

Evaluation of Support for Pāngarau Teachers Working in Wharekura

Pania Te Maro
*Te Whare Wānanga o te Ūpoko
o te Ika a Māui*
Victoria University of Wellington
<pania.temaro@vuw.ac.nz>

Robin Averill
*Te Whare Wānanga o te Ūpoko
o te Ika a Māui*
Victoria University of Wellington
<robin.averill@vuw.ac.nz>

Joanna Higgins
*Te Whare Wānanga o te Ūpoko
o te Ika a Māui*
Victoria University of Wellington
<joanna.higgins@vuw.ac.nz>

This case study examined the impact that a pilot project of professional development and support had on nine teachers of pāngarau¹ working in wharekura² in the Hawkes Bay, Taranaki, Waikato, Wellington, and Whanganui regions. The relative usefulness of the modes of delivery (hui,³ in-school visits by the facilitator, and video conferencing) and teacher and facilitator perceptions of the impact of the support project on teacher content knowledge and teacher practice were also examined. This evaluation found that the support project had a positive impact on teachers' content and pedagogical knowledge, the students of those participating made impressive achievement gains, and certain facilitator characteristics are considered by participants to be important for generating such progress.

Hutia te rito o te harakeke
Kei whea te kōmako e kō
Kī mai ki ahau
He aha te mea nui o te ao?
Māku e kī atu
He tangata, he tangata, he tangata.

*Pluck the shoots of the flax and it will die.
Then where will the kōmako be?
Say to me
What is the greatest thing in the world?
I will respond
It is people, it is people, it is people.*

Background

This paper discusses wharekura Te Poutama Tau and pāngarau. Wharekura Te Poutama Tau is a numeracy professional development project for teachers of pāngarau at secondary school level in Māori-medium schools. It is based on the Number Framework developed for New Zealand schools as part of the Numeracy Development Projects.

The aims of Te Poutama Tau are to lift the achievement of students in numeracy and to be responsive to Māori goals of language revitalisation and empowerment through education. Building the capability of teachers in the teaching and learning of numeracy is a pathway to attaining these aims (Christensen, 2004; Trinick, 2005, 2006).

The importance of teacher development in raising student achievement is clear (Sowder, 2007). Key elements contributing to students' positive achievement through teacher development in Te Poutama Tau include: the use of diagnostic tools to gather data about students' number knowledge and strategies; using data to set clear goals; focusing on student learning of knowledge and strategies from the Number Framework; the clarity of the Framework; building students' positive attitudes to numeracy; the continuous evaluation and monitoring of goals; and support from school leadership (Trinick, 2005).

Evaluations of Te Poutama Tau have called for: a strong emphasis on teacher professional development at the higher stages of the Framework; linking number knowledge and strategies to other strands of the mathematics and statistics learning area; exploring further ways to improve language use in

¹ Pāngarau: mathematics

² Wharekura: Māori-medium secondary school(s)

³ Hui: congregation, meeting, a coming together

teaching and learning; and improving the outcomes of those students making little or no stage gains (Christensen, 2004; Trinick & Stevenson, 2005, 2006, 2007). These findings are consistent with *Teacher Professional Learning and Development: Best Evidence Synthesis Iteration [BES]* (Timperley, Wilson, Barrar, & Fung, 2007) in terms of using data and expertise to challenge teachers' existing beliefs and providing programmes that focus on student learning rather than on teaching programmes.

A recent study (Trinick & Parangi, 2007) into the conditions of wharekura pāngarau teachers found that a range of issues impacted on their delivery of pāngarau. These issues included: the isolated nature of teaching pāngarau at wharekura level (usually one teacher across all levels); pāngarau teachers carrying teaching loads in other curriculum areas; support and professional development not being available in te reo⁴; no provision of a professional development programme equivalent to the Secondary Numeracy Project (SNP) in English-medium schools; insufficient resources, including people; resources in English needing translation into te reo; only an underdeveloped pāngarau language available to teachers, who are generally second language learners of te reo; and outside commitments to marae, whānau, and hapū⁵. Recommendations arising out of this study were:

- to create and provide assistance for wharekura pāngarau teachers that would be of benefit to them and therefore to wharekura students;
- to develop a range of professional development initiatives and resources;
- to support and ease teacher workload in wharekura.

