

# When assessment is about learning

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Literacy Learning:  
*the Middle Years*

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## Introduction

This paper describes the implementation of an interdisciplinary unit entitled *Maths to save the sea*. The unit was originally implemented in a class of middle years' students in a Queensland high school using an outcomes based model. I have since worked on the unit to include essential learnings rather than outcomes, the preferred model in Queensland in 2008. *Maths to save the sea* is the result of an effort to manage the many and varied expectations of teaching students in the middle years. The unit incorporates literacy and numeracy, interdisciplinarity, middle years' signifying practices (Pendergast & Bahr, 2005) and concepts of authentic and productive assessment. What makes this unit interesting is that this was achieved within a context of a traditional and conservative high school where high stakes, criterion-based assessment was the norm. What follows is a discussion of the original unit presented to Year 8 students, with the addition of essential learnings in the Queensland State school system in 2008. The next section looks at the context of classroom implementation.

## Rationale and classroom context:

### Low achieving students and high stakes assessment

As the national testing regime in Years 3, 5, and 7 attests, all children in Australia are meant to reach externally arbitrated standards. This places immense pressure on students who are termed *low achieving*. By the time this unit was first implemented, students in my class had heard themselves described in that way for eight years. Add this stigma to the exigencies of adolescence, and the class in general was a difficult one to teach. The students were evidencing the process of synaptic pruning, coming to terms with gender identity, experimenting in moral development and were capable of resisting the ways they had been constructed as adolescents (Pendergast & Bahr, 2005). These students had become accustomed to failure and ways to avoid failure. Generally as well, there is often a slowed academic development in this age group. Often there is the expectation that all students can meet the relevant outcomes in each of the Key Learning Areas. This expectation, however, does not universally apply to this age group. Many students, and especially those with languages other than English, have not necessarily gained the expected basic levels of literacy and numeracy by the middle years (Luke et al., 2003).

The tensions here are palpable. I was faced with a number of issues which needed to be thought through before the unit was written. I first used experiential understandings and gut instinct and decided that students would:

- achieve to the appropriate level outcomes in Mathematics and Studies of Society and Environment (Level 4 outcomes, as per the Queensland Syllabus);
- have several opportunities to meet outcomes (formative and summative);
- experience a rich environment where they would learn collaboratively (teaming), be exposed to higher order thinking, enter into strong relationships with teachers and peers and have the chance to negotiate their work and how learning would occur;

- be able to make connections between the Key Learning Area content of Mathematics and Studies of Society and Environment and learn the *ways of knowing*, the *tools* and *heroes* of each discipline;
- be immersed in the literacies of each discipline and be able to discuss the ways they use each literacy to make meaning
- be engaged in rigorous, appropriate and future oriented learning.

### Organising ideas for the unit:

The unit *Maths to save the sea* was framed by three questions that were derived from Wyatt-Smith, Cumming and Elkins (2005, p. 271). These were:

1. What is it that students will know?
2. Why is this knowledge valued?
3. How will effective instruction emerge to find out what students know?

Assessment and learning were re-framed so that the students in the middle years' class would have positive consequences from their learning. The next section of this paper looks at the three questions which underpinned the unit.

### What is it that students should know?

The unit was written from the school's curriculum framework and incorporated the demands of Semester One's Mathematics examination, the content of which roughly aligned with the Level 4 outcomes from the Queensland Junior Mathematics Syllabus and the Studies of Society and Environment (SOSE) core content of environmental sustainability and the production of a business plan. This content would currently align with the *Essential Learnings* produced by the Queensland Department of Education, Training and the Arts (2008), notably the following SOSE Essential Learning example:

Interrelationships between human activity and environment can result in particular patterns of land and resource use, and can cause environmental problems, and students should respond to local and global issues by taking action in planned and enterprising ways. (Queensland Department of Education, Training and the Arts, 2008, p.1)

In mathematics, students had to cover disparate topics ranging from percentages, fractions, profit and loss to the geometry of squares and triangles. The Head of the Mathematics Department was concerned only that the content was taught and tested. This left professional license for teachers to choose *how* the content would be addressed. I used the concept of a *big idea* or open question, which would encompass disparate content and allow students to experience success in the examination.

