the language of the *Standards* is significant in professional discussion in the school.

School	Personnel involved	Focus	Outcomes	Uses of *Standards*
		approaches to 'mainstream' topics in mathematics, with teachers trialling aspects of these and reflecting on their experience.	learning.	
Sunnytown State High School — a medium sized suburban 8-12 schools.	All year 9 mathematics teachers.	The project involved the development, trialling and reflection on a five-week unit in Chance and Data in year 9. The key aim was to more effectively exploit the fact that year 9 mathematics classes have access to a computer room for one lesson per week. Hence the unit was collaboratively to explicitly include computer-based activities.	Although the original intent was for the computer-based lessons to be incorporated into the teaching, they in fact became the core learning experiences that provided richness and reality to the teaching and learning. Collegial and professional discussion was significantly enhanced during the teaching of the unit. Teachers' enthusiasm has extended to developing other 'computer enhanced' teaching units off their own initiative.	Self-assessment used initially by teachers to help focus attention — moved from centring on the technology to their main aim being more engaging environments and pedagogies for students. Also used to focus reflection.

School	Personnel involved	Focus	Outcomes	Uses of *Standards*
Rocky Inlet State High School — a complex, large outer suburban 8-12 school.	Nine teachers of year 8 and 9 mathematics were involved in the project with and under the leadership of the mathematics coordinator.	The explicit purpose was curriculum review and renewal in the context of the new 1-10 mathematics syllabus and the school's move to middle years methodologies. For the coordinator the concurrent expectation was for teachers to engage with the pedagogical implications of the changed curriculum.	The most pressing need was for suitable programs of work for the first semester or so in years 8 and 9 for teachers to use from the start of the 2006 school year, and these were prepared through collaborative working teams. The process of developing these resulted in clarification of a range shared pedagogical 'imperatives' and these have been incorporated into the programs.	Staff initially undertook the Self-assessment against the *Standards*. The coordinator was pleased (and in some cases surprised) with their overall positive response to this and the foci of their reflections which became the basis for their ongoing curriculum development work.
Sloane State High School — a large 8-12 school in an outer suburban location.	Five teachers new to the school were involved in the initial upskilling; the whole staff were to be engaged in the curriculum review and reform component.	Initial upskilling involved technical training ('button pushing') delivered by an experienced and expert staff member in an extended program. This training gave these	The project did not proceed past the initial staff training. This initial activity was under the supervision of a senior manager in the school (formerly mathematics coordinator). The follow	Staff undertook the self-assessment process as an analysis of pedagogies, not for personal reflection.

School	Personnel involved	Focus	Outcomes	Uses of *Standards*
		people a basic platform of knowledge and skill for considering the usefulness of technology in their teaching of mathematics. All staff then came together in planning processes to identify whether, where and how to incorporate the use of ICTs in the school's mathematics program.	up activities were to be led by the acting coordinator, but that person did not fulfil that role.	
Pebble Beach cluster — a large suburban 8-12 school and its three feeder primary schools	The year 6-7 teachers from each of the schools plus most of the high school's mathematics faculty (18-20 people in all)	The group was established by the schools' principals as a result of general dissatisfaction about 'transition in mathematics'. Two key foci were • 'multi-level' classroom approaches (teaching and learning practices that are effective for the wide range of	The targets for the project were quickly found to be too ambitious. Hence the focus really became building the groundwork and planning for a more long-term and substantial move towards continuity in students' experience of mathematics across the transition from primary to secondary	The group used the AAMT *Standards* as a frame of reference for discussions about good teaching of mathematics, and what they aspired to for their students. Through this process the *Standards* became an important part of the language used in discussions and expressing their aspirations for students' learning and classroom

School	Personnel involved	Focus	Outcomes	Uses of *Standards*
		students normally present in a single class) • development of 'Curriculum Consistency Statement for years 6-9' — and associated practices — across the schools. The strategies used have included a lot of talking and sharing at 'formal' meetings and school visits for classroom observation, plus strategic input from an Academic Partner.	school. The harmony of the group — between the primary and secondary members — grew as those involved came to appreciate others' contexts. The school and classroom visits made a significant contribution to this growth in mutual understanding and respect. There has also been some classroom trialling of 'multi-level' approaches. The schools are committed to this as a long-term project.	experiences.

Some observations about the in-school projects

Diversity

It is inevitable that there is great diversity across the professional learning programs undertaken in each of the schools, given that they were asked to design a project that suited their needs and aspirations. This diversity is apparent in two main ways — the foci of the programs (i.e. *what* the teachers sought to learn about) and the strategies and processes used in the programs (i.e. *how* the teachers were to learn).

It is interesting to note that there is an 'assessment' theme in several of the schools in the New England cluster; this is absent in the Brisbane cluster, replaced by a fairly common focus on pedagogy and alternatives in what students do to learn mathematics. A possible explanation for this can be found in the broader educational contexts of the two states. In Queensland there is a new 1-10 Mathematics Syllabus in which there is a major emphasis on 'working mathematically' and this is seen as new territory for many teachers of mathematics — hence the Brisbane Cluster's focus on pedagogy and classroom activity. In contrast, NSW teachers have been working with their 'new' K-10 Mathematics Syllabus for a few years — assessment of students' learning in the light of that syllabus is something of an emphasis in that state. This suggests that, when trusted to undertake professional learning without any 'instructions' (as was the case in this project) these teachers have taken a lead from the wider context. Their use of the AAMT *Standards* has not substituted the authority of schools and education systems. Rather, working with the *Standards* has assisted teachers to move in directions broadly defined by relevant education authorities with a confidence that those directions are also seen as important from within the profession.

Commonality

As well as some commonalities in the focus of the projects within clusters, another common theme across the schools' projects is that they have sought to provide opportunities for teachers to work together on planning, development and reflection. This has taken different forms according to the structure of the project, and is often not apparent in the brief descriptions of each project. It is something, however, that was very often mentioned by teachers as a valuable component of the project in their school, thus reinforcing the importance of collaborative work in professional learning (as in Standard 2.2 — 'Personal professional development').

Teachers' ownership of the work and professional learning

In a number of schools there appeared to be high levels of teacher ownership of the work being done. The approach of asking schools to design their own project has been a strong contributor to this ownership. As indicated above, the projects were aligned with school or system priorities, so there was a sense that the teachers were 'playing the main game', albeit in their own way. The ownership of the work is

possibly best signalled by the number of schools that have clear plans for continuing or extending the work from 2005 into 2006.

Effort and enthusiasm

The scope of many of the projects went well beyond the funding and other support provided. Schools and the teachers themselves, through commitment of their own time in many cases, have tried to fill the shortfalls. In many cases, the effort has been complemented by reports of high levels of enthusiasm for the work and their learning.

Of course, a few schools did not achieve all that they set out to do — their plans were, in retrospect, too ambitious. Importantly this has been translated into intentions for 2006, and this suggests that the work has proven itself to be worth doing.

Interest from school leaders

It is interesting that a number of projects have reported significant levels of interest from their school's leadership. In theory, principals and others should be interested in and involved in the professional learning and development activities in their schools. Certainly, where such interest has been demonstrated it was appreciated by the teachers involved.

Some patterns in the use of the *Standards*

The Self-assessment form of the AAMT *Standards* clearly emerged as a commonly used activity in the schools. The leaders of projects in the schools saw this as a practical way of introducing the *Standards* to their colleagues, as well as for its intended purpose of helping teachers reflect on their practice to begin to identify and discuss strengths and weaknesses.

This use of the Self-assessment form of the *Standards* as a tool to assist reflection was also evident in many of the schools towards the end of the project. In this case the idea was to use the *Standards* for teachers to identify the 'distance travelled' in their professional learning.

Several schools used the *Standards* in a way that was not anticipated. These schools were involved in professional learning projects to develop programs and develop classroom activities and approaches. Teachers in these schools used the *Standards* to identify key pedagogical features they were seeking to embody in their practice, essentially through the experiences they were planning for the students. They dealt with the *Standards* as 'pedagogical imperatives' rather than as descriptors of personal practice. Their conversations about practice went beyond merely discussing 'the activity' to the essence of why that approach might be used (or why not) in terms of their understanding of the *Standards* and the practices they identify as 'excellent'.

Use and effectiveness of the *Standards*.

In this section the main data from the evaluation tasks will be presented together with the relevant analyses. The first meetings of the two teachers' clusters were attended by the evaluators, and both meetings were productive from the perspective of evaluation:

1. Ethics forms were distributed, and the evaluators' role explained, together with Monash's Ethics procedures.

2. The Personal Learning Needs questionnaires were completed by the participants, including the consultants, and collected by the evaluators. As agreed in the plans these were not copied for the participants.

3. The AAMT *Standards* Self-assessment questionnaires were completed by the participants, copied for the evaluators and returned to the participants.

4. School plans were seriously and energetically discussed in the small groups/clusters.

5. Contact was made with the consultants, who were interviewed about their perceptions of their role, and particularly with respect to their own evaluations of the teachers', schools', and students' development.