A pilot project for professional development was designed in an attempt to address issues for wharekura pāngarau teachers raised in the Trinick and Parangi (2007) study. The project took into account: the isolation of wharekura pāngarau teachers; their need to work with others in a similar fashion to SNP teachers; and their need to stay in contact with each other. The project included three modes of delivery:

- Hui. Participants met as a cluster for two days four times in the year to: receive expert, specific, and focused facilitation of wharekura Te Poutama Tau; develop mathematical language, concepts, content, and pedagogical knowledge; discuss needs; have questions responded to; and network. At least one hui was scheduled to occur during a holiday period to minimise disruption to teaching and to alleviate the difficulties of finding classroom relievers.
- In-school visits by the facilitator (one facilitator worked with the nine schools in the pilot project for the year). Facilitator modelling, observations, and sharing of expertise within each wharekura allowed teachers to observe their students in action. These visits occurred at arranged intervals after the hui. The facilitator visited each kaiako⁶ at least once between each hui. Some kaiako received between two and five visits between each hui.
- Video conferencing. This provided a mode of delivery that allowed isolated kaiako to share ideas and network with others in a focused, pre-planned distance-workshop situation. All video conferences were preceded by an email from the facilitator outlining the purpose and what kaiako needed to prepare for showing or discussion. The video conferences occurred approximately every three weeks; altogether, there were six video conferences.

⁴ Te reo: Māori language

⁵ Hapū: a sub tribe of a tribe, made up of a larger extended whānau group.

⁶ Kaiako: teacher(s)

Research Aims

This study explored the impact in nine lower North Island wharekura of the pilot project's support for teachers of pāngarau at year 9. In particular, it explored the impact of this provision of additional support on:

- teachers' content and pedagogical knowledge
- classroom practice.

Exploration of facilitator characteristics was not initially part of this study. However, researcher observations, subsequently backed by participants' comments, indicated the importance of investigating and reporting on the facilitator characteristics that appeared to be most important for the additional support to be optimally effective. This aspect of the professional development project relates to findings of the *Effective Pedagogy in Mathematics/Pāngarau: Best Evidence Synthesis Iteration [BES]* (Anthony & Walshaw, 2007), which states that interaction between people is tied closely to pedagogy and that productive interaction, as well as enhancing skill and knowledge, also has an impact on identity and disposition. This BES links pedagogical approaches to achievement outcomes and also to social and cultural outcomes that became an aspect of this project.

Participants and Method

The wharekura Te Poutama Tau pilot project involved wharekura in Hawkes Bay, Taranaki, Waikato, Wellington, and Whanganui. All the schools involved in the project in those areas were invited to participate in the study, and all agreed to take part.

Participants in the study included the facilitator and the year 9 pāngarau kaiako from each of the nine wharekura. All the wharekura were small, with fewer than 50 students and up to three staff, and were situated in urban areas. All but one of the wharekura were linked to kura tēina⁷, and all but one included years 9–13. Class sizes ranged from five to twenty-two students. Teaching of pāngarau was in te reo Māori (eight wharekura) and in English (one wharekura).

The facilitator, a Pākehā male, was a speaker of te reo Māori and had taught for over 20 years, including three in wharekura. The kaiako teaching experience in wharekura ranged between two and six years, and each was the sole teacher of pāngarau in their wharekura. None of the kaiako held tertiary mathematics qualifications, and none had teaching qualifications specific to secondary school. All but one of the kaiako also taught in subjects other than pāngarau. One of the kaiako was the teaching principal. Three were male and six female. All kaiako agreed to be involved in the evaluation research and to provide data. Important factors in participants' willingness to be involved appeared to be relationships that were already in place and the use of elements consistent with the principles of a Māori-centred approach (Cunningham, 1998) alongside kaupapa Māori approaches (Bishop & Glynn, 1999). Prior established relationships existed between: researcher-facilitator; facilitator-wharekura; facilitator-kaiako; researcher-wharekura; and researcher-kaiako. The facilitator had strong prior relationships with both the initial group of kaiako and the main researcher. The main researcher was instrumental in further wharekura and kaiako joining the pilot support project.