The original unit was organised around an outcomes framework. Learning outcomes are descriptions of observable demonstrations by learners. A learner demonstrates learning outcomes at one level before working towards a demonstration of learning outcomes at the next level. Thus learners needing more time or needing different or additional contexts are not forced to move on to the next level.

### Open questions

In Studies of Society and Environment, students had to engage with the economics of businesses and I combined this with environmental issues. The question, *How can businesses be profitable and environmentally aware*, emerged. This question contextualised the task of writing a business plan. In my mind *profitable* incorporated the Mathematics content to be assessed. The big idea incorporated knowledge I had only recently gained about the Guylian Chocolates Company. This company sells chocolates in the shape of sea creatures

and the profit made from every chocolate sea horse in every chocolate box sold worldwide is given to a foundation whose aim is to protect endangered seahorses. Here was the catalyst for the unit, and some amazing potential for Mathematics activities – percentage of seahorses in box, fraction of seahorses in box, percentage of profit per box, size of box and so on. Students could learn about business plans by writing one for their own lunchtime business, the profit from which could be sent to a charity of their choice and to fund a trip to Sea World on the Gold Coast. This content appealed to the class and was timed to be implemented after the students had finished a unit on ‘Survival Maths’. For that unit, students had been cast aways on a deserted island (my classroom). The school was located in Brisbane’s bayside near the sea and many students loved the beach.

### **Sequence of lessons and lesson matrix**

The matrix in Table 1 shows part of the unit’s organisation, re-written to show Essential Learnings rather than outcomes. I have focused mainly on the work relating to Studies of Society and Environment. The full unit plan includes lesson sections in relation to the Mathematics content.

### **Why is this knowledge valued?**

Values which underpin a Middle Years Curriculum include:

- learning collaboratively;
- learner centred approaches;
- outcomes based assessment;
- flexibility;
- an awareness of ethics;
- community orientation, and
- strategic links (Cumming, 1998).

Most of these values were addressed in the unit. At the very least, an awareness of issues in the environment and an awareness that each individual can take action to improve the environment incorporates Bloom’s Taxonomy, where knowledge is comprehended, applied, analysed, synthesised and evaluated. Each of these is a valuable tool for thinking. In the unit students were exposed to a variety of opportunities to use each part of the taxonomy and they went to and from each stage in the taxonomy. The next section looks at other values covered in the unit.

### **An awareness of ethics**

Each student was also encouraged to value the emotional aspects and responses to the topic, to make judgements (even if negative), and to aim for exciting creations and ideas for improvements. Students not only considered the facts, but also had opportunities to think about the facts and to see what lay behind them. This is critical thinking at its best.

This knowledge is valuable because students are engaged in solving real world problems at a deep intellectual level. Interdisciplinarity is valued – in this case, as a means to show what the disciplines of Studies of Society and Environment (SOSE) and Mathematics have in common and in opposition. Students started to talk about the *ways of knowing* in each discipline and were introduced to some *heroes* in each discipline (SOSE – Guylian; Maths – Fair Trade websites). Students learned that each discipline had different *tools*, but that these tools combined were more powerful than apart. Wyatt-Smith et al. (2005) observe that teaching is not so much about transmission as, ‘providing situations that facilitate students making meaning in their own terms, based on their own prior experience and knowledge’ (p. 272).

