A microscopic miew of young Māori scientists in action

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Abstract:

The question of success in science finds this study of a remote primary school at Taneatua, in a class of Year 7/8 enjoying their 'creditable achievement' through their scientific project work. Students worked in pairs on several science projects for a science fair. Methods of investigation implemented scientific skills and attitudes often used for such projects. These skills and attitudes proved to be invaluable as a measure for the way scientists work. Such interactions drew attention to the many complex skills in which the students successfully engaged to complete their science assignments.

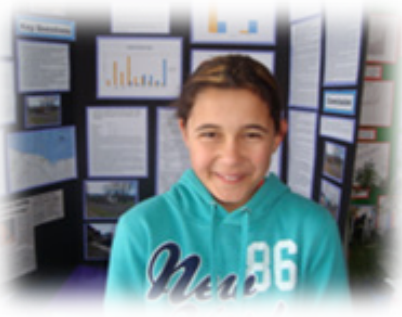
The first significant point of this discussion is that the school context for the students is Māori-medium. Such a context is not generally known to produce the kind of creditable achievement spoken of in the school's ERO Report. The catalyst for these creditable science achievements relate to the ability of the Māori classroom teacher (who is non-Māori) to inspire science inquiry within Māori learners. The context of a microscopic view reveals budding Māori scientists in action which the study considers is worthy of a close-up focus of the way they went about their achievements.

Profile of the School as a Leading Light in Primary Māori Education

Taneatua School has a roll of about 300 children who come from the small town of Taneatua and the rural areas that surround it. The students range from New Entrants to Year 8 students with around 98% being Māori and with most having a whakapapa to Ngai Tūhoe. The school has two level 1 Māori immersion classes. (ERO Report: 2010) The most interesting point about the report was the response to the question of how the school's curriculum promoted 'student learning: engagement, progress and achievement'. Of particular interest to this paper was the inclusion of science being recognised as a 'creditable achievement' for the school. Taneatua School is not kura kaupapa Māori (Māori-language immersion) status but all the children enrolled are Māori.

The Case Study

The first project titled 'Toxic or Not' was an investigation into eco-friendly products to test how friendly some of these were. Where the students live most people have septic tanks so the researchers for this topic thought they would do a test on toilet cleaners aiming to check if eco-toilet cleaners were more friendly than non eco-friendly ones. The equipment they used included two chemical toilet cleaners (Janola and Harpic) , two eco-friendly ones (Ecostore and Ecover), water, eighty four plastic cups, a staple gun, twenty eight plastic containers or jars, labels, vivids, a measuring beaker, potting mix, a stirrer, newspaper and apples and boxes to put the labelled eighty four cups into and four hundred and twenty worms. The study notes highlighted the section on ethics approval prior to investigating animals. Animal Ethics approval was not required for worms. Additional resources included their note book for recording everything they did, a computer to search the net, A4 paper to record their typed information, coloured paper for backing their pages, a digital camera for photographs to record some of the work they did, a display board and a table to hold up everything they wanted to show. It was interesting to learn that out of the four hundred and twenty worms only two worms were harmed.



Te Trina Mokomoko and Tonnes of Trucks

The topic for the second project called 'Tonnes of Trucks' was a study of the total number of trucks that passed through Taneatua that was also compared to the number that passed through Ohope, the beautiful beach town east of Whakatane. To make the comparisons the other partner in this study was a student from Ohope Beach School. Three 'big questions' were posed. The first wanted to know whether more trucks passed Taneatua or Ohope and how many. Question two was to find out the difference between the weight of trucks that travelled through Taneatua and Ohope. The third wanted to know what the effects the trucks had on the people who lived and worked near the roads of Taneatua. A space for any other comments was included at the end. From this questionnaire a survey reported the results and with a summary of the answers to the survey questions. Letters including those sent via email to and from various people were collated. The surveys were carefully charted and graphed. Computers provided the means to record and process the written reports. They also calculated the mathematical results of the surveys. A collection of maps aligning with the investigation gave the location of Taneatua and Ohope. A camera to capture pictures of trucks passing by, newspaper clippings, human resources and a notebook to log information were also resources used. The

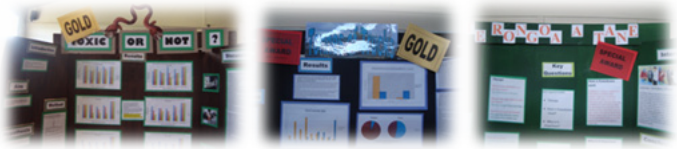
most significant feature about this project is that a month after the Science Fair a logging truck crashed into the back of a school bus. The New Zealand Herald (September, 2011) reported that as the bus was pulling over to the side of the road the truck collided into the rear of the bus injuring thirty five children with six seriously hurt.