In keeping with the context of the study and in order to maximise participation and data, quality elements consistent with kaupapa Māori research methodology were included. For example:

- Participation in the study drew on established relationships;

⁷ Kura tēina: primary school

- Steps were taken to establish and develop relationships where they did not already exist (for example, *kanohi ki te kanohi*⁸ meetings between researchers and facilitator and/or kaiako before and during data gathering);
- All aspects of the data gathering were negotiated with the facilitator;
- Data collection methods and timing were negotiated with kaiako and the facilitator;
- The facilitator was consulted regarding the themes that emerged from the data.

Data collection included:

- questionnaires completed by the facilitator and kaiako at the initial hui (May, six completed kaiako questionnaires) and the final hui (December, five completed kaiako questionnaires);
- audio recording of the first day of the final hui, including a video conference between the facilitator, kaiako, Malcolm Hyland (Ministry of Education), and Jim Hogan, the secondary mathematics adviser for the Waikato region;
- two interviews with the facilitator (one early in the project and one towards the end);
- one kaiako interview at the final hui (initially planned as individual interviews, this was held as a group interview in response to the participants' request. The facilitator was not present when his role was discussed);
- informal observation of facilitator-kaiako interactions at the initial and final hui.

Analysis

Data analysis was generative and open. It included finding and coding relationships between concepts and ideas and placing them in manageable chunks relating to the themes that were emerging in line with the research question, thus reducing complexity. The themes emerging from analysis of statements and ideas commonly expressed by kaiako and the facilitator were identified collaboratively by the researchers. The key themes were then discussed with the facilitator to enhance trustworthiness. They were then synthesised to create a story of the outcomes of the evaluation of the wharekura Te Poutama Tau professional development project for teachers.

Findings

Teacher Growth

Many wharekura teachers do not initially see themselves as maths teachers and are still gaining confidence in the wharekura setting. (Facilitator)

All participants reported that the additional support provided through the project generated personal growth in content and pedagogical knowledge. The facilitator commented on the personal teacher growth he had seen in kaiako over the project, particularly regarding their confidence in their practice and in having others observe and discuss their teaching, and in them seeing the big picture of Te Poutama Tau and how it can work for students. He felt all delivery modes of the project contributed to teacher personal growth.

Some schools, some teachers have done heaps and others have done just little bits, but I can see changes in all of them. Just occasionally having opportunities where the kids talk and that they're not telling them all the time, and starting the class with a starter, a warm up, which is something

⁸ *Kanohi ki te kanohi*: face-to-face

they didn't do before. There's some teachers who've made huge changes in that they've completely re-jigged their whole classroom. In the space of less than a year, they've gone from a sort of whole-class, teacher-dominated kind of thing and now they've got three or four groups all operating independently and they're servicing them. (Facilitator)

I think all the teachers will say, particularly with the strategies, it's really made them, that's what's actually improved their understanding, the penny's dropped about how different strategies worked. They're beginning to see that actually the strategy is maths generally. I think that must be one of the biggest – in terms of content knowledge ... insights, because once they themselves see that, they realise, well actually, what they're trying to do with the students is not get them to get answers but to be able to see those patterns and structures and talk about them and explain what's going on. (Facilitator)

Further evidence of teacher growth is indicated by the student achievement data collected before and after the project. Data was collected from 125 students. Data from students at years 8, 9, and 10 showed average gains across all strategy and knowledge domains:

- Year 8 data (22 students, one class) showed greater shifts in their teacher's focus areas (addition/subtraction, multiplication/division, and place value) and smaller shift in other areas. The smallest shift occurred in the fractions domain;
- Year 9 data (77 students) showed greater shifts in proportion/ratio and fractions, with consistency in the size of stage gains across all domains between students at different initial stages;
- Year 10 data (26 students) showed greater gains in multiplication/division, proportion/ratio, and fractions.