Table 1: The unit matrix and design

<b>UNIT TITLE: SAVING THE SEAHORSES (re-written to show how the Essential Learnings apply)</b>			<b>KEY LEARNING AREAS AND YEAR: Studies of Society and Environment, English, Mathematics</b>		<b>DURATION OF UNIT: 10 weeks</b>
<b>KNOWLEDGE AND UNDERSTANDING</b>		<b>WAYS OF WORKING</b>	<b>CONTEXT FOR LEARNING UNIT CONTEXT:</b>	<b>SCHOOL PRIORITIES:</b>	
Interrelationships between human activity and environments result in particular patterns of land and resource use, and can cause environmental problems <i>e.g. overgrazing and erosion; overuse of fossil fuels and carbon dioxide emissions.</i>		Respond to local and global issues by taking action in planned and enterprising ways	Students have learned in class discussion that the seahorse display at Sea World is in jeopardy because Seahorses in the wild are under threat. They learn that Guylian Chocolates donates the money from every seahorse to saving the seahorses. The students are encouraged to take action themselves and to help an endangered sea creature.	The school is situated near the beach. The principal and the curriculum plan expect teachers to use the local environment in their planning.	
<b>LEARNING EXPERIENCES</b>		<b>LESSON ONE</b>		<b>LESSON TWO</b>	<b>LESSON THREE</b>
<b>WEEKS ONE AND TWO</b> Orienting and introducing	Investigating the issue and making plans	Students hear testimonials about the destruction to seahorse populations and other sea creatures.	Students log on to Guylian Chocolate website and learn more about the endangered sea horse. They learn that much can be done by the business community to save the seahorse. Students write a paragraph about their reactions to what they have learned.	Students watch <i>Happy Feet</i> – the scene where an animal has plastic wrapped around its neck. Students engage in a class discussion about ways to solve this problem. They learn that they can be active.	Students are introduced to the Culminating Summative Assessment. It becomes clear that students need to work in groups to solve a problem.
<b>WEEK THREE</b> Group forming and storming	Early research and forming groups. Students decide on a product to sell.	Students form their groups in this lesson. They decide the sea animal they would like to help. They decide on a product they would like to sell at morning	In their working groups, students learn the elements of a business plan: reason for their business; a description of what they are trying to sell and	Students work in groups to complete the first draft of their business plan.	Students work in groups to complete the first draft of their business plan.

		tea or lunch, in order to save money to send to their chosen animal.	why; how they will supply their product-costs, and profits.		
<b>WEEKS FOUR AND FIVE:</b> Enhancing and sorting	Students make their product and explain their business plan.	Students work in groups to complete the first draft of their business plan.	<b>Formative assessment:</b> Students complete a group/personal analysis sheet to determine how well each student is working in the group.	Students begin making their product to sell.	Students prepare for lunchtime sales.
<b>WEEK SIX</b>		In-class time is devoted to the final write up of their business plan. Teacher conferences with each group to see how they are going and to offer advice.	In-class time is devoted to the final write up of their business plan. Teacher conferences with each group to see how they are going and to offer advice.	In-class time is devoted to the final write up of their business plan. Teacher conferences with each group to see how they are going and to offer advice.	<b>Formative assessment:</b> Students submit copy of their business plan.
<b>WEEK SEVEN</b>	<b>Summative assessment:</b> Students set up their stall at lunchtime and sell their product.		<b>Major summative assessment item due:</b> Students will learn how an economic enterprise such as chocolate manufacture can be used to resource preservation of wildlife. Using the case study as an example, students are to raise money to save an animal of their choice. Students will work in groups of 5 to set up stalls at lunch time to sell a product. A portion of the income or profit will go towards their charity.  Students are to write a business plan for their lunchtime business, cost and resource their product, provide a business and brand name for their product, and write a spreadsheet which will account for debits and credits. Each group will sell their product for two days in a fortnight.		

### Learning collaboratively

In the teaming exercises, students used a variety of the skills they already possessed through verbal linguistic means, both inter- and intra-personally, in a manner which allowed for silent reading or bold movement. Students were encouraged to see their natural environment in new ways and to form a connection with that environment. Students could also be logical and mathematical about the financial success of ventures made by businesses in relation to environmental issues. Value was placed on the wealth of material and prior knowledge students in the middle years bring to their classrooms. Such activities provide relevance and connectedness to the students' worlds and opportunities to form their identities in relation to these matters. Students also formed a group identity as they experienced the group processes of forming, storming and norming.

