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Numeracy in a reform-based learning environment

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Abstract

Curriculum reform in Tasmanian schools centres around the implementation of an Essential Learnings framework. This framework has provided a catalyst for pedagogical change; for teachers to work collaboratively; in cross-curricular ways and; for assessment to be authentic and support learning. The place of numeracy in this reform-based learning environment is the focus of a research project which commenced in 2005. A professional learning program for middle years' teachers with a goal to improve student outcomes in numeracy has been co-constructed with participants and will be evaluated at several stages through the project. An important component of the project involves working with teachers as they continue to implement the Essential Learnings. This paper reports on the baseline data received via a teacher profile and discusses teachers' responses to questions on planning and implementing units of work in the area of numeracy.

Introduction

In Tasmania, a major curriculum reform, the Essential Learnings (ELs) framework is being implemented in all State schools and many Catholic schools. The process has involved both top-down and bottom-up construction of change, initially agreeing on a set of values and purposes, identifying 18 Key elements within five Essential Learnings (Thinking, Communicating, Social Responsibility, World Futures and Personal Futures), constructing outcomes and standards documentation and calibrating work samples (Department of Education, Tasmania [DoET], 2002; 2003). Underpinning the introduction of the framework is a focus on pedagogy. A set of agreed learning, teaching and assessment principles has also been produced (DoET, 2002) with the Teaching for Understanding (TfU) framework (Wiske, 1998) being adopted and promoted to teachers. Assessment and reporting against the ELs are being progressively introduced, with all schools reporting against the key elements 'Being Literate', Being Numerate' and 'Maintaining Wellbeing' in 2005.

Professional learning to support teachers' adoption of the reforms has been provided primarily through the School Education Division of the Department of Education. This has been in the form of face-to face professional learning, appointment of curriculum leaders in clusters and/or schools, and a wealth of printed and on-line material (http://www.ltag.education.tas.gov.au/default.htm). Planning proformas and exemplar units embedded in the ELs framework and reflecting the TfU have been published on the Learning, Teaching and Assessment Guide (LTAG website) and made available to teachers. Work samples to guide assessment have also been published. Encouragement of collaborative planning has been unprecedented, with

many schools providing group planning time for teaching teams. This has provided an impetus for teachers not only to become familiar with the new framework, but also to plan engaging, and authentic learning experiences that cross traditional key learning area (KLA) boundaries and provide opportunities for authentic demonstrations of achievement (DoET, 2002).

Although providing exciting opportunities for integration and provision of authentic learning experiences, the position of traditional KLAs such as Mathematics is not specifically addressed in the framework. This is not inconsistent with similar curriculum reforms in other states of Australia. In the case of Mathematics, preparing all students to be numerate adults, or quantitatively literate, is of vital importance (Steen, 1997; 2002). However, the need for some students to experience formal mathematics which can lead to tertiary study and contribute to the innovation is also recognised as important.

> We should keep in perspective the numerous and varied requirements and expectations of schooling. As part of their basic education students require deep knowledge across a range of learning areas and broad literacy, numeracy, scientific and technological skills. Interpretive skills and a variety of communicative and social skills are also fundamental. The concept of a broad, general education for personal growth and social participation must be balanced by the requirement for sound vocational preparation.
>
> (Committee for the Review of Teaching and Teacher Education (CRTTE), 2003b, p. 15)

Indeed, this illustrates the challenge posed for teachers and curriculum designers alike in addressing the need for general education to meet the requirements of the twenty-first century, together with preparation of some students to contribute to the innovation required in Mathematics, Science and Technology. A major contributor to this debate in the field of mathematics, Steen (2002) declared that quantitative literacy is not the poor relation of the elite mathematics curriculum. There is a critical need for the elite students to appreciate the purposes and applications of the mathematical thinking they have developed within the formal mathematics curriculum.

Echoes of this debate can be seen in the curriculum framework in Tasmania. Emphasis has been placed on the importance of being numerate rather than of the knowing Mathematics. As an identified key element, Being Numerate is recognised as a cross-curricular understanding, and one that is important for development in all students.

