

Standards for Excellence, Sustainable Assessment and the Development of Teacher Identity

Steve Thornton

University of Canberra, Australia

Immediate Past President, Australian Association of Mathematics Teachers Inc.

<Steve.Thornton@canberra.edu.au>

Sue Wilson

Australian Catholic University, Canberra, Australia

<s.wilson@signadou.acu.edu.au>

The Australian Association of Mathematics Teachers has recently developed *Standards for Excellence in Teaching Mathematics in Australian Schools*. These *Standards* outline what teachers believe are the characteristics of highly accomplished teachers of mathematics, and provide both a framework against which teachers can be assessed and for teachers' ongoing professional learning. Boud (2000) argues that assessment should be sustainable in that it equips students with the skills and attitudes that will enable them to meet and monitor their own future learning. This paper describes how the *Standards for Excellence* were used to develop an assessment methodology in the context of teacher education that has the potential to develop a powerful and robust sense of teacher identity for exit students.

Focus of the paper

This paper outlines how an innovative approach to an assessment task, built around the Australian Association of Mathematics Teachers (AAMT) *Standards for Excellence in Teaching Mathematics in Australian Schools* (2002), both contributed to pre-service teachers' development of a strong sense of teacher identity and shed light on their journeys as pre-service teachers. The assessment task was the culmination of a course of instruction in mathematics pedagogy, during which time these pre-service teachers created a strong and cohesive learning community.

Theoretical framework

Standards for Excellence

The Australian Association of Mathematics Teachers (AAMT) *Standards for Excellence in Teaching Mathematics in Australian Schools* (AAMT 2002) were developed over a period of three years as a Strategic Partnerships with Industry Research Grant, in which Monash University was the research partner and AAMT was the industry partner. The methodology involved extensive consultation with teacher focus groups, with input and advice from the broader mathematics and mathematics education community. The development of the *Standards for Excellence* is set within a national and international context in which professional standards have become an increasingly important element in describing and promoting excellent teaching (NCTM 1991, Ingvarson 1995, Ramsey 2000, Commonwealth of Australia 2003).

The AAMT *Standards for Excellence* outline three domains in which excellence in teaching mathematics is evident: professional knowledge, professional practice and professional attributes. Professional knowledge includes knowledge of mathematics, of students and of how children learn mathematics. Professional practice includes creating an effective learning environment, planning for learning, teaching in action, and incorporating appropriate assessment in teaching. Professional attributes include personal attributes such as enthusiasm for teaching mathematics, a commitment to personal professional development and adopting community responsibilities such as promoting mathematics.

The *Standards for Excellence* are intended to serve at least two major purposes: enabling a transparent and defensible method of accrediting teachers of mathematics as highly accomplished teachers, and

providing a framework for effective professional development. They thus provide a description of one high-level step along a teacher's professional journey, and a vision of teacher identity at this point.

Sustainable assessment

Boud (2000) describes the existing paradigms of formative and summative assessment, arguing that summative assessment does not equip students well for the processes of effective learning in a learning society, and that we need to develop a new focus on formative assessment. He argues for a new paradigm termed "sustainable assessment", that has the potential to equip students as life-long learners. As the AAMT *Standards for Excellence* make clear, life-long learning is a key attribute of highly accomplished teachers of mathematics.

Boud argues that assessment always does "double duty", in that it both judges achievement and transmits what we value; that it is assessment both for learning and for certification; that it has a focus on the immediate but that it also equips for life-long learning; and that it attends to both content and process domains. He suggests that sustainable assessment attends to these dichotomies, and that it enables students to evaluate their on-going learning and development without being dependent on formal, external feedback mechanisms. He sees sustainable assessment as an integral part of this life-long learning.

Teacher identity

Teaching is a complex profession. As recognised by teachers themselves in developing the AAMT *Standards for Excellence*, excellent teaching is dependent upon knowledge, action and beliefs. These three aspects of teaching excellence do not exist in isolation; each influences and depends upon the others, and they are intricately woven to form the complex fabric of teaching. It is the teacher's motivations for, and feelings about, the complexity of teaching that I call teacher identity.