Towards the end of the projects, the questionnaires were re-administered and the teachers were interviewed about their projects, and their effectiveness (Instruments are reproduced in Appendices 3 – 8).

In this section the first sub-section concerns the PLUMS AAMT *Standards* Summary Sheet that asked initially for teachers' priorities for improvement among the *Standards*, with the follow-up at the end of the project enabling teachers to identify their perceived improvement. The next sub-section reports the relevant teachers' comments from the Personal Learning Achievement Questionnaires. The third sub-section reports the relevant data from the school-level interviews about their projects.

Teacher's responses to the Standards *Summary Sheet*

The AAMT *Standards* Summary Sheet is shown in Appendix 5. It was decided that only Domains 1 and 3 of the AAMT *Standards* would be addressed. Domain 2 identifies Professional Attributes of excellent teachers and covers Personal attributes (2.1), Personal professional development (2.2) and Community responsibilities (2.3). In the context of these practically oriented in-school professional learning programs it was thought that a focus on these aspects of the *Standards* would be less relevant as they are not generally the shared focus of this sort of collective professional learning program.

All-in-all full sets of data were obtained from the 15 teachers who completed the two questionnaires. This was a regrettably small number, due to the difficulties of some key teachers not attending both meetings where the questionnaires were administered, or not returning them. Although the number represents just over half the key teachers, there are some interesting findings in the data.

Teachers' priority ratings

The first administration of the *Standards* questionnaire asked the teachers to rate the *Standards* in terms of their priority for improvement. The actual wording asks respondents to:

Please rate each Domain and each *Standard* (**1 as the lowest rating**, through to **4 as the highest rating**) in terms of the priority you have for improving your teaching through further development of these Domains and Standards.

The details of the teachers' initial priority ratings are shown in Appendix 6. The patterns of responses are quite different from teacher to teacher. It would therefore appear that these teachers have taken the *Standards* as a personal reflection tool and identified their own priorities. In terms of the anticipated uses of the *Standards* within these projects, this is a component of the needs analysis wherein the teachers used the *Standards* to express where they place their professional learning priorities.

What is apparent in the data is that these teachers were willing and able to identify significant professional learning needs. Level 4 was chosen 37 times, level 3 38 times, level 2 26 times, and level 1 only 4 times. It would seem that the *Standards* enabled teachers to identify and express a wide range of needs in their teaching of mathematics.

In the face of diverse responses the average of the priorities for each Standard were calculated to obtain the overall picture for the group's priorities against the *Standards*. These averages are ranked in order of decreasing priority in Table 6 (actual average score in parentheses):

Table 3

Summary of teachers' initial priorities (decreasing order)

Highest priority	Standard 3.4	*Your assessment of students (3.67)*
	Standard 3.2	*Your planning of lessons/topics/learning experiences (3.4)*
	Standard 3.3	*Your teaching in action (3.13)*
	Standard 1.3	*Your knowledge of students' learning of mathematics (3.0)*
	Standard 3.1	*The learning environment you create (2.87)*
	Standard 1.1	*Your knowledge of students (2.73)*
Lowest priority	Standard 1.2	*Your knowledge of mathematics (2.4)*

Some comments on these data:

- The average rating for Standard 3.4 (3.67) is remarkable. Only one teacher gave it a 2 rating. Three gave it a 3, while the rest (11 teachers) rated it as a 4 (highest) priority. Professional learning about assessment practice in mathematics is clearly a very high need across the schools in this project.

- In general, Domain 3 (*Professional Practice*) was perceived as of more of a priority than Domain 1 (*Professional Knowledge*). This probably reflects a practical orientation among the teachers.

- That the lowest priority of 2.4 was given by these practising teachers to Standard 1.2 'Your knowledge of mathematics' would disappoint some in the field of mathematics education who are concerned that the overall level of teachers' knowledge of mathematics is diminishing and believe that this is the key area to be addressed. These teachers would not seem to share that view, although it is true that Standard 1.2 did attract two ratings of 4 and 5 ratings of 3 (i.e. nearly half the respondents saw it as an 'above average' priority)

Teachers' improvement ratings

The second administration of this questionnaire asked for the teachers' rating of the extent of improvement in each of the seven relevant Standards. The actual wording of the instruction to respondents was to:

Please rate each Domain and each Standard (**1 as the lowest rating**, through to **4 as the highest rating**) in terms of the **Extent of the improvement in your teaching** through your involvement in this Program.

The details of the teachers' improvement ratings are shown in Appendix 6. Again the patterns of responses are quite different from teacher to teacher, suggesting that these teachers have taken the *Standards* as a personal reflection tool and been able to identify their own growth. In terms of the anticipated uses of the *Standards* within these projects, the teachers have been able to use the *Standards* to provide a measure of the 'distance travelled' in their professional learning.

What is apparent in the data is that these teachers were willing and able to identify substantial personal progress. Rating 4 was chosen 43 times, and rating 3 was chosen 37 times out of a possible total of 105. Clearly these teachers were comfortable with the progress in their practice and expressing this against the AAMT *Standards*.

Again the averages of the reported improvements for each Standard were calculated. These averages are ranked in order of decreasing improvement in Table 6 (actual average score in parentheses):

Table 4

Summary of teachers' perceived improvement (decreasing order)

Most improvement	Standard 3.3	*Your teaching in action (3.6)*
		and
	Standard 3.2	*Your planning of lessons/topics/learning experiences (3.6)*
	Standard 1.1	*Your knowledge of students (3.27)*
	Standard 3.4	*Your assessment of students (3.2)*
	Standard 3.1	*The learning environment you create (3.13)*
	Standard 1.3	*Your knowledge of students' learning of mathematics (3.0)*
Least improvement	Standard 1.2	*Your knowledge of mathematics (2.6)*

Some comments on these data:

- The relatively high levels of improvement reported for Standard 1.1 is interesting, given that this Standard had generally rated quite low in the teachers' initial priorities. This can be viewed as a 'coincidental' effect and reflects that by focussing on teaching and learning practices (Domain 3) these teachers have also improved their 'knowledge of students'. The use of the AAMT *Standards* as a reflection tool has enabled these teachers to be aware of their improvement in this area, even though it was not a high priority.

- The improvement rating reported for Standard 3.4 'Assessment of students' did not match its top priority rating. Although many of the professional learning programs focussed on student assessment to reflect its priority in the minds of teachers and schools, progress in this area still seems to remain a challenge for teachers of mathematics.

- Standard 1.2 'knowledge of mathematics' received the lowest average rating for improvement against the *Standards*. This reflects a similarly low rating of this Standard in the priority data reported earlier. It would appear that, in contrast with the observation about the coincidental effect noted in relation to Standard 1.1, teachers did not see that their focus on teaching and learning practices had any significant effect on their 'knowledge of mathematics'.

Individual teachers' priorities and improvement ratings compared

While the overall teacher ratings were interesting and important, the questionnaires were an individual matter. Hence it is equally important to view the individual results. A measure of the match between intentions and/or hopes for the professional learning program (i.e. initial *priority*) and what the teacher judged had happened in terms of their professional learning (i.e. *improvement*) has been developed. These data are provided in full in the third table in Appendix 6, and summarised in Table 7 below.

Table 5

Individuals' priorities and improvements compared

Type	Level of 'match'	Number	Comments
4 + 4	Good: priority and improvement rated 4	23	As a measure of 'teacher satisfaction' - the extent of improvement in the most important areas, a combination of these two gives a total of 35. This is the vast majority of the possible cases) and is an indication of a significant level of teacher satisfaction.
4 + 3	Satisfactory: priority 4, improvement 3	12	
4 + <3	Poor: priority 4, improvement less than 3	2	This high level of satisfaction is also borne out by there being only two cases of poor satisfaction.
<4 + 4	Unintended improvement: priority less than 4, improvement 4	21	Supports the comments in the previous section about 'coincidental effects'. Reflecting on their learning against the AAMT *Standards* seems to help teachers become aware of the full range of outcomes from professional learning programs.

Further comments on these data:

- A similar analysis of the Standards given a 3 for 'priority' (the second highest rating) that is not included in Table 7 supports the view that the teachers were satisfied with the outcomes of the project, in terms of their own professional learning. Of the 38 3s for initial 'priority', 15 were matched with a 4 for 'improvement' and 18 with a 3 (i.e. 33 as expected or better). In only 5 cases (13%) was the improvement less than the priority given to the particular Standard.

- The detailed data in Appendix 6 show that there were only four ratings of 1 for improvement, and in each case these were areas of low priority for the teacher involved (a 1 or 2 for priority).

Teachers' comments from the Personal Learning Achievement Questionnaire

There were many comments, nearly all positive, about the professional development program as a whole. Here the focus is on the comments in relation to the *Standards*.

Following are some of the verbatim comments that referred directly to the *Standards*. The themes to which the teachers referred will be summarised in the next section. The comments are in reference to the three key questions on the questionnaire.

