MURITAI SCHOOL BOARD OF TRUSTEES SCIENCE REVIEW
[August 2010]

This paper is a follow up from the 'Science Strategy Review' tabled at the October 22nd board meeting (2009). The strategy was a follow up after analysis of comments in the 2009 parent survey highlighted parent interest in the level of 'experimental based' (traditional) science opportunities for their children. They preferred practical science, where students were able to develop a hypothesis, methods for testing this and where they were able to evaluate how accurate their hypothesis has been.

Introduction:

When senior staff worked together at the end of last year to develop a school wide long-term plan, under the umbrella theme 'Learning from Others', they selected science as the major integrated studies focus for term 2. Planning learning intentions and subsequent opportunities for students focused on providing:

1. 'Experimental based' and 'Hands on' activities.
2. 'Inquiry based' learning opportunities where students were able to question and explore independently to develop both skills and knowledge.

The following information presented in this paper is an analysis taken from teacher's summative assessments. The assessment information places student achievement for each achievement objective against a 5 point scale (well below, below, at, above, well above). 'At' represents the expected level of achievement for that child at that given point in time, i.e. there is a difference in expectation of achievement between a Y5 and a Y6 student even though both are working towards achieving level 3 of the New Zealand Curriculum. Analysis of the results, for each area of the school is presented in a table and includes a summary outlining key findings.

NB:

The Y1/2 have covered the practical experimental based science through 'enrichment programmes'. They have not been included in this analysis as their major focus shifted (based on prioritizing student learning needs) to developing effective questioning skills.

WHOLE SCHOOL SUMMARY:

- Overall achievement is high, indicating our students are achieving well against their expected level.
- There is a small cohort identified in Years 3 and 4 that will be targeted for future and on-going support in science (Year 3 = 8-9 students // Year 4 = 5-7 students).
- Students responded positively to the practical experimental based science opportunities. Teachers commented on the high level of engagement, especially for the boys.
- Teachers also commented on how the science focus provided an opportunity for our gifted and talented students to shine and be extended in a learning area of particular interest and strength. Many were used to support other students during cooperative learning strategies.
- Y5-8 teachers described student's strengths in their ability to describe and articulate their findings. A focus on information literacy helped students to become more familiar and confident in interpreting and incorporating associated 'technical language' as part of their inquiry.
- An area of focus for future learning could look to support students in discovering alternative ways for recording and presenting data, especially for year 3 and 4.

SO WHAT?

- We know our student's are doing well in science.
- We have identified students who either require additional support or extension.
- That 'experimental' based science strategies work well alongside 'inquiry' learning strategies in order to strike a balance between developing students inquiry skills and knowledge.
- That this is a model of learning that should be continued in 2011.

Y3/4 Unit:

Big Idea: Some physical changes can be reversed. Some physical changes cannot. We call these changes 'Permanent' and 'Temporary'. Focus on 'Fair Testing' (understanding about science), 'Predicting, recording, experimenting' (Investigating in Science), 'The Science investigation process' (Communicating in Science).

Key Curriculum Assessment: do students understand that some materials can be returned to their original state, while some have minor changes, and others cannot be changed back?

Achievement Summary:

YEAR 3 (60 students)					
	TEACHER 5 POINT SCALE - *number of children and % representation against whole group*				
LEARNING OUTCOMES: (Can students...)	1. Did not achieve/ well below expectation	2. Achieved with teacher assistance	3. Achieved/ At expectation	4. Achieved above expectation	5. Achieved well above expectation
Develop a hypothesis? (60)	- (0)	1 (2)	29 (48)	28 (47)	2 (3)
Develop a system of collecting information when they observe an experiment? (60)	0 (0)	8 (13)	34 (57)	18 (30)	- (0)
Present an accurate record of their observations? (60)	0 (0)	9 (15)	34 (57)	14 (23)	3 (5)
Draw a reasonable conclusion based on the data they collected? (60)	- (0)	9 (15)	33 (55)	18 (30)	0 (0)
Explain the key difference between temporary and permanent changes? (38)	- (0)	2 (5)	25 (66)	11 (29)	0 (0)
Describe possible variables that may affect an experiment? (0)	- (-)	- (-)	- (-)	- (-)	- (-)