> Being numerate involves having those concepts and skills of mathematics that are required to meet the demands of everyday life. It includes having the capacity to select and use them appropriately in real life settings. Being truly numerate requires the knowledge and disposition to think and act mathematically and the confidence and intuition to apply particular principles to everyday problems.
>
> (Department of Education, Tasmania (DoET), 2002, p.21)

In implementing the new curriculum framework, Tasmanian teachers have been met with a number of challenges. They have been encouraged to adopt different planning practices – using the features of the TfU framework, and where possible to plan cross-curricular and collaborative units. They have also needed to think outside the traditional Key Learning Areas as organisers and with content not prescribed, consider what they will teach and importantly, why they are teaching it. This is then linked closely with how the teaching will occur – closely matching purposes with

appropriate teaching and learning activities, with an emphasis on Inquiry and Reflective Thinking (two overarching Key Elements). Finally, assessment has become a substantial focus not only through mandated assessment against key elements, but also as an important aspect of the teaching and learning process.

Taking account of the background context, a research project was conceived at the intersection of the state curriculum reform at the school level in Australia and Commonwealth concern for continued production of innovative and creative scientists and technologists (CRTTE, 2003a, p. ix). The researchers acknowledge the importance of quantitative literacy for all students and have focussed in the middle years (grades 5-8) where this is being developed, both as a necessary attribute for all and as a foundation for study of formal mathematics for some students. The researchers have also recognised that this is a critical time to support teachers as they work through the challenges outlined above. Named Mathematics in Australian Reform Based Learning Environments (MARBLE), the project aims to improve student numeracy outcomes through provision of teacher professional learning.

The MARBLE professional learning program is theoretically underpinned by Shulman's (1987a, 1987b) essential teacher knowledges. For the purpose of this project, four of the knowledges have been chosen as a focus;

- mathematical content knowledge (building teachers' knowledge of the mathematics they need to teach);
- pedagogical content knowledge (modelling and building understanding of pedagogical content knowledge appropriate to middle years numeracy);
- knowledge of students as learners (using student profiles to identify students' mathematical thinking and to plan to meet the identified issues);
- curriculum knowledge (in the context of the curriculum reform, to support teachers in adopting practices and building confidence in implementing innovation).

The researchers recognised that there are a number of important factors which contribute to successful Professional Learning. Two key features which have been identified in the seminal work by Hawley and Valli (1999) are the involvement of teachers in the identification of what they need to learn, the process to be used and the facilitation of collaborative problem solving. In terms of mathematics, Schifter (1998) found that professional learning experiences in which teachers were engaged with the content of the mathematics curriculum that they taught, in ways that challenged and deepened their own mathematical understandings, assisted them to make significant changes in their classroom practice. A teacher profile was used as a data collection instrument at the beginning of this project, identifying areas of teacher need and providing a valuable planning tool for appropriate challenges and collaborative activities that engage the teachers with the curriculum they are teaching. As a snapshot of teacher understandings, the profile will also provide valuable baseline data for evaluation of the project.

This paper presents data from the teacher profile with respect to the adoption of the Essential Learnings curriculum framework. This relates significantly to the focus on curriculum knowledge identified above. The following key questions will be considered:

1. What teaching and learning experiences do teachers currently adopt to promote understanding of numeracy in the middle school classroom?

2. What levels of teacher knowledge and experience are displayed with respect to applying the ELs curriculum framework to the teaching of numeracy?

3. Which areas pose the greatest challenge to teachers' implementation of the ELs framework with respect to the teaching of numeracy?

Methods

The teachers were drawn from nine schools in two rural clusters (one in the South and one in the North of the state). The schools represented were three primary schools (grades K-6), one secondary school (grades 7-10), and five district high schools (grades K-10). Grades taught by the participating teachers are outlined in Table 1. It should be noted that a number of teachers from the secondary and district high schools had middle school duties and some taught outside the 5-8 grade level. The teachers ranged in experience with 14 teachers having less than five years teaching experience, 15 with 5-14 years experience, and 13 with 15 years or more.

Table 1: Grade levels taught and gender of participating teachers

	Primary	Secondary	Primary/secondary	No grade specified	Totals
Male	7	8	4	0	19
Female	10	9	3	1	23

All teachers who were involved in the project completed a teacher profile at initial meetings with the researchers. The profile, modified from the work of Watson (2001), was originally designed to assess teacher knowledge in relation to Chance and Data, taking into account the kinds of teacher knowledge identified by Shulman (1987a, 1987b). The instrument used in this project focussed on the four knowledges identified above and had sections which looked at teachers' mathematical knowledge, knowledge of their students as learners of mathematics, teachers' confidence and attitudes in relation to the mathematics they teach and, their understanding and experience with implementing the Essential Learnings curriculum in relation to mathematics. This paper will discuss the results obtained in the latter section of the profile.