1. What have you personally gained from this PD program?

DP: I have developed my style of programming through the use of the *Standards*. By using the Standards 1.3 ('Knowledge of mathematics learning') and 3.1 ('Learning environment') as a guide tool, my programs have become more student focused.

RM: More thorough and conscious programming for the needs of my students (as in Standard 3.2 ('Planning for learning').

BD: As well as an improved collection of materials, I realised that I had to distil some of my techniques into their (the *Standards*) elements in order to pass them on (to colleagues).

FD: Greater understanding of the *Standards* and their relevance to our school situation.

TF: Deep knowledge of defensible, fair, effective assessment. Collaboratively working with other teachers to develop consistent judgements and assessments[8].

SP: Insight into the effectiveness and utilisation of the teaching *Standards*.

HP: Further insight into the Maths *Standards*.

TD: I have gained experience in synthesising national (AAMT *Standards*), State (QSA Maths outcomes), and school agendas.

DF: The PD made me look again at three important aspects of teaching – the three domains (of the *Standards*).

[8] Several of these words and phrases occur in Standard 3.4 ('Assessment of student learning'). The teachers did not refer to the Standards document when recording their responses. Hence this teacher, at least, seems to have taken on the language of the *Standards* to a significant extent.

RAM: The knowledge of the existence of the AAMT *Standards* and their direct relationships to my improving as a teacher.

2. How has this PD program differed from others you have participated in?

DP: This program I found related to the department's QTP program, and by using the two (sets of) standards together allowed me to develop professionally ensuring better outcomes for my students particularly through mathematical language.

RM: Focus on one subject rather than trying to apply the *Standards*/principles to too many areas.

BL: I liked the logical progression (via the *Standards*) of needs analysis – problem diagnosis – plan of attack – solution.

FD: The use of a separate set of *Standards* rather than using DET outcomes

HR: This project has allowed me to be the learner and active participant rather than the recipient of information.

DF: Very different, in that using the *Standards* we were able to create a project and then oversee the running of it and the effects it had on other teachers and students.

RAM: The way in which we approached our program was directed by the *Standards*.

3. What are some of the really good things about the program?

BD: The focus on the *Standards*.

BL: Development of professional dialogue on real school issues.

HR: The program enabled our whole school to take a similar journey and work as a team to improve outcomes for our students.

TF: Professional development using the AAMT *Standards*, a new challenge with a specific direction/target thanks to AAMT and therefore a baseline to come back to and compare (progress on the different) domains (of the *Standards*).

TD: The vision of a nationally recognised standards framework that was not just thrust upon us, but given an opportunity to be embraced as part of our planning at our school.

RAM: The AAMT Standards gave us direction and helped the program move quickly to areas that needed improvement

Other comments from teachers on the Personal Learning Achievement Questionnaire were mainly about the following more general aspects of the project that they found beneficial:

- The great value of having time for collegial working, sharing, planning etc.
- The 'hands-on' nature of the program.
- Being given the opportunity to pursue our own ideas within a structured framework.
- Flexibility to choose what specific areas of the curriculum to focus on.
- The value of having an academic critical friend available throughout the program.

School level interviews

The interviews were carried out with school groups during the final meeting of the program participants in the New England cluster and with coordinators during school visits for the Brisbane cluster. The following are from notes and audio-tapes and represent the significant points made by the teachers.

1. How have the teachers benefited from their involvement in the project? Can you provide any evidence?

Working more together. Planning together. Teaching strategies improved. Confidence in using IT – regular use of data projector. Using IT in different ways. Teachers developed their own plans. Using the material developed. More thought going into assessment. More feedback on ideas. More assessment focus on what the students can do and know. Developing journals from the students. Seeing student involvement. Learnt how to 'script' a practical lesson. More evidence of younger staff sharing. Learnt from watching other classes. It provided opportunity for collegial discussions. The *Standards* provided a focus for improvement. Improved computer skills across a range of tools. More confident to try things with the students. It has made us stop and think "where are we going?" More understanding between primary and secondary school. Improved professional activity across schools.

2. How have the students benefited from the project? Can you provide any evidence?

Growing confidence shown in the assessment tasks. Some difficult concepts much better. Dynamic geometry links geometry with algebra. Language

improvement. Very engaged in the activities. Demonstrating their improved learning through the different assessment tasks. With a "bottom year 8 hostile class" the alternative assessments gave outlets to explain feelings. So marks improved and so did confidence. They remembered specific activities. 'Fun' rather than 'normal' maths. Improved communication. Assessment no longer a 'test'. Merging teaching and assessing helped. More engaged and enthusiastic. One student skipped another class to come to maths.

3. What are your PD plans for 2006?

Continue if the maths budget allows. Crucial to have the extra time that the project has provided. Follow up with similar activities. Continue with the sharing. Develop more cooperative assessment in the other Measurement strands. Extend the journals to other year groups. Develop alternative assessment tasks. More focus on science, especially group work. Develop better curriculum programming. Use a standards based needs analysis for further professional development within the school. PD support for the implementation of the program developed in the project. Intend to revisit the *Standards* in relation to PD needs.

4. How have the *Standards* helped in developing your school's mathematics teaching and learning?

The approach in the project made them (*Standards*) workable. Positives and affirming current activities. Provoked thinking. Useful language. Good starting point for PD, especially the assessment section. Useful for feedback to parents. Checklists helpful. Good to have a focus on maths, especially for primary teachers. General standards work is too broad. Useful to have a thorough analysis. They provided a purpose a basis for what the group was doing. It does help you to think and reflect on what you are doing. The *Standards* enable teachers to identify their professional development needs in a supportive environment. There is an increased awareness of the *Standards* and they have helped validate the work of teachers. By identifying the number of aspects that are involved in teaching.

In responding to the first two questions the teachers reflected on the professional learning program itself. Their comments did not refer to the AAMT *Standards*. Rather, they spoke — often very positively — of the benefits for their and their colleagues' teaching of mathematics, and of their students' learning. This is to be expected as these teachers' first concern was to generate positive outcomes for themselves, their colleagues and students. It is not possible to conclude that the use of the AAMT *Standards* definitely caused the positive outcomes that are reported. Their responses to the fourth question, however, do tend to indicate that they found the *Standards* useful in a range of ways, and that this contributed to the achievement of positive outcomes for teachers and students.

Some schools' experiences using the Standards *in greater detail*

It has been noted that the schools' projects were quite diverse. This was inevitable, given that each school designed a professional learning program to meet its own needs. However some of the variation is in how the *Standards* are used and present useful insights from the project.

Four schools have been chosen both because of the positive impact of the use of the AAMT *Standards* as well as to present different approaches that may be of general interest[9]. Each is an example of using classroom-based inquiry as a central component of the professional learning programs, the most common approach used in the schools in this project. Two are from primary schools and two from secondary schools— one of each from each cluster — also reflecting the different locations and types of school. Another important variable is less easy to describe, but relates to the style and 'tightness' of expectations built into the program. The following is a summary:

School	**Level**	**Program expectations**
Sunnytown State High School	Secondary	Focussed with a specific product as well as standards related change.
Harding State School	Primary	Broad based relating to both the *Standards* and curriculum implementation.
Leafy Street Primary School	Primary	Focussed with a specific outcome as well as *Standards* related change.
Girls Own College	Secondary	Broad based relating to both the *Standards* and assessment practices.

[9] Other variables that are not explored are those about the content of the professional learning programs.

Sunnytown State High School

Synopsis: A metropolitan secondary school that used the Standards *to support a targeted project.*

The two coordinators[10] at Sunnytown State High School used the *Standards* based needs analysis during the initial conference to identify the focus for the project. Their focus was on enhancing learning experiences through the use of available technology and the specific stated outcomes from their school professional learning plan were:

We would like our students to become more competent and confident users of Mathematics. (1.2)

We want the students' learning environment to be enhanced by the available technologies. We would like to see active engagement, inclusively, and motivation to develop enthusiasm, enjoyment and interest in Mathematics. (3.1)

They had also identified Standards 2.2 and 3.2 in their needs analysis. There was some adjustment of the original plan based on discussions at the school level particularly when they realised the expertise that was available within the school. The professional development sessions (two half days) were presented by different staff members rather than bringing in outside expertise. This also enabled some time release for staff to develop computer-based lessons. Originally the focus was on the weekly lesson in the computer room but the staff realised the importance of imbedding these in the on-going program — a learning sequence with technology.

The value of having the weekly computer room lesson imbedded in the ongoing program meant that the teachers were able to focus more broadly on pedagogical issues and the specific Standards. Each of the year 9 teachers would trial the lesson and then they would discuss it and talk about how to further improve it.

The collegial discussions that happened after they had presented to their class were astounding. I haven't been involved in that sort of working for a while.

One of the coordinators commented:

I felt unconfident and I learnt a lot. (I am) a lot more comfortable to try things with students.