### Flexibility

Each of the four Productive Pedagogy dimensions (Department of Education, Queensland, 2002) were accounted for, particularly in relation to intellectual quality where substantive conversation occurred between students, students and teacher, students and non-class mates, Sea World administration, and so on. This bridged the gap between school and community. There was little opportunity for the teacher to own the classroom discussion through the IRE or initiation-response-evaluation sequence (Hardman, Smith & Wall,

2003), as most of the time students were engaged in group tasks. Middle years' education is more about student engagement than behaving well in a predetermined structure. The Head of Department for Mathematics seemed surprised that students could learn mathematical concepts without using IRE, the usual teaching method adopted in the school.

### **Learner centred approaches**

Overwhelmingly though, the value of the knowledge taught in the unit resided in the success students achieved. Students were given the dignity of being *winners* from the unit's beginning. They could choose the sea animal to research and to support; they could choose the product they would make and sell at their lunchtime stalls, and they could choose costs and profits and accept losses. They could also organise their own trip to Sea World. Students in the middle years have a growing need for independence and the negotiated framework of the unit provided for this.

### **Strategic links**

All of this required students to engage with literacy and numeracy and their problems with each. Students had to identify areas which needed improvement. To write their business plan, students needed a familiarity with an English genre and the functional grammar associated with a report or procedural text. This task provided an ideal opportunity to explicitly teach grammar and writing in context. To surf the net for ideas re the business plan and the sea creature they wished to save, students needed skill in the area of multiliteracies and the many ways of reading texts. Concepts of textual semiotics, reading in a variety of contexts for a variety of purposes, reading the mood of their group and reading the computer screen were each important. By the end of the unit, students had a repertoire of reading and writing practices so that rigour inhered within the process (Cumming, 1998). I was very much aware of literacy issues in the middle years, notably the sacrificing of deep literacy learning in favour of addressing the considerable increase in content area reading (Luke et al., 2003). There was also the problem of the assumptions made about the literacy and numeracy of this age group. As one would expect, there was a full range of levels of literacy competence within the group of students.

### **Assessment:**

#### **How will effective instruction emerge to find out what students know?**

The lessons were taught over a number of weeks using constructivist principles, including contextualised activities, meaningful tasks and the opportunity for students to draw on prior schema. Explicit teaching was used where necessary. The assessment timetable was incorporated into formative and summative assessment (see Table 2), so that students could learn as they were being assessed. The exam for Mathematics was broken down into its component parts and each section assessed as soon as students met the outcome.

Best practice in outcomes based assessment requires that learners can demonstrate outcomes, that instruction and content relate to the outcomes and are explicitly taught, and that the time to meet outcome is flexible because people learn in different ways and at different rates (Queensland School Curriculum Council, 2002). A key indicator of best practice is that learners can receive feedback on their performance immediately and in understandable terms, and can then independently monitor their self performance in terms of what they know and are able to do. Learning, teaching and assessment must be indivisible.

In Queensland today, the essential learning framework has similar expectations, but the

essential learning students are to meet is on an A–E scale. I have not had the opportunity to implement this unit in an A–E environment, but I suspect that success with the Mathematics exam in this unit suggests that the unit would work well. Students did well on the Mathematics test.

The unit set out three culminating assessment items:

1. Students will learn how an economic enterprise such as chocolate manufacture can be used to fund wildlife preservation. Using the case study (Guylian Chocolates) as an example, students are to raise money to save a sea animal of their choice. Students will work in groups of five to set up stalls at lunch time to sell a product (e.g. Whalo-Fizz, Seal Slurpies). Students are to liaise with staff at the school tuckshop to assure the staff that products for sale will not be the same as provided by the tuckshop. A portion of the income or profit will go towards charity.
2. Students are to write a business plan for their lunchtime business, cost and resource their product, provide a business and brand name for their product and write a spreadsheet which will account for debits and credits. Each group will sell their product for two days in a fortnight.
3. Students are to take responsibility for one aspect of the planning involved with taking the class to Sea World. Group assignments include the organisation of:
  - Contact before, during and after excursion with Sea World’s Education Liaison Officer (letters, permission forms, risk assessment);
  - Transport options from Brisbane to Sea World (comparative costs of bus trip, private cars, rail transport);
  - Picnic lunches (cost, type, transport);
  - Excursion worksheet (liaise with Sea World’s Education Liaison Officer, on-line Sea World tasks, liaise with class teacher, printing and distribution).