Twenty years ago Shulman (1986) discussed the distinctive kinds of knowledges necessary to be a teacher, identifying pedagogical content knowledge as a key aspect of excellent teaching. More recently he has articulated a taxonomy of learning, culminating in commitment and identity, which are realised as values are internalised and character developed. He argues that an educated person's "commitments always leave open a window for sceptical scrutiny, for imagining how it might be otherwise" (Shulman 2002).

Mayer (1999) distinguishes between role and identity in self-formation as a teacher, suggesting that core beliefs constitute one's teaching identity. Students' reflective journals indicated that teaching personalities were privileged over pedagogical and subject knowledge, and that pre-service teachers often felt that what they were learning in their University studies, and what they were asked to do in schools during the practicum, were contradictory to their personal feelings about what it meant to be a teacher. Drake, Spillane and Hufferd-Ackles (2001) describe teachers' identity as their sense of self as well as their knowledge, beliefs and orientations to work. They describe the many influences on primary teachers' sense of identity, in particular some of their feelings of failure as students in school mathematics and their struggle to make sense of and incorporate new ways of teaching.

Building on Lave and Wenger's (1991) influential study of five apprenticeship learning situations, Adler (1998) emphasises that knowledge about teaching is tied to the context of teaching, that it is dynamic and that it is "simultaneously personal and social". She suggests that this knowledge is not acquired in the academic study of teaching, but that it evolves through "legitimate peripheral participation in a community of practice" (Lave and Wenger 1991), of which pre-service education is one ingredient. For Adler this knowledge is tied to pre-service teachers' identities, and is built through discourse and through making the hidden assumptions of teaching transparent. Mayer (1999) also stressed the need for pre-service teachers' personal theories to be made explicit, deconstructed and problematised through reflection and discourse.

Thus it would appear to be essential to construct learning and assessment opportunities in pre-service teacher education that promote the formation of habits of mind that enable pre-service teachers to link theory and practice (Ebby 2000), through reflecting on their own teaching in a framework that makes explicit not "how to be" an excellent teacher of mathematics, but "what it is to be" an excellent teacher of mathematics. In Boud's (2000) terms, assessment in pre-service teacher education must be sustainable.

The portfolio and interview

Journal writing (Artzt 1999, Brown 2001), case studies (Hammermas, Darling-Hammond and Shulman 2001), professional conversations (Britt, Irwin and Ritchie 2001, Thornton and Blain 2002) and the

preparation and presentation of structured portfolios (Frid and Sparrow 2003) are all recognised as valuable tools to promote pre-service teachers' capacity to be reflective practitioners.

In the study described below pre-service teachers were required to reflect on their knowledge and to see themselves as active researchers of their own teaching in the context of the *Standards for Excellence* described above.

I teach a subject Secondary Teaching Studies (Mathematics) to students at the University of Canberra, Australia. This subject is a one-semester subject that forms part of either a one-year Graduate Diploma in Education or of the final year of a four-year Bachelor of Education degree. Students enrolled in this subject hope to teach mathematics to secondary students, aged 11 to 18, in the following year. For most of these students this subject of 36 hours is the only one in which they look specifically at how students learn mathematics, at mathematics curriculum, and at different approaches to teaching mathematics. All students also undertake a four-week period of Professional Experience, during which time they work full-time in a school under the guidance of an experienced teacher of mathematics.

Assessment for this subject typically involves three assignments: an exercise in micro-teaching, the development of a set of detailed lesson plans, and the accumulation and presentation of a portfolio of activities, resources, lesson plans and reflections during the semester and particularly during the period of Professional Experience. While these assessment tasks have immediate and obvious practical value, it is debatable to what extent they meet the criteria of sustainable assessment, nor to what extent they promote the development of teacher identity, as described above. Yet for these students, this is their only pre-service experience in mathematics education, hence it is critical that they are well positioned to become life-long learners of the art and craft of teaching mathematics.