The coordinators reported an enthusiasm amongst the teachers including one teacher who was developing further units based on the model produced as part of

[10] Neither of these was the Mathematics Head of Department in the school. They were Year 9 teachers who were approached by the HOD to lead this work because of their interest and willingness, and to provide them with the professional experience of coordinating a project involving others.

the project. They undertook a survey of all teachers at the end of the project and the results were incorporated into their evaluation of the project. The process provided a vehicle for professional discussion and interaction. There is an intention by the Head of Department to use the model including the needs analysis in the future

Some of the teachers' enthusiasm has been derived from their observations of students' learning and attitudes through the careful and planned use of ICT in this unit of work. The latter is best summed up by a situation faced by the Coordinator. One student — known in the school as something of 'a reluctant learner' in mathematics — skipped a lesson in another subject in order to merge into another class while it was having its computer-based lesson in mathematics — something he admitted to enjoying. He convinced the teacher of the mathematics class he joined that it was all approved. Naturally, when the teacher of the other subject noticed his unapproved absence, the Mathematics Coordinator was expected to 'do something about it'. His dilemma was that he did not want to punish the boy too harshly for wanting to spend *more* time on mathematics!

Harding State School

Synopsis: A metropolitan primary school that used the Standards *to support teachers with a general exploration of aspects of the 'Working mathematically' strand in their own teaching.*

The project at Harding was based on a standards focused needs analysis with support from an outside consultant. The coordinator used the AAMT *Standards* Self Evaluation as a survey of individual staff to help identify the group professional learning needs that would be the focus of the project.

The areas identified were:

Domain 3:

3.2 Planning for learning

3.3 Teaching in action

3.4 Assessment

Domain 1:

1.3 Knowledge of children's learning

While there was no particular area that was identified in Domain 2, there was an acknowledged need for professional development and a need to improve community awareness of mathematics. As mentioned in the overview of the project the implementation of the new syllabus was the school's overall focus. An additional

survey was completed by each staff member that focused particularly on their expectations of the project.

The work of the outside consultant was identified as key to this project. She was aware of the focus of the project and used modelled lessons and subsequent mentoring to support the teachers. Some of the teacher's comments included:

I thought it was great. This was applied straight away. Better than PD. It was immediate. It meant that you could think about it; what you could do next with your class.

Most of us chose things that we wanted more knowledge in. When you have identified the areas as one you need to work on and then you are able to use it. You have the expert who is able to provide the immediate needs.

It made you think more about how the children were learning. There were very specific examples that were effective. Lots of rich mathematical language.

In addition to regular meetings during the project, the staff met for a reflection session at the end of the project. Some other quotes from teachers in the reflection staff meeting illustrate the significant positive impact of the project include:

…very inspiring…different resources used in different ways, and familiar (physical) resources used in new ways. I've got to look out for maths everywhere.

I now see ways of getting the kids problem solving visually and spatially…not just always looking for numbers

made me think about how the kids are thinking

Put reflection into teachers' practice…helps with assessment…leads to peer support

Girls are loving maths now.

Appreciate now how to make a 'gentle' beginning with language use, build the concept and the idea and then get to the appropriate language use as an endpoint.

The staff were able to identify future directions for their own and the school professional development. While specific data was not collected on the outcomes for students the teachers clearly saw a positive impact particularly on attitudes and motivation.

Improved awareness of themselves as learners of maths. (about Grade 1 students)

The kids can see the maths is real life – soccer and money.

The intention was for the teachers to revisit the initial survey particularly in relation to expectations and the *Standards* but the move of the coordinator into a consultant position with the departments limited this. However the following response to a question *Can the* Standards *be useful for real teachers in real schools?* Perhaps sums up the teachers' enthusiasm for the approach and the recognition of its effectiveness:

Important to revitalise us. It has been good to do it as a whole school. There has been sharing as you are doing it. The whole school aspect has made it really worthwhile.

Leafy Street Primary School

Synopsis: A large primary school in a regional centre that used the Standards *in a targeted project on assessment practices.*

At Leafy Street Primary School, the AAMT *Standards* have informed and guided a project that has seen the whole staff working extensively with a range of people from outside the school, and with each other on a focussed activity. The number of staff involved, and nature of the collaborative activity required a high level of organisation of people and professional activities over three school terms. This was summed up in an extensive and detailed project 'plan' that runs to several pages. This level of detail is not included in this report; rather the key elements and links to the use of the AAMT *Standards* have been extracted.

The Mathematics Committee had overall carriage of the project. The four members of the committee were drawn from different Band levels and took responsibility for working with their Band level team. In consultation with the Principal, the committee had identified 'assessment in mathematics' as the broad priority area for mathematics professional learning in 2005. When introduced to the project the Committee was quickly able to see the potential for the *Standards* as a means for focussing the teachers' investigations in 2005 in ways that made the task feasible (i.e. not seen as 'too much work' by the staff).

The key activities in the project were:

- The Mathematics Committee members familiarised themselves with the *Standards* through general discussion and using the Self-assessment version to help them clarify their foci. This was in preparation for the initial discussions with the teachers in their Band level teams.

- Mathematics SNAP Staff Meeting at which all staff looked at assessment tasks and completed the Self-assessment version of the *Standards*.

- Data from the staff self-assessments were collated to identify the particular foci to look at in assessment — *Working mathematically*, *Language and mathematics* and *Students' attitudes* — and planning the sequence of collaborative professional learning events in the program.

- Staff meetings and the School Development Day as professional learning in mathematics as planned.

- Program of teacher release for Band level teams to work with Mathematics Committee member to develop the Working Mathematically Assessment Task(s) for use at each Band level. The nature of these tasks was guided by reference to the parameters of good teaching and assessment practice as described in the AAMT *Standards*.

- Further collaborative planning in regular Grade Level meetings.

- Assessment Tasks trialled with all classes in the school (1-2 weeks teaching and assessment in mid-term 4).

- Teachers at each grade released to moderate students' work on the Assessment Tasks and to reflect on their learning through the final survey to identify improvements against the *Standards*.

- Mathematics Committee considered results and planned further work.

The coordinator of the project — a Year 6 teacher who is chair of the Mathematics Committee — indicated that, like most primary schools, the staff has a range of needs in teaching mathematics. The *Standards* had helped them to 'funnel down to a single focus' as described above. She confirmed that the whole process had been 'a lot of work', but that the sharing, professional dialogue and teamwork that she observed were all very positive. She described the staff as now 'all on the same wavelength' and feeling like they had made progress as a result of checking back against their original needs and goals from the surveys. The challenge for her and her team on the Mathematics Committee is to capitalise and create a 'flow through to other areas of maths' in the future.

Girls Own College

Synopsis: A regional secondary school with an exploration of alternative assessment practices that was informed by using the Standards.

The impetus for a focus on assessment in this school grew from awareness among a number of the staff that the traditional approach to assessment — formal pen-and-paper common year level tests and examinations — has several limitations. These included a recognition that important outcomes highlighted in 'newer' syllabuses are difficult or even impossible to assess in this way; and that, in a girls' school in particular, this approach to assessment results in many students experiencing anxiety and being 'unable to demonstrate what they know and can do…to do their best'. The inclusion of more performance-based assessment in the new Year 11 General Mathematics course provided a vision of the style of extended tasks that may be applicable in years 7-10.

There is no 'pressure' from the school's administration to change assessment practices in mathematics, however. Hence the Mathematics Coordinator wants there to be an ethos of 'playing around' with assessment over time. She sees this as a seed project for the faculty to build on over time. This kind of gradual approach is seen as important in making expanded assessment practice part of teachers' everyday work rather than yet another 'job to do'. The AAMT *Standards* have been used as a referent for the school's work. Staff found that their dissatisfaction with a too-heavy emphasis on testing was reinforced by the assessment standard (3.4). Their explorations have been guided by the features of assessment outlined in this *Standard*, and by the value of good assessment data for teachers' planning for learning (*Standard* 3.2).

For the most part, the teachers' exploration occurred through the development and trialling of performance-based assessment tasks. The school's intranet was used to share these among the teachers at each year level. The intranet was also a way of sharing teachers' reflections on the tasks. It was the first time the staff had used this means for sharing reflections and suggestions on specific activities, and, while the uptake was not great in this instance, the aim was to add this means 'for the long term'. Some mechanism for focussing reflections around the *Standards* was seen to be a useful development for the future.

The teacher who trialled the use of journals as an assessment strategy took this work in a novel direction, based on her identification of the need to address aspects of Standard 1.1 ('Knowing your students') with her lower-achieving Year 8 class. Test anxiety was a very common issue for these students, commonly reflecting their overall negative self-image as learners and doers of mathematics. The teacher instituted a process of giving the students their test papers one question at a time. They pasted the question into their journal and then wrote their response. The result was that students were not intimidated by a long test paper ('I can't do all that!') and just dealt with the questions one at a time. The students' achievement in the tests was markedly improved through this simple strategy.