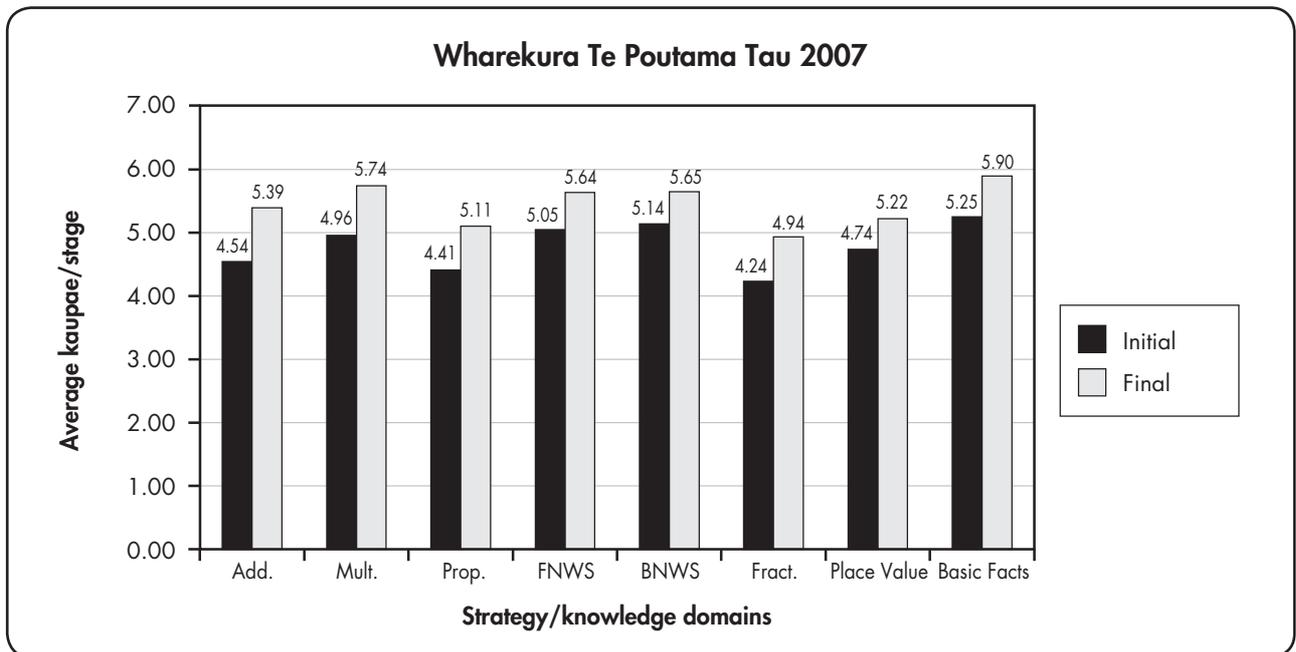


Figure 1. Average stage gain for all students in each of the domains

In general, the students with the lowest initial strategy stages made highest average stage gains (see Figure 1 and Table 1). For example, across the addition/subtraction, multiplication/division, and proportion/ratio domains:

- students initially at stage 4 had average gain of between 1 and 1.5 strategy stages;
- students initially at stage 5 and 6 had an average stage gain of 0.7–1.1 strategy stages.

Table 1
Average Stage Gain for All Students in Each of the Strategy Domains

Initial Stage	Addition/ Subtraction	Multiplication/ Division	Proportion/Ratio	Fractions
3		2.0	1.5	0.7
4	1.0	1.3	1.4	0.6
5	0.8	1.1	0.7	0.7
6	0.8	0.8	0.9	-0.3
7	0	0.3	0.8	

Again, positive average stage gains across all students existed across all knowledge domains (see Figure 1 and Table 2) and the greatest average stage gains were fairly consistently seen for students with the lowest initial strategy stages (for example, 0.7–2.0 stages at level 3 versus 0.5–0.7 stages at level 5). Smaller effects were noted across the knowledge domains of fractions and place value, with students at levels 6 and 7 showing no stage gains in these domains.

Table 2
Average Stage Gain for Each of the Knowledge Domains

Initial Stage	Place Value	Basic Facts
2	2.0	
3	1.8	2.0
4	0.8	1.4
5	0.5	0.7
6	-0.1	0.2
7		0

Delivery Modes

Questionnaire responses indicated an even split amongst participants' views of whether the most useful mode of delivery was the hui or the in-school visits. The following section discusses specific features of each delivery mode.

a) Hui

In his final interview, the facilitator expressed a preference for two four-day hui in the year as opposed to the three-day hui that he had initially planned. He had changed the three-day hui to two days in response to kaiako feedback that three days was too long. Having longer hui was important to the facilitator so that kaiako could have time out away from their kura to enable them to focus on their professional development: "... just push everything aside and focus on getting those main ideas clear" (facilitator).