YEAR 4 (49 students)					
	TEACHER 5 POINT SCALE - *number of children and % representation against whole group*				
LEARNING OUTCOMES: (Can students...)	1. Did not achieve/ well below expectation	2. Achieved with teacher assistance	3. Achieved/ At expectation	4. Achieved above expectation	5. Achieved well above expectation
Develop a hypothesis? (49)	- (0)	2 (4)	22 (45)	22 (45)	3 (6)
Develop a system of collecting information when they observe an experiment? (49)	1 (2)	7 (14)	27 (55)	14 (29)	- (0)
Present an accurate record of their observations? (49)	1 (2)	7 (14)	29 (59)	12 (25)	- (0)
Draw a reasonable conclusion based on the data they collected? (49)	- (0)	3 (6)	27 (55)	18 (37)	1 (2)
Explain the key difference between temporary and permanent changes? (27)	- (0)	5 (18)	14 (52)	8 (30)	0 (0)
Describe possible variables that may affect an experiment? (0)	- (-)	- (-)	- (-)	- (-)	- (-)

YEAR 3 /4 (109 students)					
	TEACHER 5 POINT SCALE - *number of children and % representation against whole group*				
LEARNING OUTCOMES: (Can students...)	1. Did not achieve/ well below expectation	2. Achieved with teacher assistance	3. Achieved/ At expectation	4. Achieved above expectation	5. Achieved well above expectation
Develop a hypothesis? (109)	- (0)	3 (3)	51 (47)	50 (46)	5 (4)
Develop a system of collecting information when they observe an experiment? (109)	1 (1)	14 (13)	62 (57)	32 (29)	- (0)
Present an accurate record of their observations? (109)	1 (1)	16 (14)	63 (58)	26 (24)	3 (3)
Draw a reasonable conclusion based on the data they collected? (109)	- (0)	12 (11)	60 (55)	36 (33)	1 (1)
Explain the key difference between temporary and permanent changes? (87)	- (0)	8 (9)	47 (54)	31 (36)	1 (1)
Describe possible variables that may affect an experiment? (55)	- (0)	14 (25)	19 (35)	22 (40)	- (0)

Summary:

- Noticeable strengths in ability to develop a hypothesis and being able to explain the key difference between temporary and permanent changes.
- Of interest is a small cohort of 8-9 Year 3 and 7 Year 4 students who require additional support for developing systems when collecting information from observing experiments and how to present accurate records of their observations. It is important to note that for many students this is the first time they have had to independently record information from observations as in the junior school the teacher would scaffold this process.
- Teachers were most pleased with student improvement to draw conclusions from pre and post anecdotal records.
- Unit of work involved many practical and fun experiments resulting in a high level of student engagement and interest in science. Lessons were structured and students were exposed to lots of scientific learning experiences.

Y5/6 Unit:

Big Idea: Solar energy is the best way to generate electricity in New Zealand.
Investigating in science: Carry out science investigations using a variety of approaches: classifying and identifying, pattern seeking, exploring, investigating models, fair testing, making things.
Key Curriculum Assessment: **(Students will…)**

- *Investigate what components are needed in a complete circuit.*
- *Investigate what materials are electrical conductors and insulators.*
- *Investigate how shadows are formed when the light from the sun is shaded.*
- *Investigate how solar (photovoltaic) energy generates electricity.*
- *Critically evaluate and compare solar energy with alternative energy sources.*

YEAR 5 (39 students)					
	TEACHER 5 POINT SCALE - *number of children and % representation against whole group*				
LEARNING OUTCOMES: (Can students...)	1. Did not achieve/ well below expectation	2. Achieved with teacher assistance	3. Achieved/ At expectation	4. Achieved above expectation	5. Achieved well above expectation
Identify the components of electrical circuits and show flow of electron (39)	**0** (0)	**2** (5)	**6** (15)	**20** (52)	**11** (28)
Explain what causes a shadow and why the change through out the day (39)	**0** (0)	**0** (0)	**6** (15)	**13** (33)	**20** (52)
Explain how photovoltaic cells generate electricity (39)	**0** (0)	**0** (0)	**13** (33)	**14** (36)	**12** (31)
Identify an alternative form of renewable energy and explain how it generates electricity (39)	**0** (0)	**2** (5)	**6** (15)	**10** (26)	**21** (54)