Data obtained from the section of the profile reported in this paper were primarily in the form of open ended responses. To obtain an overall picture of the range of responses, all individual responses were listed and categorised (in some instances this represented multiple responses from a single teacher). These were clustered (Miles & Huberman, 1994) and frequencies recorded. Selected teacher comments have been used to illustrate representative responses. Where it was possible, descriptive statistics have been used to illustrate patterns in response.

Results

The first section of the profile asked teachers to brainstorm their ideas regarding significant factors for teaching mathematics and numeracy in the middle years. To focus their ideas, two specific questions were provided for response. Each of these are discussed in detail below.

1.1 How would you go about improving students' numeracy and mathematical understandings in the middle years?

Thirty-seven of the 42 teachers responded to this question, all but one giving multiple suggestions. The 99 responses were categorised under themes that are summarised in Table 2.

Table 2: Responses themes for Question 1.1

Themes		Number of Responses
Teaching and Learning Activities		84
Teacher Factors		7
Inadequate teacher background	(2)	
Need for Professional Learning	(4)	
Need for a common vision	(1)	
External Factors		7
Increase class time allocated	(3)	
Lower student/teacher ratio	(1)	
Class grouping	(1)	
Increase access to technology	(1)	
Behaviour Management issues		1
Total Number of Responses		**99**

Clearly, teaching and learning activities and approaches were at the forefront of the teachers' thinking around ways to improve mathematical understandings. Analysis of this predominant theme uncovered several dominant sub-themes (with number of responses in parentheses). These were: making real life connections (19); using hands-on or practical activities (14); and using numeracy across the curriculum (6). There were very few specific examples given by teachers to illustrate how they would incorporate these into their teaching of mathematics. A typical response was;

> Plan learning experiences which include real life, hands-on problem solving activities.

Responses concerning mathematical pedagogy were given by fifteen teachers. These were problem solving (4), exploring and explaining alternative strategies and processes (8), developing mental computation strategies, repetition, and use of games. With respect to mathematical content, only five teachers made specific suggestions for inclusion in the curriculum: multiplication tables, division, measuring, mental

computation strategies, critical interpretation of data and use of calculators. One teacher, however, had a different perspective towards content, 'Delay and even eliminate the teaching of certain areas, such as division of fractions – maybe find more practical methods including the use of calculators'.

Seven teachers described approaches to teaching and learning that were broader in scope than mathematics. These are summarised by the following responses.

> Develop a supportive classroom environment that fosters student questioning, class discussion, risk taking, concept attainment, linking concepts etc.
>
> Vary teaching style to cater for different learning styles and abilities … develop a range of assessment strategies.

Consideration of the students' prior knowledge or understanding was addressed by two teachers as was use of group work as a classroom strategy. Providing opportunity for discussion was cited by a further three teachers:

> More discussion, sharing thoughts and ideas.

The opportunity to explore cross curricular links was given in the second question of this section.

1.2 Describe some of the ways you use mathematics to enhance student learning in key learning areas other than mathematics or in the Essential Learnings key elements.

Thirty-five teachers provided responses to this section, with most giving multiple examples. Data collection, analysis and graphing were most commonly cited as mathematical concepts that had broad application across the curriculum (16 teachers citing 27 examples). Measurement, budgeting and logic were also given as examples of content that could be applied across learning areas.

Only eight of the 42 teachers made specific reference to how mathematics could be applied to Essential Learnings or key elements, although a further four talked about applications in Inquiry Based Learning (IBL) or integrated units. One teacher gave a specific example of teaching numeracy through the Thinking-Inquiry essential.

> I have attempted to teach numeracy through Thinking Inquiry. Students have chosen an area of measurement (time, length, etc) and written at least five guiding questions, mind maps etc. to focus their inquiry. They also had to design an experiment related to their area of measurement. Students presented their work using powerpoint presentations, posters, brochures etc.

Responses linking mathematics with traditional key learning areas were more common than specific references to the Essential Learnings. Physical Education was the area in which most responses fell (10), with the subject 'PE' being referred to in seven of these cases. This was followed by SOSE (8), Science (8), ICT/Media (6), Art (4), Cooking (4), Design and Technology (4), Drama (2) and Music (2). It was also seen as linking well with Enterprise. One teacher saw its application as very broad.

> Numeracy is a basic tool/skill used in all areas. We do not programme links to other subjects. Obviously links are measurement in Technology and Science, data in SOSE, number in everything.