It is noteworthy that many, but not all, of the students involved in this class were mature-aged students, who already had varied life experiences and a strong sense of personal identity. Two of the students had left extremely well-paid careers to become teachers, others had experience as parents and community leaders. These students had a strong sense of why they wanted to become teachers and what they hoped to achieve. In general they "wanted to make a difference". They were also very aware of their own experiences as students in mathematics classes, and while they had been successful, they felt that their school experiences had not engaged them, and had not promoted the development of deep mathematical understanding. In the words of one student "I don't think I will make a very good maths teacher, because I have just begun to realise that I don't really understand anything I learned at school – I was just good at it."

As the lecturer of the subject I had been concerned for some time that the portfolio presented by students tended to be little more than an unfocused collection of resources, journal articles and lesson plans with only brief annotations, but no apparent coherence. While it told me something about the pre-service teachers' capacity to collect resources, it told me little about their capacity to thoughtfully weave these resources into the complex web of teaching mathematics, nor to make sense of their teaching experiences in the light of what they had read and discussed in their academic studies.

In an attempt to make the portfolio assessment more focused, I decided to reframe it in line with the AAMT *Standards for Excellence* described above, and to add a 20-minute individual interview, during which time pre-service teachers were asked to explain their rationale for including parts of the portfolio, and to evaluate their knowledge of, practice of, and beliefs about, teaching. Each pre-service teacher was asked to answer three questions, segments of which were:

1. The AAMT *Standards for Excellence in the Teaching of Mathematics in Australian Schools* list three aspects of being an excellent teacher: professional knowledge, professional practice and professional attributes. From your own Professional Experience describe a situation where one of these aspects was evident. Use your portfolio to provide concrete evidence to support your answer.
2. With reference to the readings discussed during the semester, describe the characteristics of a classroom in which high levels of engagement with mathematical ideas are likely to be present. Refer to a class that you taught during Professional Experience and describe how you attempted to create and/or sustain such an environment. Use your portfolio as evidence.
3. Discuss one of the quotations below. Refer to readings during the semester, a class you taught during Professional Experience, and your portfolio to support your answer.
"Of course setting is advantageous for instruction. It's just not advantageous to the students in the lower classes." Eileen Kott, teacher in Florida. In *Mathematics Education Dialogues*. November 1998 p12

Each student was then asked to bring their portfolio to an interview, to answer the three questions above, and to refer to their portfolio as evidence. Two mathematics educators interviewed the students, made notes during the interview, referred to the portfolio for any further clarification, and provided feedback within

thirty minutes of the completion of the interview. Students were informed that the interview process was an experiment, and that it was being used as an attempt to make the portfolio more focused. Each student also agreed to have the interview taped for future reference.

The interviews

As might be expected in any assessment task, there was a wide range of student responses and levels of performance. A few students were unprepared, had done little reading, and did not focus their answers or portfolio. At their best, however, the interviews were remarkable. They showed a capacity to be reflective of their own teaching, to be critical and constructive and to ask informed questions of the status quo. They provided a vivid and tangible image of pre-service teachers developing a very strong sense of teacher identity.

John

John focused on professional knowledge in his discussion of the *Standards for Excellence*. He drew parallels between a constructivist approach to teaching and his background in human communication theory. He noted that a key principle of communication was that “the receiver makes the message”, and concluded that it was thus the teacher’s role to know his students, their culture and their idiom well enough to enable each student to make the message in a productive way.

“By the third week (of Professional Experience) I was much better able to recognise the diverse requirements of the students in the class. The girl who did not listen felt she understood most of the topic and was bored. The boy at the front was being continually distracted by his girlfriend who sat next to him. The girl at the back had developed lots of go-slow tactics to hide the fact that she did not understand most of the topic. The boy in the middle needed more challenging problem to keep his interest...I began to make progress with most of these students but I have a lot to learn before I can manage appropriate learning opportunities for most people in the class most of the time.”