Another aspect of the hui important to the facilitator was creating a collegial team and maintaining that collegiality:

Another aim is for these teachers who basically work alone in their kura to have colleagues.
(Facilitator)

Kaiako expressed concern at being away for two days in terms of who was in charge of their students and about being behind in their programmes because relievers and/or the students might not follow the programmes.

Always the week before ... are your kids going to be safe ... get a good reliever ... [will they] follow the work I've left them ... worrying about relievers. (Kaiako)

A further factor impacting on participants' views of the usefulness of the hui was the low turnout at the third hui due to its timing (school holidays). However, as a result of this low turnout, two kaiako initiated increased participation and ownership of the project by the kaiako group. The stated motivation for increased ownership and input was the importance of raising student achievement and kaiako seeing the project as being of national importance rather than just about their own development and that of their own students:

I can see this programme can work and the types of mathematical thinking that the kids can have; however, I think that sometimes we have so many other things on that it just doesn't quite work, it needs to be constantly focused on. I think that we as a team of people need to make a commitment to the integration of this programme and the feedback as well! We simply just have to make time! If we fail to do so, we fail our students big time, if you're not in it then neither are our kids. (Kaiako)

b) In-school visits

The facilitator viewed the in-school visits as being an important means of providing one-to-one assistance, modelling, and informing all aspects of the project, ensuring it was responsive to needs:

I think it made a big difference [for kaiako], seeing how their kids reacted when some different work came. I think that's the most powerful part that I've seen of modelling, that the teacher sees how their own kids respond so differently to someone else doing a different kind of work. (Facilitator)

Kaiako also reported finding the in-school visits very important:

[The facilitator] came and showed me how to do a long-term plan. [This was a] watershed moment for me. [He] assessed me and I understood what level I was at, understood my strategies and what strategies I need to learn so that I can help my students. (Kaiako)

I really enjoyed when you took a class and I observed, for me especially, I mean I've been out of maths for a long time, I hadn't done maths for 10 years, so to see it in action again, and the new programme, and looking at the domains that you were covering ... I found that invaluable, beneficial, just watching, observing, using materials, having it visualised, consolidated. (Kaiako to facilitator at final hui)

c) Video conferencing

All participants found the video conferences the least useful aspect of the development. The reasons given for this included that not all kaiako had access to video-conferencing equipment, this mode of delivery was new to many, and some kaiako experienced technical or practical issues⁹ in accessing the video conferences. However, the video conferences were viewed as useful for both networking and sharing ideas:

One of the main reasons for the use of video conferencing was for networking, so that we could all have a chance to get together. At least have that regular opportunity to break down the sort of isolation of each teacher working in the individual classrooms and not really knowing what's going on in other schools. (Facilitator)

[The usefulness of video conferences] was just confirming that I was on the right track, or, oh, I'm way behind ... (Kaiako)

[Seeing] what activities others were using ... (Kaiako)

Yeah, seeing the actual delivery and content that we were using; I thought that was really good. (Kaiako)

Yeah, and looking at what other schools are doing. Oh, I tried this; have a look at this ... (Kaiako)

⁹ Some kaiako needed to travel up to an hour and a half to take part in the video conferences.

d) Additional delivery mode

A fourth important aspect of the project was frequent emailing between kaiako and the facilitator, used for:

- sharing practical information for setting up and ensuring that everyone was prepared for hui and video conferencing (dates, venue, and so on);
- asking and answering questions;
- encouragement and sharing ideas and useful websites (from kaiako and facilitator);
- maintaining rapport.

After the poor turnout at the third hui, email was used by one of the kaiako to encourage full participation in the project.

I can see this programme can work and the types of mathematical thinking that the kids can have; however, I think that sometimes we have so many other things on that it just doesn't quite work, it needs to be constantly focused on. (Kaiako)

The use of email as a tool to prepare sessions with each other was recognised and commented on.