Over time the students' journals became a major vehicle for the teacher and student to communicate about the substance of the student's learning. It is noteworthy that this teacher is newly qualified and in her first years as a teacher of mathematics. The Mathematics Coordinator in the school used this opportunity to encourage and enable her to explore this teaching and assessment strategy, with the *Standards* providing a referent and support. Other teachers have been impressed by this work and some are looking to trial the approach in 2006 — the growth in this young teacher's professional confidence through taking on a role as a leader in this area is a very pleasing outcome for the Coordinator.

Conclusions

The *Standards* were written to describe what a good teacher of mathematics is like and does. The research question was:

> To what extent are the AAMT *Standards for Excellence in Teaching Mathematics in Australian Schools* able to be used to support the professional learning of teachers of mathematics in the context of in-school, collaborative professional learning programs?

How were the *Standards* used?

In planning for the project, a number of potential uses for the AAMT *Standards* were identified. These were outlined to participants as part of the initial conference but were not mandated. Each school was free to plan their own project in consultation with their academic partner and/or project staff. Each of these is discussed in relation to their actual use:

- **needs analysis**: The initial conference involved the participants in an individual needs analysis. This was subsequently used as a core component for most of the projects. The needs analyses undertaken involved individual reflection and response — a 'personal' purpose but was able to be translated to a collective need through collaborative discussions. It is noteworthy that the individual needs analyses were often brought together in a way that linked comfortably with school (or even system) priorities and directions, and served to sharpen these groups' foci and approaches. There is clearly strong evidence of the effectiveness of the use of the *Standards* as a tool for groups of teachers identifying shared needs.

- **setting directions and targets**: Many teachers highlighted the value of the *Standards* in providing a common professional language. For those projects that were concerned with developing and using student learning experiences with a particular pedagogical 'flavour' (as described in the *Standards*) the use of the *Standards* for this purpose is clear. The directions and targets for the professional learning were clearly shaped by the *Standards*. We would argue that not only did the process used by most projects bring together the external imperatives with the standards based needs but in fact tempered the tendency for a focus on procedural implementation of curriculum or other systemic requirements. The *Standards* provided support for the design and implementation of effective professional learning plans based on the individual and collective needs of the teachers.

- **designing actual professional learning activities**: No specific instances of this use for the *Standards* except for the needs analysis has been reported though they did provide the focus or purpose for a range of activities such as increasing the range of assessment practices used. This may well be a result of 'getting on with the business' but also reflects the nature of the *Standards*. It may also have resulted from the emphasis with coordinators and others that the project was not designed to provide in-service about the *Standards* themselves. It is worth noting that many teachers made comments that were effectively about the usefulness of the *Standards* in providing a language for their

professional discussions — while these are often informal, such discussions are certainly 'professional learning activities' that appear to have been framed and supported by the *Standards* in this project. The provision of a range of standards linked professional learning activities might be considered by AAMT.

- **guiding progress**: Again, there are no specific cases of this use of the *Standards* reported from the schools or through the evaluation. The relatively short duration of this project provided few opportunities for the work to get too far 'off track' or for time to pause and "step back" to reflect.

- **establishing 'distance travelled' by teachers in their learning**: The teachers have used the *Standards* to identify their self-assessment of 'improvement' in their knowledge and skills against each of the *Standards*. In many of the schools the coordinator has also commented at the group level, although this was usually expressed in more general terms and not linked to the *Standards* themselves. Hence it would appear that the *Standards* are more useful as a measure of 'distance travelled' in teacher professional learning at the *individual* level than at the *collective* level. That said, the nature of this project has restricted the data to self-reporting of improvement — the results in Tables 7-9 need to be viewed in that context. Hence, while it is legitimate to conclude that the *Standards* can be, and have been used, to measure 'distance travelled', there is clearly much scope for developing methodologies for this in practice. It also raises the question – do *Standards* that are phrased individually put the onus on the individual teachers to develop themselves through their projects, rather than expecting the project leaders to do the developing?

Overall, it appears that the uses of the *Standards* by the teachers and schools in this project are much more obvious and identifiable at the beginning and end of their work. Uses would appear to have been much more embedded in the work during the projects. Only study of the individual professional learning programs would have been able to identify and tease out uses of the *Standards* during the project. This was well beyond the scope of this project.

What were the benefits of using the *Standards* for Professional Learning?

Data collected as part of the evaluation has provided evidence of considerable positive impact of the project. In summarising the benefits for the teachers the following points were evident:

- **structure**: Schools found the *Standards* 'help with planning' and 'enable systematic organization of activities'. Several were reported from using the *Standards* as a means for teachers to reflect on their practice —'affirm what is being done well, point to deficiencies, help administrators (in planning)'.

- **language**: There were a number of instances in which teachers explicitly adopted the language of the AAMT *Standards* as their language for discussing

teaching practices. A number of teacher-leaders highlighted that the language of the *Standards* 'helps sharing meanings about intentions and activities, enriches discussions and debates, clarifies relevance of ideas'.

- **priorities**: The broad foci for the schools' professional learning programs were determined from a range of influences that were both internal and external to the schools and teachers. In this context the AAMT *Standards* helped 'priorities to be determined, in a specific subject area'. The fact that these priorities were directly linked to a set of national teaching standards gave a number of the teacher-leaders and their colleagues' confidence that they were 'on the right track'.

- **subject specificity**: Several of the teacher-leaders found that it was valuable to have a focus on one subject (i.e. mathematics). This was especially the case for primary teachers. Teachers were not asked to work with 'just vague generalities'. The AAMT *Standards* were found to 'recognise and name teachers' particular needs and deficiencies in mathematics'.

- **assessment**: Standard 3.4 ('Assessment') was found to be a very useful — if challenging — component of the Standard, with several groups focussing on it.

In addition to the benefits from the use of the *Standards* it is important to highlight benefits that related to other aspects of the project 'as a whole'.

- **adequate finance:** enabled teacher release for collaborative working, meetings etc.

- **self-generating structure:** enabled schools/teachers to focus their activities on their perceived needs, good to have academic support for these, good not to have to follow a set program

- **with the *Standards*:** not just an 'open-ended free-for-all', the AAMT *Standards* gave the necessary structure within which the school and individual development plans could be furthered.

Some other issues

In thinking about the use of the AAMT *Standards* some further issues have emerged including:

- The *Standards* were developed by a few (select) teachers, and haven't really been 'put out there' for thorough 'road testing' with a group of people who had (mostly) no prior experience. The teachers in these projects have been remarkably quick to come to grips with it all and adopt it as a language that is useful to them. There were no discernable differences between teachers' (primary/secondary; city/country; male/female) capacity to take on the *Standards* in this way.

- One concern that was anticipated was that teachers may feel threatened or at least uncomfortable if they are required to "measure" themselves against the *Standards* in a collective project. The use of the *Standards* as a needs analysis where the collective was the focus seemed to ameliorate this and there was little evidence of such anxiety. There was actually some evidence that using the *Standards* in this way was seen as an acknowledgement of teachers as professionals. Teachers saw their strengths recognised in the *Standards*, and this seemed to make them more comfortable with the document, and more willing to identify areas where they felt they could improve.

- For many primary teachers, most professional development involves general issues, however, the subject specific standards approach provided opportunities to explore mathematical pedagogy.

- The *Standards* seemed to have a level of authority in the minds of the teachers involved. They were able to connect the *Standards* with school and system directions seemed to give greater credibility to both.

- In the cluster of schools that focussed on transition from primary to secondary school, the language of the *Standards* provided a way of talking about the issues that had a positive orientation that looked for and could name agreed common ground. This is in stark contrast to other efforts on transition in mathematics that can takes sides that blame each other for problems experienced by students in the process of moving from primary to secondary education.

- For those schools that used the *Standards* to describe features of learning experiences that they want to incorporate in their teaching programs, the *Standards* became the means for describing what might be called the group's set of 'pedagogical imperatives' — what they aspire to in their teaching.

- The schools had considerable ownership of their projects. While the *Standards* were provided as a framework, the common use of a needs analysis provided opportunity for the focus to reflect the shared aims. This also enabled the individual, school and systemic imperatives to mesh in worthwhile projects. The ownership by teachers did, in many cases, also result in them doing significant amounts of work — well above what might be reasonably expected in the light of the modest funding provided through the project.

Continuing the debates about *Standards* and their uses.

The uses of professional teaching standards have been broadly characterised as being 'regulatory' or 'developmental'[11]. The AAMT's work with *Standards* has included the development and implementation of a process of assessment and credentialing of teachers as Highly Accomplished Teachers of Mathematics. Clearly this is a 'regulatory' use of the *Standards* — attaining the credential is controlled by the Association and there are strict 'rules'. Not all teachers of mathematics will meet the requirements for being a HAToM. Engaging with the process is strictly voluntary, however — only those teachers who choose to be assessed need to have anything to do with the process. The evaluation of the *Teaching Standards Assessment Evaluation Project* (Brinkworth, 2005)[12] determined that the AAMT *Standards* provided an appropriate base for the assessment process. In other words, the AAMT *Standards* are able to be used in a regulatory way.