> Six children were seriously injured after an unladen logging truck crashed into the rear of a school bus that was pulling over on the side of a road in rural Ruatoki, south of Whakatane, at about 3.30pm. … Most passengers were young children from the nearby Taneatua School,… (The New Zealand Herald,

The shock of a real life threatening experience to tamariki (children), whānau (families), companies, St John's services, doctors, hospitals, the police and nationwide news iterated the issues and dangers 'Tonnes of Trucks' examined in this research. Science is real.

Hinemataroa Maui and Te Mironui Te Moana

The third Taneatua School Science Project was the only entry with a Māori theme. Kawakawa, a native plant of Aotearoa, is well known for many things in the Māori world. However, the most commonly known powers of the kawakawa are for its medicinal properties. 'Why is kawakawa called the miracle plant?' was the key question for this study. The search for answers developed into 'Kawakawa Te Rongoa a Tane' (The Medicine of Tane). Tane is regarded to be the God of the Forest in Māori Lore. Kawakawa used for medicinal purposes and as an anti-oxidant is still a common practice for Māori. This scientific inquiry inspired these students to learn about their natural and cultural environment. Resources used included the internet, a number of books, however, the most informative resources for the project were the whānau (family members). Microsoft Word processed the written data on A4 sheets backed with coloured card. They collected samples of the kawakawa leaves. Some of these were soaked in a container of water. Visual records of different stages were captured by digital camera.



Suffice to say that all were testament to the dedication of the classroom teacher.

Under the leadership of their classroom teacher the senior students of C1 at Taneatua School were able to meet the criteria set to present science projects at the regional Science Fair. They not only applied the methods of investigation through questioning, hypothesis, testing, recording and discussing results but they also received recognition for the work they did. In a Māori-medium setting it has been an inspiration to find a non-Māori person passionate enough to guide a class of twenty Māori students to successfully achieve their objective.

A microscopic view of young Māori scientists in action

Introduction:

A visit to Taneatua School in 2011 led me to classroom C1, where some excited Year 7 and 8 students were completing a range of science projects for the Eastern Bay of Plenty Science and Technology Fair. There were nine completed projects that students, in pairs, from this class had worked on. Their teacher had inspired and expertly guided the students through a journey of scientific exploration and research.

One might ask, so why is this such a big deal? Well firstly, because these students are from a small rural school in the remote town of Taneatua; secondly, because they are predominantly of Māori descent, and thirdly, because they chose to take up the challenge of participating in a science-based assignment, and entering the local Eastern Bay of Plenty Science and Technology Fair. This meant competing against other larger and better resourced Year 7 and 8 science students in the Eastern Bay. The students' toughest competition came from Whakatane Intermediate school (complete with their own Biotechnology classroom), St Joseph's School in Whakatane and Awakeri School. The students of Taneatua Primary School guided by their classroom teacher worked to meet the criteria required for the fair.

This article attempts to discuss, understand and explain why these particular students were able to engage in several science projects and produce such high quality educational outputs. How was it made possible for them to assemble and utilise the necessary scientific, skills, attitudes and resources for each of these young scientists in action?

It is expected that a classroom teacher's job is to teach students the requirements of the curriculum, yet at Taneatua School that pursuit was more elusive and, instead focussed more specifically in increasing Bio-technical developments. The conversations developed here are intended to analyse the general assumptions of what is accepted as the norm, in terms of educational leadership and Māori student's participation in science. Māori tamariki (children) playing the role of scientists in a rural primary school setting is perhaps rare, yet this is a natural practice in this classroom. A microscopic view here shows a typical Māori child, a child born to Māori parents who practice Māori customs, values and beliefs, all the while learning to adjust to the dominant culture and all its hegemonic trappings located in a world of science.