I like how you posed in emails something to think of before the actual video conference so [we] could come to the conference with something that we'd thought about. So that was good to sort of collect ideas when you sent your email. (Kaiako)

Affordances and constraints across delivery modes

The delivery modes in the project were explored through elements that supported the effectiveness of each mode (affordances) and those issues that limited the effectiveness of each mode (constraints) (Table 1). The affordances supporting its effectiveness were: time to share and discuss ideas; prior organisation; and flexibility. The constraints were: issues such as finding suitable relievers to allow attendance at hui and time for discussions during in-school visits; and logistical transportation or technical issues. In spite of the constraints, all kaiako endorsed all modes of delivery as important for their growth and the success of the project (Table 3).

Table 3
Affordances and Constraints of Delivery Modes

Delivery Mode	Affordances	Constraints
Hui	<p>Focused time all together to model, discuss, and participate in numeracy strategy learning and problem solving</p> <p>Prior structure and organisation, including agenda</p> <p>Kaiako bringing activities to share and discuss</p>	<p>Time consuming, including time out of class</p> <p>Transportation logistics</p> <p>Accessing sufficient suitable relievers (particularly problematic for wharekura sharing the same relieving pool)</p>
In-school visits by facilitator	<p>On site, able to experience and discuss the specific context of each kaiako, answer specific questions</p> <p>Students were able to hear facilitator/ kaiako discussions</p> <p>Facilitator flexibility regarding visit timing, use of modelling, and length of visit</p>	<p>Lack of teacher release</p> <p>"Kotahi hāora noa iho taku wā wātea engari i noho ia mō te rā, kāti, i muri hoki."¹⁰ (Kaiako)</p>
Video conferences	<p>Cost- and time-effective</p> <p>Environmentally friendly</p> <p>Prior structure (email and tasks prior to conference)</p> <p>Kaiako bringing activities to share and discuss</p>	<p>Technical and access difficulties</p> <p>Beginners in this mode in 2007; however, experience improved practice.</p>

¹⁰ I only had one hour of release, but he stayed for the day as well as after [school].

The combination of modes

Participants considered the combination of all three modes as important for the wharekura Te Poutama Tau initiative. This was evidenced by a shift in questionnaire responses, from the initial questionnaire, in which most participants indicated they felt only one or two modes would be useful, to the final questionnaire, in which everyone ranked all modes as being important. The modes of delivery were seen to be complementary, and the combination allowed the momentum of the project to be maintained. Regardless of whether kaiako had or used access to the video conferences, all received the emails and associated tasks sent in preparation for them.

Facilitator and kaiako views of the three main delivery modes were examined to explore how each mode promoted teacher growth (pedagogical and content knowledge development) and contributed to the development of a learning community (Table 4). Some aspects were common to all modes (for example, sharing project experiences), and others were specific to particular delivery modes.

He āwhina ā ngā mea katoa, he raruraru ā ngā mea katoa.¹¹ (Kaiako, questionnaire response)

Table 4

Most Important Aspects of Delivery Modes for Teacher Growth

Delivery Mode	Most important aspects for teacher growth (pedagogical)	Most important aspects for teacher growth (content knowledge)	Most important social factors
Hui	<p>Maintaining project momentum</p> <p>Sharing teaching strategies: "Have different approaches to teaching". (Kaiako)</p> <p><i>Having questions answered, individual help</i></p> <p>Modelling (e.g., diagnostic interview)</p>	<p>Maintaining project momentum</p> <p>Sharing teaching strategies: "Have different approaches to teaching". (Kaiako)</p> <p><i>Having questions answered</i></p> <p>"[The usefulness of video conferences] was just confirming that I was on the right track, or, oh, I'm way behind ..." (Kaiako)</p> <p><i>Doing and sharing mathematical activities</i></p>	<p>Maintaining project momentum</p> <p>Sharing teaching strategies: "Have different approaches to teaching". (Kaiako)</p> <p>Individual discussions with facilitator</p> <p><i>Networking</i></p> <p>"He rawe te mahi ā-rōpū."¹² (Kaiako)</p>
In-school visits by facilitator	<p>Focused reflection time</p> <p>Kaiako seeing what their children can do (with the facilitator)</p> <p><i>Individual help (e.g., needs-based, using the diagnostic interview)</i></p> <p>Modelling "Pai ake ki te kite i ngā mahi e kōrerohia nei e te kaiwhakahaere."¹³ (Kaiako)</p>	<p>Focused reflection time</p> <p>Content knowledge development</p> <p><i>Having questions answered</i></p>	<p>Focused reflection time</p> <p>Energising</p> <p>Enhancing sense of common purpose</p>
Video Conferences	<p>Sharing project experiences (teaching ideas): "Yeah, seeing the actual delivery and content that we were using; I thought that was really good." (Kaiako)</p>	<p><i>Doing and sharing mathematical activities. "[Seeing] what activities others were using ..."</i> (Kaiako)</p>	<p>Sharing project experiences: "Kia whakawhiti whakaaro, kia wānanga, kia werohia."¹⁴ (Kaiako)</p> <p><i>Networking</i></p>