The use of the AAMT *Standards* in the *Professional Learning Using the Mathematics Standards* project has clearly been focussed on their 'developmental' use. The *Standards'* use in this context has been shown to be broadly effective in a range of school-initiated professional learning programs in a range of schools. Hence the AAMT *Standards* are also able to be used developmentally with groups of teachers in these settings.

Further, this effectiveness has been based on providing fairly minimal initial and ongoing input to the schools and teachers about the *Standards* themselves and how they might be used. It seems that, for those involved in this project, the total 'package' of the AAMT *Standards* — their development by a professional association, subject specificity, size, structure, language, other support materials, etc — was sufficiently appealing for them to take on the *Standards* as a useful support for their work.

The conclusion that the AAMT *Standards* are able to be used for both regulatory and developmental purposes is significant. This demonstrates that it is possible for a set of professional teaching standards to be able to meet these dual purposes. In other words, teaching standards themselves are not necessarily regulatory or developmental.

This is not to say that the AAMT *Standards* can be used in all — or indeed any — other regulatory frameworks. In fact, the AAMT Council has recently proscribed the

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[11] See, for example Sachs, J. 2005. Professional standards: quality teachers for the future. Paper presented at *Ways forward with standards*, a conference conducted by the National Institute for Quality Teaching and School Leadership (now Teaching Australia). Melbourne, October. (see http://www.teachingaustralia.edu.au/home/LatestNews/judythsachs-keynote.pdf

[12] http://www.dest.gov.au/sectors/school_education/publications_resources/profiles/AAMT_TSAEP_Evaluation_Report_Oct2004.htm

use of the AAMT *Standards* in any other process of assessment or performance management of teachers than its own process for awarding the credential of Highly Accomplished Teacher of Mathematics.

Similarly, the developmental usefulness of the AAMT *Standards* has only been demonstrated in the context of in-school professional learning programs. That said, it needs to be noted this is emerging as a (the?) key mode for organising teacher professional learning. Further, the schools in this project have demonstrated substantial symbiosis between the *Standards* and a range of school and system-wide professional learning imperatives.

It needs also to be noted that these findings do not imply, however, that ***all*** professional teaching standards can have this duality of purpose. Further work is required to identify any features of the AAMT *Standards* and associated regulatory and developmental processes that may contribute to this duality.

How creative tensions in the use of the AAMT *Standards* relate to this project

The following tensions were identified in the project to develop the AAMT *Standards* (Bishop et al, 2002)[13]. The TSAEP further explored them in the context of using the *Standards* in a regulatory way. The current project has also worked with these tensions, with the following issues identified:

- *Standards and standardisation*: developing and accepting different models of school-based professional learning. This project has clearly shown that it is possible to use the AAMT *Standards* for progressing the learning programs for groups of teachers without standardising the processes. Once again the *Standards* have shown themselves to be robust indicators of levels to be aimed at, without being too challengingly out of range.

- *Manageability and substantive evidence:* keeping teachers' professional learning on track, monitoring progress, collecting evidence of success/achievement. The *Standards* have undoubtedly helped with achieving this balance. When teachers are engrossed in the activities of any professional learning program it is all too easy for them to lose sight of the important goals. The *Standards* helped to keep teachers on task, with a view to the development and with a perspective on what they have achieved.

- *Creativity and consistency*: limiting and stimulating what might have been attempted. Whilst individual Standards acted as goals, their subject specificity helped to keep the teachers focused on the relevant activities. Whether for determining needs, planning the activities, organising the groups to maximise

[13] Bishop, A., Clarke, B., Morony, W., Ocean, J. & Siemon, D. 2002. *Final report of the Excellence in Mathematics: Professional Standards Project.* Unpublished Report.

the value of the activities, or evaluating their group's progress, the focus provided by the *Standards* helped to shape and not delimit the teachers' work.

- *Accessibility and high standards*: realism versus idealism. Whereas in the previous *Teaching Standards Assessment Evaluation* project some teachers felt rather intimidated by the high expectations described in the AAMT *Standards*, in this project that was not the case. Perhaps it was because these teachers were not being individually assessed that they were able to remain confident about their ability to use the *Standards* to assist in their own professional learning and development.

Final words from the teachers

Although the emphasis in this project has been on schools and the professional learning of their teachers, the *Standards* are still focussed on the individual teacher. Whether they should be modified for a whole school approach, or whether there should be an additional *Standard* which directly addresses whole school developments, is an issue which will need to be considered in another project. For now, it has been satisfying and professionally significant to hear from the teachers how much they have valued the approach adopted in this project.

To finish this report therefore we thank the teachers, their schools, and the academic supporters for their professional engagement with the project, and reproduce below a sample of the teachers' final reflective comments:

The program enabled our whole school to take a similar journey and work as a team to improve outcomes for our students.

Professional development using the AAMT *Standards*, a new challenge with a specific direction/target thanks to AAMT and therefore a baseline to come back to and compare domains.

The vision of a nationally recognised standards framework that was not just thrust upon us, but given an opportunity to be embraced as part of our planning.

The AAMT *Standards* gave us direction and helped the program move quickly to areas that needed improvement.

Appendices

1. School Plan Proforma
2. Evaluation Design
3. AAMT *Professional Standards* Self Evaluation
4. Personal Learning Needs Questionnaire
5. PLUMS AAMT *Standards* Summary Sheet
6. PLUMS AAMT *Standards* Improvement Sheet
7. Personal Learning Achievement Questionnaire
8. Data re Teachers' Initial Priorities and Improvement
9. Interview schedule for PLUMS teachers

1. School Professional Learning Plan Proforma

School		
Focus of professional learning	*What will teachers be learning about, working on, trying out etc.?* *What do teachers want their students to get better at as a result? (academic and/or affective)*	
Plan of action Note: This is an outline only, and subject to change.	***What***	***When***
Uses of AAMT *Standards*		
Use of project resources Project resources can be used to cover costs of school-specific outside consultancies, attending courses and conferences; professional materials etc.		
School resources to be applied to the project These are the actual and in-kind resources being committed by the school.		
Key Contact Person	Name: Phone: Fax: email	
Academic Partner	Name: Phone: Fax: email	
Other Teachers Involved		
Principal	Name: Phone: Fax: email	

The above arrangements are agreed:

Signed (Principal or nominee) Date:	**Signed (Will Morony, AAMT)** Date:

2. Evaluation Design

The fundamental purpose of the evaluation is to provide an overall assessment of these two core issues:

- Has the project been effective in establishing the efficacy of the AAMT Standards for in-school professional learning programs?
- To what extent can the strategies developed in this project be useful in other professional development programs in schools with diverse locations, settings and contexts?

The following are the broad areas that the evaluation will need to address in order to enable reporting against the project's objectives:

- To what extent, and in what ways, has using the AAMT *Standards* assisted the development, implementation and monitoring of in-school professional learning programs.
- The impact of the professional learning program on student outcomes[14].
- The contribution of the AAMT *Standards* to the actual strategies implemented in the schools (and possibly at the level of the hubs)
- The 'distance travelled' by the teachers as indicated by their progress against the *Standards* (in terms of their knowledge, skills and understanding about the teaching and learning of mathematics).
- The information, encouragement and support that were provided by the AAMT to enable those involved in the Project to understand and work with the AAMT *Standards*.
- Any other professional (or other) impacts on participants (teachers involved, school leaders, local AAMT personnel, consultants and other contributors to the in-school professional development projects).
- AAMT processes in conducting the project.

The evaluation of the project will involve the collection, analysis and reporting of both qualitative and quantitative data. The data will be collected at strategic stages throughout the project, and will not just be the responsibility of the evaluators, i.e. there is an expectation that there will be an evaluation component in the professional learning activities of teachers, schools, clusters and consultants. For example, teachers and schools will incorporate in their programs measures to determine the impact of their learning on students' outcomes.

Data collection procedures

The quantitative data collected by the evaluators will be of two kinds:

1. Program demographics: to give a picture of the scale of the work being undertaken in the in-school professional learning programs. This will include the number of teachers involved in various activities, time on tasks (attending sessions, reading, reporting etc) and other features.

2. Professional learning developments: to survey overall changes in the needs, attitudes, and understandings of the project participants.

These data will provide suitable background and outcome measures for interpreting the qualitative analyses. The qualitative data will include non-intrusive observations by the evaluators and analysis of participants' feedback. The latter will be largely self-reporting (actions; changes in participant teachers' professional knowledge and skills; levels of satisfaction or concern) but there will also be interview and case-study data of particular participants and their teams.

In addition, there will be:

- Inspection and analysis of documents including information sheets about the project and the AAMT *Standards*; on-line materials relating to the *Standards*; plans, reports and other documentation of schools' individual professional learning programs; case studies prepared by school-based and project personnel; minutes and other materials of the Advisory Committee and the PLUMS Working Party; and

- The evaluators' notes taken at meetings, workshops, conferences and school visits that are feasible within the project.

There are three phases of the project, from the evaluators' perspective, as follows.