A Māori–medium setting: success in science

The Māori medium setting selected for this article is Taneatua School. According to an Education Review Office report in 2010 this school has a decile rating of 1. A decile 1 rating means that the school draws its students from a low socio – economic

community. Factors that the Ministry of Education consider in the decile ratings rely on census information often based on the income households receive, the occupation of the parents, the number of people who live in the homes, the educational qualifications of the parents and the need for income support. Schools rated as decile one does not mean that the quality of teaching and learning is of a low level.

In her webpage article (n.d.) about Māori Medium Education Margie Hohepa talks of such a situation as being a challenge. She thought the challenge for schooling improvement was related to raising student achievement in Māori Medium Education. Her thoughts are echoed by Russell Bishop . He speaks of 'the need to provide a classroom context where caring and learning relationships are paramount to the educational performance of Māori students.' At Taneatua School such a climate operates within the pedagogy they pursue in their bilingual English/Māori education. This is evident in their emphasis on sporting, cultural and science programmes.

> Students experience high levels of success at local, regional and national levels in a range of sporting codes and cultural activities. Creditable achievements have been made in regional kapa haka, the science fair and netball. (ERO Report: 2010)

To have entries in the local regional science and technology fair within the field of science was hailed by the teachers, principal, support staff and students at Taneatua School as an upward achievement attainment, a set of leading light programmes. In a paper commissioned by the Royal Society and the Prime Minister's Chief Science Advisor Sir Peter Gluckman in 2010, there is a discussion about engagement and achievement in science. Gluckman (2010 p.17) suggests there needs to be more clarity 'about the purpose of science education – what it is students should learn, and why?' The purpose he said was to 'produce future scientists' and should lead toward 'educating for citizenship' (ibid). Gluckman's definition of achievement is aligned here to the potential of Māori students and their success in science. His suggestions align with what is happening at Taneatua School where a genuine interest and curiosity in science, and an aptitude to carry out scientific studies that traditionally have been considered to be a low interest subject area is now the new buzz

One of the statements that Gluckman makes about 'new theories of learning' is an pertinent here.

Learning is a process of coming to know things in, and linking them with, specific contexts. Teaching informed by this approach encourages discussion of ideas, their implications and how they relate to and affect each other; effectively, to model the ways scientists think, talk and argue with each other about science ideas. (Gluckman's Report, 2010: p.30)

Students have a natural curiosity to learn about the physical world around them. The children in this study demonstrated such curiosity in their learning process during their explorations and questioning of the many things that happen in their world. And when they have a teacher who is passionate about science then indeed we have the effective model of the way scientists think, talk and argue. The study of the School's programme showed that through the interest and engagement kindled by the teacher science skills and techniques are developed. Children can then carry out investigations and solve problems in order to reach a conclusion to an aim and hypothesis and thereby emulate scientific behaviours.

The teacher is a critical agent to shining the light on the skills and aptitudes needed for scientific exploration as the MOE document says below:

> Science education needs to make science more accessible to Maori students. It must make teaching strategies which are effective with Maori students and must be responsive to the diversity of their cultural and language backgrounds. Acknowledging tikanga Maori, and valuing the use of Maori language and the experiences of Maori students, affirms their identity and creates a positive learning environment. (MOE, 1996: p.12)

The samples of work the students had carried out, show the passion for science learning that was found in this study of Taneatua School.

Conclusion

This microscopic analysis of science taught within a small rural Māori-medium educational setting, promotes the notion that tamariki Māori have the aptitude, the ability and the talent to participate in scientific studies of which generally is reserved for mainstream education. Taneatua School provides a setting that champions young learners in a rural Māori context, to become budding scientists, and demonstrates the influence classroom leadership in science can have upon Māori students.

Champions of science: a holistic approach

In the introduction to his paper, Inspired by Science (2010) Gluckman spoke of encouraging 'debate on how better to engage students with science, with a particular focus on the role of schools.' (Gluckman, 2010: p.3) Senior student engagement at Taneatua School is evidenced through their completed projects displayed at the fair. The classroom teacher provided the guiding questions. The students gathered the information by using knowledge and methods with the support of the principal and a teacher's aide to realise that vision promotes this interest in the study of living things, in chemistry and in physics in their rudimentary investigations.