John saw learning as problematic and dependent on a range of factors beyond transmission of information. He was able to incorporate what he had observed in practice with what he had read and discussed in his academic studies, and to incorporate his prior knowledge and experience. His sense of teacher identity would thus include a strong appreciation of diversity.

Malcolm

Malcolm reflected upon a singing observation sheet he had seen used in an early childhood setting. The teacher observed how each child sang, using prompts such as whether the child was opening her mouth, or moving her lips. Malcolm put a “productive mathematics behaviours” (Corkill 1999) checklist on his list of things to do, so that he would be able to more effectively monitor changes in students’ behaviours. This was at least partly in response to his observations that many students came to class unprepared both in terms of having the appropriate physical resources for learning and a productive frame of mind for learning. Like John, Malcolm saw knowledge of students as critical for effective learning, and recognised that he would need to take practical steps to continually develop that knowledge.

Linda

In her response to the second question Linda chose to focus on the characteristics of classrooms with high levels of engagement. She described how teachers at the school at which she was teaching told her to “never have discussions, and always give short, sharp comments”. She felt that such advice was contrary to a classroom environment in which high levels of student engagement would be evident. She noted that her plans to be creative and to engage students in solving problems “did not really pay off” in the school where she was teaching.

Linda was particularly interested in looking at mathematics learning in context. She described a journal article (Nicol 2002) she had read in which pre-service teachers had visited workplaces, but often been unable to recognise the mathematics being used. She felt that this lack of capacity to see and appreciate mathematics in a workplace context militated against creating an engaging and relevant environment for students. She described one class in which students who had a history of failure in mathematics were given “real-life maths, not that stuff you get in other classes.” Yet the real-life maths was restricted to questions such as “How many days are there in May?”, or “If I spent \$1.50 from a \$10 note, how much change would I get?”. Linda was wrestling with the very complex issue of what relevance really means in a mathematics classroom, and recognised her own lack of knowledge of mathematics beyond the school classroom.

Melissa

In thinking about an important issue in mathematics education (Question 3), Melissa reflected on her experiences with, and reading about, setting students based on their perceived ability levels in mathematics. She discussed the pros and cons, noting that setting students into ability groups made life easier for the teacher, but asked whether the students were really being provided with differentiated learning opportunities, or whether they were just being given more (or less) of the same at a faster or slower pace.

Melissa described how, in teaching fractions to a year 7 class, her supervising teacher had asked her to split the class into three groups based on results in a pre-test. On reflection she felt that, while they had worked diligently through the work assigned, the most advanced students had not been challenged in any significant way, and that, in general, the lowest achieving students remained the lowest achievers. However one student who had been placed in the lowest achieving group was able to complete the post-test with only one error. This was exciting for both the student and his teacher, who had not expected such a result.

Melissa commented on the immense volume of literature on ability grouping, and asked why the practice continued to be widespread when there was significant evidence of negative social impact and limited academic impact. She expressed her disappointment that teachers at the school where she was teaching used the expression “Zoo” class to describe the lowest achieving group, saying that the grouping practice tended to concentrate students with behavioural problems into the one group. However she also recognised that, for one student in her year 7 class, being given work at a level with which he felt comfortable had completely changed his attitude towards mathematics, and she wondered if such a change would have taken place had the students been taught as a whole class. Melissa concluded by saying “I haven’t got an answer, I’m still sitting on the fence”.

As noted by my co-interviewer these, and most of the other students in the group, had thought deeply about their teaching, about what they had read and talked about in their academic studies, and about how it related to their practical experience. They did not provide glib answers, but saw knowledge of teaching as developing through reflection over a long period of time. Melissa noted that “by putting it all together (for the interview) it’s touched on layers of other issues”.