Another teacher, however, expressed the belief that such connections were 'not really happening'. Overall it was evident that most teachers could describe, and give specific examples of, how Mathematics could be linked across curriculum areas. The notion of outcomes, in either Mathematics, numeracy or an area other than Mathematics, was not addressed by the teachers' responses in this section.

The second section of the profile concerned planning and implementation of numeracy units. The first item in this section asked teachers to choose a concept they thought was important and outline how they might design and teach a unit for this topic. Specifically they were asked to outline: understanding goals of the unit; how they would introduce the concept; what class time would be spent on the concept; the teaching methods and groupings they would use; assessment strategies they would use and how other work across the curriculum would contribute to the understanding of the concept. Teachers were also asked to indicate whether they had previously taught this concept, and if so, had they enjoyed it and how had their students responded.

Of the forty-two teachers completing the profile, thirty-eight responses were received to this item. All of the responding teachers detailed a topic that they had previously taught and that they had enjoyed teaching, with only one exception, a teacher who indicated both yes and no to this question. Responses to the items in this section are summarised below.

Topic chosen

The majority of teachers chose a topic in the number strand, with units based around mental computation strategies being most commonly cited. The responses are outlined in the table below;

Table 3: Topics selected by teachers to outline planning process

Strands	Topic	Number of Teachers
Number		**14**
	Mental Computation	**(5)**
	Fractions	**(5)**
	Decimals	**(2)**
	Percentages	**(1)**
	Proportional Reasoning	**(1)**
Measurement		**6**
Pattern and Algebra		**3**
	Patterns	**(1)**
	Mobile Phone deals	**(1)**
	Linear Relationships	**(1)**
Chance and Data		**10**
Cross Strand		**4**
	Problem Solving	**(1)**
	Finance	**(1)**
	Cartesian plane	**(2)**
No Response		**4**

Understanding Goals
Teachers were able to identify what they wished to cover in the unit. In most cases teachers represented this as a list of goals – commonly three for each unit, with eight teachers outlining a single goal only. Of these, forty-eight goals referred to understanding of a concept, principle or big idea in mathematics. A further twenty-five described skills rather than understandings. Only two of the teachers expressed the understanding goals in terms of questions, interestingly both describing units in measurement.

- What can be measured?
- What strategies/tools are used in measurement?
- Why is estimation so important?
- Why do we use standard units of measurement?

Introducing the concept
An initial whole class discussion or brainstorm was the preferred introduction for the majority of teachers (eighteen of the forty-two). Eleven of the teachers proposed to centre the discussion around a real life problem or example, whereas a further eight planned to begin with a mathematical problem such as an equation. Introducing a concept using games was common to all the teachers describing a chance unit; games were also suggested as an introduction to the teaching of fractions/decimals.

Although there were very few specific examples of activities outlined, use of concrete materials was referred to by eight teachers, including all five who were teaching Chance. Use of examples from the media was mentioned by two. Opportunities for students to demonstrate their level of understanding at the beginning of the topic were not specifically addressed by most teachers. Two teachers proposed mind mapping, one outlined the use of 'Think Boards' to demonstrate level of understanding, another suggesting placemats' to allow students to demonstrate their thinking, and a fifth teacher did not specify a teaching activity.

Teaching methods and groupings I would use include …
Twenty-three teachers outlined the use of some whole class instruction – either explicit teaching (14) or whole class activity/discussion (13). Small group work was specifically described by 27 teachers, with two outlining sharing between groups as a strategy. Thirteen teachers described individual tasks as being used, in six cases these being project based. Use of hands-on or concrete materials was described by six teachers, IT and mathematically-based games by four each. The other methods emerging in this section were use of peer tutoring and guided discovery (each mentioned by two teachers) and outdoor activities and models (each mentioned by a single teacher).

Assessment methods and strategies I would use include…
The most common response to this question (18 teachers) was the use of teacher observation for assessment. Whether this was primarily for formative or summative assessment was not always clear. Seeking verbal responses from students to explain their understanding was outlined by seven teachers, including three of the eighteen above. Ten teachers said they would use a formal test to assess the concept, with

another ten assessing bookwork or worksheets. Investigations, projects or presentations were used by eight teachers. Rubrics were used by five of the teachers for outlining assessment to students.

My students generally respond to this concept by…
The teachers' comments on the student response to their teaching of the concept predominantly concerned either the students' enjoyment or understanding of the concept. They are summarised in Table 4.