The intended phase (April-May, 2005)

In this first phase the 'starting points', needs, and intentions of the participants will be the focus. The initial conference will be the first point for assessment in this phase, but documentation will also be obtained from schools as to their plans, projects, and self-evaluation processes.

1. The brief Personal Learning Needs questionnaire for teachers, to be given at the conference before anything is discussed (kept by evaluators).

2. Following input by AAMT, the *Standards* Self-assessment questionnaire for teachers to be given, based on the *Standards* (kept by evaluators)

3. Summary of Ranking Priorities of the 10 *Standards* by teachers for use with school teams (copied for evaluators)

4. Following school team discussions, Ranking Priorities by Teams (copied for evaluators).

5. Records of conference discussions, to be noted by evaluators.

After the conferences, School Teams' plans will be copied and sent to evaluators.

The implemented phase (May- October, 2005)

In this main phase the school-based projects will be monitored, through visits to selected schools, plus individual interviews and focus group discussions. Consultants will also be interviewed, and their own data copied and recorded.

Data may also include any written material prepared by teachers and consultants, as well as specific feedback information from teachers and consultants, based on guidance from evaluators.

One visit will be made to each node, and to selected schools and teachers for interviews and focus group discussions (taped).

An interim report will be written and circulated.

The attained phase (November 2005 – January 2006)

In this final phase, data will be collected at final node conferences, as follows:

1. Personal Learning Achieved questionnaire, based on PLN but asking for reflection on achievements.
2. Repeat of *Standards* Self-assessment questionnaire, omitting the 'priority for improvement' section.
3. Team feedback on the achievements relevant to the initial priority list.

In addition, the final conference will be documented, and the schools' and consultants' reports and self-evaluations will be collected.

The final report will be compiled.

Alan Bishop and Barbara Clarke

Monash University, April 2005

3. AAMT Professional *Standards* Self-assessment

This instrument provides teachers with an opportunity to reflect on their teaching in relation to the AAMT's Professional *Standards* for Excellence in Teaching Mathematics.

The three sets of columns enable you to rank the attribute (**1 as the lowest**, through to **4 as the highest**) in terms of:

- Its importance to you, in your teaching context;
- Your honest self evaluation (the n/a column can be used if you believe the attribute is not relevant to you); and
- The priority you have for improving your teaching through further development of this attribute.

It is anticipated that the Self Evaluation can be used in a variety of ways; in part or as a whole, individually or to help plan a PD program for a school or faculty group. As a professional development activity in its own right — a group of teachers could fill in their own Self Evaluation and share the reasons for their responses, or be asked to pick one they rated themselves highly on and give examples of what they do that they feel good about. More detailed descriptions of these sorts of PD activities will be published as the self evaluations are trialled by AAMT members and other teachers around the country.

The AAMT Professional Standards Self Evaluation should be read in conjunction with Standards for Excellence in Teaching Mathematics in Australian Schools (http://www.aamt.edu.au/standards/standxtm.pdf)

Domain 1 — PROFESSIONAL KNOWLEDGE

1.1 Your knowledge of…(students)	**Importance**				**Your rating**					**Priority for improvement**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**n/a**	**1**	**2**	**3**	**4**
your students' social and cultural contexts													
the mathematics your students know and use													
your students' preferred ways of learning													
your students' confidence with mathematics													
how your students feel about learning mathematics													

1.2 Your knowledge of… (mathematics)	**Importance**				**Your rating**					**Priority for improvement**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**n/a**	**1**	**2**	**3**	**4**
mathematics — sound and coherent													
mathematics — appropriate to the student level(s) you teach													
mathematics — enables you to be a confident and competent user of mathematics													
the broader mathematics curriculum													
how mathematics is represented and communicated													
why mathematics is taught													
connections within mathematics													
connections between mathematics and other subject areas													
how mathematics is related to society													

1.3 Your knowledge of… (students' learning of maths)	**Importance**				**Your rating**					**Priority for improvement**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**n/a**	**1**	**2**	**3**	**4**
current theories relevant to the learning of mathematics													
learning sequences in mathematics													
appropriate representations, models and language													
a range of effective strategies and techniques for teaching and learning mathematics													
a range of effective strategies and techniques for promoting enjoyment of learning and positive attitudes to mathematics													
a range of effective strategies and techniques for utilizing information and communication technologies													
a range of effective strategies and techniques for encouraging and enabling parental involvement													
a range of effective strategies and techniques for being an effective role model for students and the community in the ways they deal with mathematics													

DOMAIN 2: PROFESSIONAL ATTRIBUTES

2.1 You…(personal)	**Importance**				**Your rating**					**Priority for improvement**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**n/a**	**1**	**2**	**3**	**4**
demonstrate enthusiasm for mathematics and its learning													
have a conviction that all students can learn mathematics													
are committed to maximising students' opportunities to learn mathematics													
set high achievable standards for the learning of each student													
aim for students to become autonomous and self directed learners who enjoy mathematics													

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**
are committed to the continual improvement of your teaching practice													
take opportunities for personal professional development													
build your own knowledge, understanding and skills in mathematics													
build your knowledge and understanding of teaching and learning of mathematics													
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													
learn from your experiences.													

2.3 In relation to your interaction with other 'communities' relevant to your teaching of mathematics, you…(community responsibilities)	**Importance**				**Your rating**					**Priority for improvement**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**n/a**	**1**	**2**	**3**	**4**
are a positive advocate for mathematics and its learning in the school													
are a positive advocates for mathematics and its learning in the wider community													
interact effectively with the families of the students you teach													
provide strategies for assisting students' mathematical development outside the classroom													
create and take opportunities to involve students in mathematical activities beyond the classroom													
collaborate colleagues both individually and in teams – learning; sharing insights, practices and resources; supporting and mentoring others; and providing feedback													
participate in school decision-making													

DOMAIN 3: PROFESSIONAL PRACTICE

3.1 The learning environment you create…	Importance				Your rating					Priority for improvement			
	1	2	3	4	1	2	3	4	n/a	1	2	3	4
addresses the psychological, emotional and physical needs of students													
responds to the diversity of students' individual needs and talents													
empowers students to become independent learners													
motivates to improve their understanding of mathematics													
motivates students to develop enthusiasm for, enjoyment of, and interest in mathematics													
has an inclusive and caring atmosphere of trust and belonging													
values active engagement with mathematics													
fosters communication skills													
encourages co-operative and collaborative efforts													

3.2 You plan lessons/topics/learning experiences that …	Importance				Your rating					Priority for improvement			
	1	2	3	4	1	2	3	4	n/a	1	2	3	4
are coherently presented and organised													
involve substantive, non-trivial mathematics													
build on and enrich students' existing knowledge and appreciation of mathematics													
involve a variety of appropriate teaching strategies													
are enhanced by available technologies													
are enhanced through the use of other resources													
take account students' backgrounds and prior mathematical knowledge													
provide opportunities for students to explore and apply mathematics across key learning areas													
provide opportunities for students to explore and apply mathematics beyond the school setting													

3.3 In your teaching you…	Importance				Your rating					Priority for improvement			
	1	2	3	4	1	2	3	4	n/a	1	2	3	4
arouse curiosity													
challenge students' thinking													
engage students actively in learning													
initiate purposeful mathematical dialogue with and among students													
initiate purposeful mathematical dialogue among students													
model mathematical thinking and reasoning													
teaching promote, expect and support creative thinking and mathematical risk-taking in finding and explaining solutions													
Intervene and provide appropriate assistance when students need it													

3.4 In relation to student assessment, you…	Importance				Your rating					Priority for improvement			
	1	2	3	4	1	2	3	4	n/a	1	2	3	4
regularly assess and report student cognitive learning outcomes													
regularly assess and report student affective learning outcomes													
use a range of defensible, fair and inclusive assessment strategies appropriate to the students													
use a range of defensible, fair and inclusive assessment strategies appropriate to the learning context													
maintain on-going, informative records of student learning outcomes													
use records to map student progress													
use records to plan appropriate future learning experiences													
provide purposeful feedback to students													
provide purposeful feedback to parents													
provide purposeful feedback to school authorities													

4. Personal Learning Needs Questionnaire

Personal information

Name….....

Age group (please circle) 20-30 31-40 41-50 51+

School.....

Preferred contact information (phone, email, etc.)

Classes taught.

.....

Subjects taught

.....

What are you personally hoping for from this PD program?.....
.....
.....
.....
.....

Here is a list of terms concerning mathematics teaching and learning aspects. Please use this list when answering the next 3 questions, but also feel free to add other aspects which you consider important (max 3) for answering the questions.

A. Mathematics content knowledge (yours)

B. Mathematics proficiency (yours)

C. Mathematics understanding (students)

D. Mathematics proficiency (students)

E. Students' learning approaches

F. Students' attitudes

G. Motivational ideas for teaching

H. Different teaching approaches

I. Different assessment methods

J. Classroom interaction skills

K. Class discipline and control

L. Preparing classroom activities

M. Computer technology in the classroom

N. Calculators in the classroom

O. Homework

P.....