YEAR 6 (49 students)					
	TEACHER 5 POINT SCALE - *number of children and % representation against whole group*				
LEARNING OUTCOMES: (Can students...)	1. Did not achieve/ well below expectation	2. Achieved with teacher assistance	3. Achieved/ At expectation	4. Achieved above expectation	5. Achieved well above expectation
Identify the components of electrical circuits and show flow of electron (49)	**1** (2)	**1** (2)	**2** (4)	**27** (55)	**18** (37)
Explain what causes a shadow and why the change through out the day (49)	**0** (0)	**1** (2)	**7** (14)	**20** (41)	**21** (43)
Explain how photovoltaic cells generate electricity (49)	**1** (2)	**1** (2)	**14** (28)	**21** (43)	**12** (25)
Identify an alternative form of renewable energy and explain how it generates electricity (49)	**0** (0)	**1** (2)	**11** (22)	**20** (41)	**17** (35)

YEAR 5/6 (88 students)					
	TEACHER 5 POINT SCALE - *number of children and % representation against whole group*				
LEARNING OUTCOMES: (Can students...)	1. Did not achieve/ well below expectation	2. Achieved with teacher assistance	3. Achieved/ At expectation	4. Achieved above expectation	5. Achieved well above expectation
Identify the components of electrical circuits and show flow of electron (88)	**1** (1)	**3** (3)	**8** (9)	**47** (54)	**29** (33)
Explain what causes a shadow and why the change through out the day (88)	**0** (0)	**1** (1)	**13** (15)	**33** (38)	**41** (46)
Explain how photovoltaic cells generate electricity (88)	**1** (1)	**1** (1)	**27** (30)	**35** (40)	**24** (27)
Identify an alternative form of renewable energy and explain how it generates electricity (88)	**0** (0)	**3** (3)	**17** (19)	**30** (34)	**38** (43)

Summary:

Year 5 Results:

- Excellent findings with 100% of students achieving at or above the expected level (for a student in their first year working towards achieving level 3) in AO's 2 and 3. 95% of students achieved at or above the expected level in AO's 1 and 4.

Year 6 Results:

- Again excellent results with between 96-98% of students achieving at the expected level (for students in their second year working towards achieving level 3).
- A cohort group of 16 students scored at or below in AO 3 – their ability to explain how photovoltaic cells generate electricity.

Overall Results:

- Fantastic results across both the year groups!
- Although the unit was science based it followed an inquiry model for identifying, exploring and investigating. The initial stage of 'excite' saw teachers incorporate lots of practical hands on activities for their students. This included creating electronics parallel and series circuits, as well as making their own solar powered light.
- What also worked well was the utilizing of experts from within and outside the community – reinforcing message of 'learning from others'. E.g. Maggie from schoolgen, Stan = creating solar powered lights.
- Teachers began with a teacher-lead inquiry on photovoltaic electricity before students investigated their own form of electricity. This was integrated in to the literacy focus for writing explanations. Students were allocated an electrical source to inquire based on literacy levels, i.e. lower reading group investigated solar power as they already had knowledge and experience in this area of learning while the more able readers were given more challenging and unfamiliar forms of electricity (geo-thermal, tidal …) to inquire.
- An area identified by teachers as a 'next step for learning' is with student's ability to process technical information and put into their own words (information literacy).
- The children enjoyed taking learning outside the classroom. It was wonderful having the solar panels across the road to take the children to.

Y7/8 Science Fair:

The aim was for students to create a question that they could research and measure. They were required to identify and outline a clear process, make a prediction (hypothesis) that included reasons as to what will happen and why. Students were also required to complete at least 2 controlled experiments and record results to show the experiments were completed. The conclusions were required to show that the results have been analyzed, comments made and that there is a clear evaluative link to the hypothesis.

YEAR 7 SCIENCE FAIR RESULTS (49 students)					
5 point scale **NB:** *3 is expected level of achievement for Year 7*					
	1	**2**	**3**	**4**	**5**
Number of Students	0	5	21	21	2
% of Group	0%	10%	43%	43%	4%

YEAR 8 SCIENCE FAIR RESULTS (32 students)					
5 point scale **NB:** *3 is expected level of achievement for Year 8*					
	1	**2**	**3**	**4**	**5**
Number of Students	0	1	10	14	7
% of Group	0%	3%	31%	44%	22%

YEAR 7/8 SCIENCE FAIR RESULTS (81 students)					
5 point scale **NB:** *3 is expected level of achievement for Year 7 or Year 8*					
	1	**2**	**3**	**4**	**5**
Number of Students	0	6	31	35	9
% of Group	0%	7%	38%	44%	11%