Each of these summative assessments were linked to learning outcomes (essential learnings today), to pedagogy and assessment. All assessment items tested terminology, specific vocabulary and numeracy, and procedural knowledge. The summative assessments were not normative, but were aimed at showing the progress that had been made to students and parents. There was a good deal of risk taking and students were constantly engaged in self reflection: wondering whether their product would sell; if the stall would make a profit; whether presentation to their peers in group work would open them to criticism or applause (Wyatt-Smith et al., 2005), and finally whether or not the field trip organisation would work.

So that the summative assessment worked and students achieved the outcomes, there were three formative assessments:

- **pre-tests**, entrance and exit slips in the first few weeks to test prior knowledge and adjust the unit plan accordingly.
- **group/personal analysis sheets** (see Wyatt-Smith et al., 2005, p. 296) to determine how well each student was working in the group.
- **Teacher conferences** with each group to see how they were going and to offer advice. The conference questions were the same for each group. In-class time was devoted to the final write up of their business plan.

I then marked the unit with the times that formative testing would occur, as shown in Table 2.

Table 2: Matrix showing formative assessment.

<b>UNIT TITLE: SAVING THE SEAHORSES (re-written to show how the Essential Learnings apply)</b>		<b>KEY LEARNING AREAS AND YEAR: Studies of Society and Environment, English, Mathematics</b>		<b>DURATION OF UNIT: 10 weeks</b>	
<b>KNOWLEDGE AND UNDERSTANDING</b>  Interrelationships between human activity and environments result in particular patterns of land and resource use, and can cause environmental problems <i>e.g. overgrazing and erosion; overuse of fossil fuels and carbon dioxide emissions.</i>		<b>WAYS OF WORKING</b>  Respond to local and global issues by taking action in planned and enterprising ways	<b>CONTEXT FOR LEARNING UNIT CONTEXT:</b>  Students have learned in class discussion that the seahorse display at Sea World is in jeopardy because Seahorses in the wild are under threat. They learn that Guylian Chocolates donates the money from every seahorse to saving the seahorses. The students are encouraged to take action themselves and to help an endangered sea creature.	<b>SCHOOL PRIORITIES:</b>  The school is situated near the beach. The principal and the curriculum plan expect teachers to use the local environment in their planning.	
	In these weeks you would not be using assessment, but you could run pre-tests, entrance and exit slips				
<b>LEARNING EXPERIENCES</b>		<b>LESSON ONE</b>		<b>LESSON TWO</b>	<b>LESSON THREE</b>
<b>WEEKS ONE AND TWO</b> Orienting and introducing	Investigating the issue and making plans	Students hear testimonials about the destruction to seahorse populations and other sea creatures.	Students log on to Guylian Chocolate website and learn more about the endangered sea horse. They learn that much can be done by the business community to save the seahorse. Students write a paragraph about their reactions to what they have learned.	Students watch <i>Happy Feet</i> – the scene where an animal has plastic wrapped around its neck. Students engage in a class discussion about ways to solve this problem. They learn that they can be active.	Students are introduced to the Culminating Summative Assessment. It becomes clear that students need to work in groups to solve a problem.
<b>WEEK THREE</b> Group forming and storming	Early research and forming groups. Students decide on a product to sell.	Students form their groups in this lesson. They decide the sea animal they would like to help. They decide on a product they would like	In their working groups, students learn the elements of a business plan: reason for their business; a description of what they are	Students work in groups to complete the first draft of their business plan.	Students work in groups to complete the first draft of their business plan.
				A procedural text. English component	