Q.....

R.....

Using the list above please identify your *top* five Personal Learning Needs

1.....

2.....

3.....

4.....

5.....

Please give reasons for your choices.

Using the list above please identify your *bottom* five Personal Learning Needs

1.....

2.....

3.....

4.....

5.....

Please give reasons for your choices.

What evidence will you look for to see whether your top needs have been met?

.....

.....

.....

Write any other comments here.

5. PLUMS AAMT *Standards* Summary Sheet

Please rate each Domain and each *Standard* (**1 as the lowest rating**, through to **4 as the highest rating**) in terms of the priority you have for improving your teaching through further development of these Domains and *Standards*.

Name.....

School.....

The information you give here will be confidential to you and to the Project Evaluators.

	Priority for improvement			
	1	**2**	**3**	**4**
DOMAIN 1: PROFESSIONAL KNOWLEDGE				
1.1 Your knowledge of students				
1.2 Your knowledge of mathematics				
1.3 Your knowledge of students' learning of mathematics				
DOMAIN 2: PROFESSIONAL ATTRIBUTES				
2.1 Your personal attributes				
2.2 Your personal professional development				
2.3 Your community responsibilities				
DOMAIN 3: PROFESSIONAL PRACTICE				
3.1 The learning environment you create				
3.2 Your planning of lessons/topics/learning experiences				
3.3 Your teaching in action				
3.4 Your assessment of students				

6. PLUMS AAMT *Standards* Improvement Sheet

Please rate each Domain and each Standard (**1 as the lowest rating**, through to **4 as the highest rating**) in terms of the **Extent of the improvement in your teaching** through your involvement in this Program.

Name.....

School.....

Date……...

The information you give here will be confidential to you and to the Project Evaluators.

	Extent of improvement			
	1	**2**	**3**	**4**
DOMAIN 1: PROFESSIONAL KNOWLEDGE				
1.1 Your knowledge of students				
1.2 Your knowledge of mathematics				
1.3 Your knowledge of students' learning of mathematics				
DOMAIN 2: PROFESSIONAL ATTRIBUTES				
2.1 Your personal attributes				
2.2 Your personal professional development				
2.3 Your community responsibilities				
DOMAIN 3: PROFESSIONAL PRACTICE				
3.1 The learning environment you create				
3.2 Your planning of lessons/topics/learning experiences				
3.3 Your teaching in action				
3.4 Your assessment of students				

7. Personal Learning Achievement Questionnaire

Name..... School……. Date……

1. What have you personally gained from this PD program?

……
……
……
……
……

2. How has this PD program differed from others you have participated in?

……
……
……
……
……

3. What are some of the really good things about the program?

……
……
……
……
……

4. What things could be improved about it?

……
……
……
……
……

5. Do you plan to follow up this program next year? If so, in what ways?

……
……
……
……
……

Here is a list of terms concerning mathematics teaching and learning aspects:

A. Mathematics content knowledge (yours)

B. Mathematics proficiency (yours)

C. Mathematics understanding (students)

D. Mathematics proficiency (students)

E. Students' learning approaches

F. Students' attitudes

G. Motivational ideas for teaching

H. Different teaching approaches

I. Different assessment methods

J. Classroom interaction skills

K. Class discipline and control

L. Preparing classroom activities

M. Computer technology in the classroom

N. Calculators in the classroom

O. Homework

P.....

Q.....

R.....

In the first questionnaire you identified the following as your top five Personal Learning Needs

1……2……3……4…….5…….

For each one, please rate your Learning Achievement through this Program, by putting a tick after one of the ratings:

1.	Excellent	Good	Moderate	Poor
2.	Excellent	Good	Moderate	Poor
3.	Excellent	Good	Moderate	Poor
4.	Excellent	Good	Moderate	Poor
5.	Excellent	Good	Moderate	Poor

For each one, please comment on what, and how, you have achieved through this Program:

1……

2……

3……

4……

5……

Please add any other comments on the back of this sheet.
Thank you for your assistance

8. Data re Teachers' Initial Priorities and Improvement

Table 6
Teachers' initial priority ratings

Standard	1.1	1.2	1.3	3.1	3.2	3.3	3.4
HR	3	4	4	4	3	4	4
KD	2	1	3	4	4	4	4
BL	3	3	4	3	4	4	4
RM	2	2	3	4	4	4	4
TF	3	2	3	1	3	2	4
FD	2	3	2	2	3	2	4
BD	3	2	3	3	4	3	4
DP	4	3	4	3	4	3	2
TJ	2	1	3	2	3	3	4
RD	3	2	4	3	3	3	4
SP	2	4	2	4	4	4	3
CS	2	2	2	3	3	2	3
RA	4	1	2	2	3	3	4
DF	3	3	2	2	2	2	3
TD	3	3	4	3	4	4	4
Ave	**2.73**	**2.4**	**3.0**	**2.87**	**3.4**	**3.13**	**3.67**

Table 7
Teachers' improvement ratings at the end of the project

Standard	1.1	1.2	1.3	3.1	3.2	3.3	3.4
HR	4	3	4	3	3	4	4
KD	3	1	2	3	3	3	2
BL	3	3	4	4	4	4	4
RM	4	2	3	4	4	4	4
TF	4	1	2	1	4	4	4
FD	2	2	1	2	2	2	3
BD	3	2	3	3	3	3	3
DP	4	3	4	3	4	4	3
TJ	4	3	4	3	4	4	4
RD	3	2	2	3	4	4	4
SP	3	4	4	4	4	4	3
CS	2	3	3	4	4	4	2
RA	4	3	3	4	4	4	2
DF	3	4	3	3	3	3	3
TD	3	3	3	3	4	3	3
Ave	**3.27**	**2.6**	**3.0**	**3.13**	**3.6**	**3.6**	**3.2**

Table 8
Individual teachers' priority and improvement ratings

Standard	**1.1**	**1.2**	**1.3**	**3.1**	**3.2**	**3.3**	**3.4**	**4 + 4** Good	**4 + 3** Satis.	**4+<3** Poor	**<4 + 4** Unin-tended
HR priority	3	4	4	4	3	4	4	3	2	0	1
HR improve	4	3	4	3	3	4	4	n/a	n/a	n/a	n/a
KD priority	2	1	3	4	4	4	4	0	4	0	0
KD improve	3	1	2	3	3	3	2	n/a	n/a	n/a	n/a
BL priority	3	3	4	3	4	4	4	4	0	0	1
BL improve	3	3	4	4	4	4	4	n/a	n/a	n/a	n/a
RM priority	2	2	3	4	4	4	4	4	0	0	1
RM improve	4	2	3	4	4	4	4	n/a	n/a	n/a	n/a
TF priority	3	2	3	1	3	2	4	1	0	0	3
TF improve	4	1	2	1	4	4	4	n/a	n/a	n/a	n/a
FD priority	2	3	2	2	3	2	4	0	1	0	0
FD improve	2	2	1	2	2	2	3	n/a	n/a	n/a	n/a
BD priority	3	2	3	3	4	3	4	0	2	0	0
BD improve	3	2	3	3	3	3	3	n/a	n/a	n/a	n/a
DP priority	4	3	4	3	4	3	2	3	0	0	1
DP improve	4	3	4	3	4	4	3	n/a	n/a	n/a	n/a
TJ priority	2	1	3	2	3	3	4	1	0	0	4
TJ improve	4	3	4	3	4	4	4	n/a	n/a	n/a	n/a
RD priority	3	2	4	3	3	3	4	1	0	1	2
RD improve	3	2	2	3	4	4	4	n/a	n/a	n/a	n/a

SP priority	2	4	2	4	4	4	3	4	0	0	1
SP improve	3	4	4	4	4	4	3	n/a	n/a	n/a	n/a
CS priority	2	2	2	3	3	2	3	0	0	0	3
CS improve	2	3	3	4	4	4	2	n/a	n/a	n/a	n/a
RAM priority	4	1	2	2	3	3	4	1	0	1	3
RAM improve	4	3	3	4	4	4	2	n/a	n/a	n/a	n/a
DF priority	3	3	2	2	2	2	3	0	0	0	1
DF improve	3	4	3	3	3	3	3	n/a	n/a	n/a	n/a
TD priority	3	3	4	3	4	4	4	1	3	0	0
TD improve	3	3	3	3	4	3	3	n/a	n/a	n/a	n/a

9. Interview schedule for PLUMS teachers

This interview is carried out during the final meeting of the program participants.

1. **Name, school, position, role in school PD project?**

2. **How many teachers are involved with your school's PD project? How involved?**

3. **How has your PD project developed in relation to your initial plans?**

4. **How did your project actually function? Meetings, how often, for what purpose? Materials, what kind, who produced? Classroom activities?**

5. **How have the teachers benefited from their involvement in the project? Evidence?**

6. **How have the students benefited from the project? Evidence?**

7. **What are your PD plans for 2006?**

8. **How have the *Standards* helped in developing your school's mathematics teaching and learning?**

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