Student and teacher reflections

My co-interviewer commented upon the maturity of the students, and on how articulate they had been. She was impressed by their “willingness to expose and consider their weaknesses in an interview.” She noted that this task had assessed higher order thinking skills such as critical reflection, and had put into practice much of the rhetoric of the teacher education course. She felt that the interview process and portfolio preparation had modelled professional excellence in a very powerful way, by respecting the pre-service teachers’ background, knowledge and experiences, and their right to reserve judgement where they had not yet arrived at a firm opinion. She felt that, in this way, the process had been unusual in its value to the students.

The interviews provided strong evidence of developing teacher identity, in particular characteristics such as scepticism, the capacity to reflect on experience to link theory and practice, and a sense of self as a learner. The pre-service teachers’ core beliefs about teaching, and about themselves as teachers, were challenged. They recognised their existing professional knowledge and highlighted their shortcomings; they evaluated their own and their supervising teachers’ practice honestly and critically; they revealed a developing sense of what they valued in learning.

However the most surprising outcome was the sense of community generated through the process. The pre-service teachers emailed each other after the interview to discuss their feelings about the task. This was an entirely self-motivated undertaking – I had not asked them to share their reflections and had expected that, like every other assessment task I had ever set, students would just be glad that it was over. On learning of this email exchange, I requested a copy with names removed, and the students were happy to provide their reflections.

“When the audience is sitting in front of you, there is more chance that you can adjust your presentation if they appear bored, confused or incredulous.”

“Because the interview is so short and the time can disappear so quickly it is very important to be organised and be clear about the main messages in your presentation (just like in a lesson)”.

“I think it is a little dangerous to try and assess people on a 15-20 minute interview, as it tends to favour those who are articulate rather than (necessarily) those who have reflected deeply. Of course every assessment will have its own bias (essays, after all, will favour those who write well), but I think the danger of assessing style rather than substance are greater in (a) short interview scenario.”

“Probably the most I got out of the whole process was how analysing, reading articles and reflecting continued to challenge me about my teaching. Many of the articles I read had direct relevance to what I had been teaching and raised lots of questions, and provided some answers, in teaching these topics. While I was preparing for an assessment item, I think I got more out of the exercise than the mark Steve gave me.”

These pre-service teachers saw the exercise as an important part of their on-going development as teachers of mathematics. They saw themselves as part of a community, and were keen to share their experiences and thoughts with others. Unprompted, they thoughtfully evaluated the validity of the interview process and made links with assessment practices beyond their current course. In this sense the portfolio and interview did “double duty” by focusing on both the immediate and the future, by transmitting what is valued as well as making judgements, and by giving students the reflective skills to attend to their on-going development as excellent teachers of mathematics.

Conclusions

The AAMT *Standards for Excellence* provide a framework through which teacher identity can be developed and evaluated. While pre-service teachers cannot be expected to show highly accomplished practice, as described by the *Standards for Excellence*, the *Standards* can provide a vision of what it means to be an excellent teacher. The portfolio and interview assessment task described above enabled students to describe their own experiences in the light of the *Standards for Excellence*. In the process it would appear that this assessment task met many of the criteria for sustainable assessment described by Boud (2000). In particular the students’ unprompted reflections provided clear evidence that they were able to evaluate their on-going learning and development without being dependent on formal, external feedback mechanisms. The portfolio and interview assessment served both the immediate purpose of evaluating current knowledge and the long-term purpose of giving students a framework for their life-long journey as teachers of mathematics.

Of course this assessment task did not stand alone. It was part of a course that included extensive instruction, discussion, reading and reflection. However it appeared to pull together students’ experiences in a very powerful and revealing way. The extent to which the developing sense of identity exhibited by these students grows and develops through their careers as teachers remains to be seen, and could profitably be the subject of further research. The AAMT *Standards for Excellence for Teaching Mathematics in Australian Schools* provides an ideal framework by which such a longitudinal study of teachers’ identity could be conducted.