		to sell at morning tea or lunch, in order to save money to send to their chosen animal.	trying to sell and why; how they will supply their product-costs, and profits.		
<b>WEEKS FOUR AND FIVE:</b> Enhancing and sorting	Students make their product and explain their business plan.	Students work in groups to complete the first draft of their business plan.	<b>Formative assessment:</b> Students complete a group/personal analysis sheet to determine how well each student is working in the group.	Students begin making their product to sell.	Students prepare for lunchtime sales.
		Formative re group work			Formative re business plan
<b>WEEK SIX</b>		In-class time is devoted to the final write up of their business plan. Teacher conferences with each group to see how they are going and to offer advice.	In-class time is devoted to the final write up of their business plan. Teacher conferences with each group to see how they are going and to offer advice.	In-class time is devoted to the final write up of their business plan. Teacher conferences with each group to see how they are going and to offer advice.	<b>Formative assessment:</b> Students submit copy of their business plan.
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		Summative assessment			

Since the first implementation of the unit, I have looked at the assessment using Wyatt-Smith et al's (2005, p.278) dimensions of effective assessment in the middle years. Table 3 shows the ways that the hallmarks of quality assessment have been met.

### Conclusion

The pressures on teachers of middle years' students are many. However, if teachers do the thinking prior to the implementation of the unit, it is possible to manage the competing tensions. Literacy in the middle years deepens as students are exposed to more content area reading and can no longer rely on the spoken word alone. Students must manage new linguistic forms used in written text such as the extended sentence and the paragraph. Students begin to learn that language has sub-sets and that discipline-related language uses sub-sets of terms not previously heard or used in the classroom (Maclean, 2005).

In the case of this unit, students were exposed to the sub-sets of terms in Mathematics, Studies of Society and Environment and Business. Teachers sometimes become overwhelmed at this point and often soldier on towards content area reading, rather than

Table 3. Hallmarks of quality assessment

Hallmark	Description
Connectedness and responsiveness	The unit uses interests from outside school (local to Bayside, fishing both a hobby and a sport offered at the school)
Explicit recognition	Students negotiated tasks with teacher (sea creature they would like to help, the charity to receive funds, the organisation of their stall and products to make, the organisation of their trip to Sea World)
Tailored, diverse and balanced range of learning and assessment options	The unit used a combination of knowledges and a wide range of semiotic systems such as Mathematics and Studies of Society and Environment (SOSE), business Mathematics in a SOSE context, sections of Mathematics (percentages, fractions, profit and loss within a business plan). The metalanguage of each discipline was taught and assessed. The unit used a combination of assessment modes: Formative: divergent, authentic questions (big ideas), checks on group work and the informal language of group work, checks on literacy knowledge (pre-tests, draft of business plan, self-assessment, check of literacy skills such as terminology, specific language, vocabulary and procedural language). Summative: team work assessed in relation to the lunch time stall, disciplinary knowledge tested with the maths exam and business plan. Assessment about gaining knowledge rather than remembering knowledge. There was an encouragement of risk taking.
Room for teacher and student talk and other interactions around quality	Self assessment (Teacher constantly discussed progress with students and formatively assessed these. A self-reflection journal could be added as a literacy assessment and as a means for the students to have a record of their journey. Interrelationship of teacher-student talk was used as a means to frame the literacy demands of the Key Learning Areas and to help students make meaning around what they were asked to do.
The deliberate integration of a mix of assessment types	The unit used communication as a member of a working group, with the teacher during formative assessment, internet searches and communication with staff at Sea World re excursion

concentrating on deep curriculum literacy learning. In this unit, I have tried to show that a deeper understanding of interdisciplinarity helps. What students really must know in terms of any discipline is its ways of knowing, its tools and the heroes in each discipline. This provides the teacher with a reprieve from worrying about the content. Within this space, teachers quickly learn to make connections they may not have otherwise made because of the concern for discipline content. Maclean (2005) argues that classrooms need to be literate communities and that one ‘way to build the classroom as a literate community is to base units of work around ‘authentic’ or service learning’ (p. 109). The unit presented here has aimed to do this.

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