Table 4: Comments referring to student response to units taught

Comments referring to	No of responses
Students' enjoyment of or engagement in the unit	17
Students' understanding	2
Both enjoyment and understanding	3
Neither enjoyment/understanding	1
No response	19

In two cases, teachers reported students being reluctant to work on tasks, particularly if it was not one that they enjoyed. One reported students enjoying group work, whereas another found students refused to engage in working on project tasks that were not directed by the teacher. Teachers who had reported using hands-on activities and games found these to be well received by students.

With respect to responses concerning understanding, two of the teachers noted that students had difficulty extending their understanding to new or more difficult related concepts.

How could other work across the broader curriculum contribute to understanding this concept?
Of the 37 teachers describing a concept, thirteen did not respond to this question. Of those who did, several replied that connections should be made to everyday life, but did not give specific examples; 'impact of decimals in real life, day to day occurrences'. Several responses were generic and referred to problem solving or strategies having a wide application. Teachers working within the number strand were able to give concrete examples of connections (budgeting, cooking), as could those working in measurement (cooking, MDT) and chance (gambling, predicting weather). The teacher who described an algebra unit revolving around mobile phone plans could suggest applications in SOSE and geography.

The final section of the profile that is to be considered is the level of teachers' experience of the ELs curriculum framework and the support materials on the Being Numerate site (http://www.ltag.education.tas.gov.au/focus/beingnumerate/default.htm). These are summarised in Table 5.

Table 5: Teachers reported experience of ELs curriculum documents

Level of Experience with each of the documents:	Essential Learnings Framework	Outcomes and Standards	Being Numerate under specific focus on LTAG
Used	24	22	8
Read	10	13	5
Seen	7	6	11
Not Seen	0	0	17
No response	1	1	1
Total	**42**	**42**	**42**

From Table 5 it can be seen that all responding teachers had some familiarity with the ELs Framework documentation, and the Outcomes and Standards. This would be expected with reporting against the framework, using the Outcomes and Standards being mandated for three key elements in 2005. Nevertheless, given this requirement it is somewhat surprising that not all teachers had actually *used* the Outcomes and Standards. It was interesting to match the level of teaching experience of the teachers with their adoption of the new curriculum documents. This is outlined in Table 6. Experienced teachers, on the whole had the greatest level of familiarity with the framework documents.

Table 6: Teachers reported usage adoption of ELs curriculum documents

	% teachers (actual number) reporting using documents		
Document Teaching Experience	Essential Learnings Framework	Outcomes and Standards	Being Numerate under specific focus on LTAG
< 5 years teaching	50 (7)	36 (5)	14 (2)
5 - 14 years teaching	53 (8)	47 (7)	13 (2)
15+ years teaching	62 (8)	69 (9)	31 (4)
All teachers	**55 (23)**	**50 (21)**	**19 (8)**

Teacher use of the Being Numerate materials was low, with only 20% of teachers reporting they had used these, and a significant proportion of the teachers not having seen them. Years of experience did not appear to be related to familiarity with these. This site has a wealth of material to support the teaching of numeracy. Whether teachers were unaware of this material, found it difficult to locate, or simply did not have the time to access, it is not known.

Finally, teachers were asked to report on their own confidence in using the Teaching for Understanding framework. Twenty teachers did not respond to this question and a further fifteen indicated they would welcome assistance with working with this. Of the remaining teachers, four indicated confidence and three developing confidence with use of this framework.

Discussion

There were a number of very positive outcomes from the data. The teachers' suggestions for improvement of numeracy outcomes are in concert with the underpinning philosophies of the Essential Learnings framework. It was also encouraging that all teachers could report on a topic that they enjoyed teaching in the area of numeracy. Nevertheless, the data indicated that adoption and implementation of the Essential Learnings framework was proving to be a challenge to the teachers.

Each of the key questions posed in the introduction will now be addressed in relation to the results obtained from the profile.

1. What teaching and learning experiences do teachers currently adopt to promote understanding of numeracy in the middle school classroom?
The teachers could describe a number of general strategies that should be adopted in the mathematics classroom, for example making real-life and hands-on activities were commonly cited. There were very few examples given, however, of specific activities in the area of numeracy. Mental computation (a recent focus of professional learning in Tasmania) was one of these, together with problem solving and exploring and explaining alternative strategies.