In his 2011 report Looking Ahead: Science Education for the Twenty-First Century, Gluckman wrote 'A well prepared primary school teacher will integrate excitement about the natural world and scientific forms of thinking into literacy and numeracy teaching, and into general educational processes.' (Gluckman, 2011: p.4) This is the type of work that the teacher of C1 has displayed in the projects produced by her students. The science format required particularly for the Scientific Investigation Process embraced literacy and numeracy skills. Gluckman's recommendation was that 'all primary schools should be encouraged to develop a science champion.' Here is a primary school that has done that for a number of years now. The theme of Gluckman's report championed those who disseminated science knowledge and practice. The classroom teacher was definitely a champion, skillfully leading and guiding her students to work on their selected science projects and entering them into the regional science fair.

Obligations relating to the curriculum, pressures teachers to provide achieveable and challenging learning outcomes in their weekly, monthly and long term plans. Programmes of study for literacy and numeracy normally prevail. However, the inclusion of other areas of learning require an equal amount of attention if an holistic educational approach is to be nurtured. Literary plans

of reading (shared, guided and a library time), writing (guided and cameo) and the mechanics of spelling and handwriting occupy a place in the teaching timetable. Cowie (2009) spoke of the 'synergies between literacy and science...' It is evident that some of the work the students carried out to produce their science projects had a very large literacy component. Another area that Cowie mentioned was the link between 'numeracy and science'. Mathematical concepts of number, measurement, algebra and statstics also find a space within the class timetable. All of these areas of learning as required by the New Zealand Curriculum 2007 are timetabled into the classroom programme. Therefore, for a successful delivery of learning programmes through out the school there must be a heavy input of Māori āhuatanga (the principles of things Māori including language and practices).

Planning and Implementation

The teacher planned for the children to take part in a science study of questions that would be of interest to them. There were nine suggested topics of investigation. The aim to Potting Around was to find the differences in potting mixes and whether the more expensive types were more effective in producing healthy plants. Paint Disasters aimed to test if dishwashing liquid when added to artist's acrylic paint would make it easier to remove paint from fabric. Energizer Ultimate Battery checked out if there was a difference between the most expensive batteries. Take Off examined ways to remove oil from concrete. Deadly UV explored the effectiveness of different sunscreen products. Grease Out studied the most effective way of removing stains made by milk products like butter fat from fabrics. The other three projects are explained in more detail in the section titled Projects One, Two, Three. The children were encouraged to work in pairs. All were introduced to a scientific framework that gave them a guideline of how they could present their investigations and research. The students of C1 then set about following the guidelines given for the Science and Technology Fair. The entry information required the exhibits to be classified as either Science, Technology, Research or Scientific Observational Drawing Study. There was a reminder that the entries 'should be a scientific ... research ... process - not just a display'. (Exhibitors Booklet, 2011:1-2). Class C1 entered their work into the Science and the Research sections.

In addition, guidelines for safety and ethics requirements were provided where the New Zealand Association Educators NZASE Ethics Approval Flow Chart indicated the need for animal ethics approval. In one of the projects the investigation involved the use of worms. This did not require Animal Ethics approval, however, this information needed to be considered and introduced the students to some of the ethical issues involved with conducting scientific research. Other guidelines from the booklet provided a framework for the 'Scientific Investigation Process' that was divided into six sections each with additional questions to aid the development of their studies.

The classroom teacher of C1, Sue Sisam, led, guided and encouraged the students in her class to take part in the Science Fair and undertake scientific studies. A teacher's aide supported Sue and the students. Another interested member of the staff was the principal who provided assistance and encouragement where possible. An example of this was noted where the principal was acknowledged by the students who worked on the study of Tonnes of Trucks for his assistance. Other important contributors to the students' projects were the students' parents and their extended whānau (families) who helped out where they could. These contributions were often in the implementation of surveys, or the collection of data, and the analysis and interpretation of these. Even the local residents and the business communities in

Taneatua and outside of the area were invited to take part in the science investigations and research. This added support spurred the students on with their studies. The variety of pedagogical practises the students experienced within each project was well orchestrated. Each pair followed the methodology that was suggested by the exhibitor's booklet. They sorted out their resources for their particular study. To be more explicit in this presentation it was better to share some of the information gathered for three of the projects.

[1] ERO Report of Taneatua School, 2010
[2] ACulturally Responsive Pedagogy of Relations

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