Summary:

- 9o% of Year 7 students achieved at or above the expected level. Of the 5 students that did not teachers are aware of their individual learning strengths and weaknesses and additional support is being provided for this group.
- 97% of Year 8 students achieved at or above the expected level with 66% achieving a 4 or above.
- Overall 93% have achieved at or above the expected level.
- Of the 7% underachieving teachers are aware of each child's specific learning needs and information from this learning process are being used to inform next learning steps.
- 55% achieved a 4 or 5.
- The senior school science fair is held every second year so this is the first time students from both year groups have completed such a science investigation at this level.
- Teacher judgements on overall achievement scores have been based on a combination of classroom observation and conferencing, along with the final product produced. It is noted that some students have received additional support from home. With this in mind it is important to point out that teachers have made a direct correlation between classroom practice, knowledge and outcomes (through assessment data, observations and samples of student work).

Of Interest:

- 20 students have been entered in to the NIWA Science Fair (results pending).
- Although the focus is on science it is important to note that children have had to bring key competencies in to affect (managing self, understanding symbols and text, thinking…)
- Student's benefited greatly from having to confidently talk about science to others at the science fair open evening and the Y1-6 classroom visits. The resulting feedback from visitors has been extremely positive and rewarding for the students.
- Teachers have noted an increase in student motivation and enthusiasm towards science (pre to post)
- Other class visits have helped promote and allow younger students to 'see science in action' at a senior school level.

Y7/8 Science Curriculum Objectives:

YEAR 7 ACHIEVEMENT SUMMARY (47 Students)			
SCIENCE CURRICULUM OBJECTIVES	No. Students		% Achieved
	Not Achieved	Achieved	
Appreciate that Science is a new way of explaining the world and that science knowledge changes over time.	1	46	98%
Build on prior experiences, working together to share and examine their own and others' knowledge.	1	46	98%
Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations.	1	46	98%
Begin to use a range of scientific symbols, conventions and vocabulary.	2	45	96%
Engage with a range of science texts and begin to question the purposes for which these text are constructed.	3	44	94%
Use their growing science knowledge when considering issues of concern to them.	0	47	100%
Explore various aspects of an issue and make decisions about possible actions.	0	47	100%
YEAR 8 ACHIEVEMENT SUMMARY (34 Students)			
SCIENCE CURRICULUM OBJECTIVES	No. Students		% Achieved
	Not Achieved	Achieved	
Appreciate that Science is a new way of explaining the world and that science knowledge changes over time.	0	34	100%
Build on prior experiences, working together to share and examine their own and others' knowledge.	1	33	97%
Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations (communicating in science).	1	33	97%
Begin to use a range of scientific symbols, conventions and vocabulary.	1	33	97%
Engage with a range of science texts and begin to question the purposes for which these text are constructed (participating and contributing).	3	31	91%
Use their growing science knowledge when considering issues of concern to them.	0	34	100%
Explore various aspects of an issue and make decisions about possible actions.	0	34	100%

Summary:

- Overall very pleasing outcomes achieved with noticeable strengths in students abilities to:
    - Appreciate science as a way of explaining the world and that science changes over time.
    - Use growing science knowledge when considering issues of concern to them.
    - Explore various aspects of an issue and make decisions about possible actions.

- Although there are no significant concerns the data highlights a small group who require additional support in understanding scientific text and symbols and for which purposes these text/symbols are constructed.
- The 'inquiry-based' model for learning allows students to select their own theme, explore it through questioning and generate ways for processing and presenting information. Through the inquiry model teachers have commented that our students are able to independently explore, interpret information and make sense of scientific concepts (information literacy). This is in contrast to using a 'concepts' based learning approach that is teacher lead and where teachers select the knowledge to be learnt. The inquiry model offers students more scope to learn and apply their skills, promoting and deepening their understanding and ownership of the learning process. Through an inquiry-based approach students are encouraged to think critically, communicate and provide evidence to support their findings.
- Teachers have noted communication as a real strength of both year groups.
- Achievement and understanding in science has also been boosted through the inclusion of a science option in the weekly technicraft programme. An example of work can be seen on Kirsten Berry's blog - link: http://room22muritai.blogspot.com/2010/08/technicraft-science-challenege-our.html .