References

- Australian Association of Mathematics Teachers Inc. 2002. *Standards for Excellence in Teaching Mathematics in Australian Schools*. Adelaide: Author.
- Adler, J. (1998) Lights and limits: Recontextualising Lave and Wenger to theorise knowledge of teaching and of learning school mathematics. In Watson, A. (Ed.) *Situated cognition and the learning of mathematics*. Oxford: Centre for Mathematics Education Research, 161-177.
- Artzt, A (1999). A structure to enable pre-service teachers of mathematics to reflect on their teaching. *Journal of Mathematics Teacher Education* 2, 143-166
- Australian Association of Mathematics Teachers Inc. 2002. *Standards for Excellence in Teaching Mathematics in Australian Schools*. Author: Adelaide.
- Boud, D. (2000) Sustainable Assessment: rethinking assessment for the learning society. *Studies in Continuing Education*, 22(2), 151-167
- Britt, M., Irwin, K. and Ritchie, G. (2001). Professional conversations and professional growth. *Journal of Mathematics Teacher Education* 4, 29-53
- Brown, T. (2001). *Mathematics Education and Language: Interpreting Hermeneutics and Post-Structuralism*. Dordrecht: Kluwer
- Commonwealth of Australia. (2003) *Australia’s Teachers: Australia’s Future. Report of the Review of Teaching and Teacher Education (3 volumes)*. Canberra: Author.

- Corkill, P. (1999). *Reflective Practice in the Mathematics Classroom*. Cheltenham, Vic: Hawker-Brownlow.
- Drake, C. Spillane, J.P. and Hufferd-Ackles, K. (2001) Storied Identities: teacher learning and subject-matter context. *Journal of Curriculum Studies* 33(1), 1-23
- Ebby, C. (2000). Learning to teach mathematics differently: The interaction between coursework and fieldwork for pre-service teachers. *Journal of Mathematics Teacher Education*, 3, 69-97.
- Frid, S. and Sparrow L. (2003). Using mathematics teaching portfolios to empower pre-service primary teachers. In Bragg, L., Campbell, C., Herbert, G. and Mousley, J. (Eds). *Mathematics Education Research: Innovation, Networking, Opportunity. Proceedings of the 26th Annual Conference of the Mathematics Education research group of Australasia Incorporated, Deakin University July 2003*. Melbourne: Author, 356-363
- Hammermas, K., Darling-Hammond L. and Shulman, L. (2001). *Towards expert thinking: How case-writing contributes to the development of theory-based professional knowledge in student teachers*. Paper presented at the Annual Meeting of the American Educational Research Association, Seattle, April, 2001.
- Ingvanson, L. (1995). Professional credentials. Canberra: Australian Science Teachers Association.
- Lave, J and Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Mayer, D. *Building teacher identities: Implications for pre-service teacher education*. Paper presented at Australian Association for Research in Education Conference, Melbourne, 1999
- NCTM (1991). *Professional standards for teaching mathematics*. Reston VA: Author.
- Nicol, C. (2002) Where's the Math? Prospective Teachers Visit the Workplace, *Educational Studies in Mathematics*, 50(3), 289-309
- Ramsey, G. (2000). *Quality Matters. Revitalising teaching: critical times, critical choices*. Sydney: NSW Department of Education and Training.
- Shulman, L. (1986). Those who understand: Knowledge and growth in teaching. *Educational Researcher*, 15(2), 4-14
- Shulman, L. (2002). Making Differences: A Table of Learning. *Change*, Nov/Dec 2002 37-44
- Thornton, S. and Blain, K. (2002). Professional development of teachers of mathematics through extended collegial dialogue: the ACT mathematics Quality Teacher Program. In Barton, B., Irwin, K., Pfannkuch, M. and Thomas, O. (Eds) *Mathematics Education in the South Pacific: Proceedings of the 25th Annual Conference of the Mathematics Education Research Group of Australasia Incorporated, University of Auckland July 2002*. Auckland: Author, 657-664