2. What levels of teacher knowledge and experience are displayed with respect to applying the ELs curriculum framework to the teaching of numeracy?
This question needs to be answered on two levels. The first is from the point of view of applying the approaches to planning and assessing of the Teaching for Understanding; the second is from the place of numeracy in the curriculum.

There is considerable encouragement on the part of the DoE for teachers to use the TfU framework for planning learning sequences. This takes the form of a published and web based guide for planning, Planning Learning Sequences (http://ltag.education.tas.gov.au/planning/default.htms), availability of exemplar units written to conform to the framework and considerable professional learning opportunities undertaken by curriculum leaders. Whilst the responses from a number of teachers indicate a clear understanding of the process of identifying understanding goals, and matching teaching, learning and assessment activities to these, clearly many teachers are still grappling with this process. Identifying understanding goals, as distinct from skills, in relation to mathematical concepts and separating unit long goals, from overarching goals, is problematic.

Assessing students' prior knowledge is also identified as a challenging area for many teachers. There were very few specific examples of how teachers would incorporate this in their programs. This has very strong connections to teacher understanding of how students learn and is clearly an area requiring professional development. Assessment practices on the whole as reported by these teachers, although moving

away from traditional testing, again appear to need further development. The TfU looks at understanding from the perspective of performance, that is,

> ….to do a variety of thought-provoking things with a topic, such as explaining, finding evidence and examples, generalising, applying, analogising and representing the topic in new ways. (Blythe, 1998, p12)

This includes using assessment as a tool for learning (for example by self assessment practices) as well as to allow students to demonstrate their understanding better through performances that incorporate using their knowledge in different ways. The data from the teachers' planning exemplars is supported by their own self-reporting of confidence with the TfU framework.

With respect to the place of numeracy in the ELs curriculum, only eight of the 42 teachers made specific reference to how mathematics could be applied to Essential Learnings or key elements. It was surprising that given the significant focus on the curriculum reform, the language of the ELs was not more broadly adopted by teachers. Indeed many teachers cited connections with key learning areas or traditional subject areas rather than key elements. With respect to integration, only four teachers talked about numeracy applications in Inquiry Based Learning (IBL) or integrated units. Clearly this represents an area that can be developed with teachers.

3. Which areas pose the greatest challenge to teachers' implementation of the ELs framework with respect to the teaching of numeracy?

Several underpinning features of the ELs framework are worthy of note when considering this question:

- Interconnection and interrelation of learning
- Engagement of learners in authentic achievement
- Clear statement of what learning is expected.

From the results of the profile, it is evident that although teachers can see in a general sense that there are relationships across key learning areas, and key elements, it is also clear that planning for authentic experiences that develop numeracy outcomes in cross-curricular ways is a challenge. This is not surprising when one considers that this innovation represents a significant rethink in planning, resourcing and need for collaboration among teachers. It is heartening, however, that many teachers recognise the need for real-life and cross-curricular connections for improving numeracy outcomes.

The need to engage learners is obviously paramount in the teachers' minds. This was a major consideration when assessing success of a unit. To this end there were a number of teachers who indicated that they used pedagogies that involved students in group work, activities, games or inquiries. However, the ELs framework emphasis on Inquiry and Reflective Thinking has not been widely adopted in the planning of these teachers. Providing more experience in planning and implementing inquiry would appear to be beneficial.

Assessment practices varied greatly across the group. It was evident that teachers were adopting the practice of collecting a variety of evidence, including observation, however few teachers indicated that performances of understanding were required and only a five indicated having used rubrics. It was interesting that not all teachers had used the Outcomes and Standards. Experience in implementing a range of assessment practices, and matching these with the Outcomes and Standards, is also indicated as an area of challenge.

Conclusion

The teaching profile provided rich data to enable planning of the Professional Learning program. Information obtained through planning exemplars is supported by teachers' own indications of areas in which they would welcome development. The data presented here, together with information from other sections of the profile (in Beswick, Watson and Brown, in press; Watson, Beswick and Brown, in press) was presented to MARBLE school coordinators and considered along with a student profile. The resultant planning process has mapped out a multi-pronged approach including modelling of inquiries, planning using the TfU framework, consideration of content, analysis of student responses and school based case studies. The involvement of teachers in the planning process and the focus on connecting the teacher learning with student learning reflects the findings of the literature (Hawley and Valli, 1999; Sykes, 1999). The project will continue to be evaluated, not only through teacher feedback but also through analysis of student outcomes.

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