Bold indicates re-occurring themes across the categories of teacher growth in content, teacher growth in pedagogy, and social factors. *Italics* indicates themes that occur in more than one mode of delivery.

¹¹ All things had helpful aspects, and all things had problems.

¹² Working as a group is fantastic.

¹³ It's heaps better to see what has been talked about by the facilitator.

¹⁴ So that we can swap thoughts, so that we can discuss them and learn, so that we can challenge and be challenged.

Focus on Te Reo Pāngarau

Evaluations of Te Poutama Tau for 2003, 2004, and 2005 included te reo as an influencing factor in student achievement in pāngarau. Trinick (2005) included te reo proficiency of teachers as well as students as being influential. Christensen (2004) noted the significant correlation between language proficiency and performance in the diagnostic interview. Te reo pāngarau is continuing to develop, particularly at the higher stages, and wharekura teachers and students operating at higher stages learn te reo along with te reo pāngarau at critical thinking, problem-solving levels.

“Te reo pāngarau” does not translate directly as “mathematical words in te reo Māori”. It is a developing concept that includes all the kōrero¹⁵ you use when you are doing mathematics: kupu pāngarau¹⁶, ways of asking and answering questions, within the context of a Māori world view. (Facilitator)

The Māori kupu¹⁷ [are] good. Pāngarau ... the word sums it up. It’s about how one thing connects with another. It’s about relationships. The pānga i waenganui i tēnei.¹⁸ And once you start thinking relationally like that, then mathematics becomes a really powerful way of figuring things out, a very efficient, powerful way of figuring things out. (Facilitator)

Te reo pāngarau was a focus area in all delivery modes, and the facilitator and kaiako commented on their growth in te reo pāngarau.

I was very happy to see that the last hui was almost entirely in te reo Māori. The work that we’ve done in our hui about te reo pāngarau, well basically, it was translation we were doing and at the start what we saw were quite clunky ways of translating stuff, but by the end of it we’d actually refined it down. We got the pukapuka¹⁹ out and found we could actually really refine it down to a good reo. I think that will carry over quite easily. We were dealing with concepts: when an object is proportional, its shape is proportional to another. How do you say that in te reo Māori? Even things like, something is ten times bigger than another and comparisons; we looked at this problem about this boy who was jumping over stepping stones, he jumped on every other stone. Well, how do you translate that? We came up with something; it was a nice succinct way of expressing that concept, and so why wouldn’t they use it. (Facilitator)

Kaiako expressed the need for a more comprehensive dictionary of mathematics terms than currently exists, particularly for terms used at senior secondary school levels. The facilitator identified wanting to consolidate and further develop te reo pāngarau through the project in 2008.

Because when you have the language, then you can make advances in the conceptual understanding – you can’t have one without the other; the mathematical thinking and the mathematical language help develop each other. (Facilitator)

Focus on Facilitator Characteristics

Data showed the importance of investigating and reporting on facilitator characteristics. Kaiako stated that it was essential to have “the right person” as facilitator, so their views of facilitator characteristics, essential for the success of the pāngarau support project, were collected. The important characteristics identified by the participants for this facilitator were: his knowledge and interaction with te āo Māori²⁰; having empathy through having taught in wharekura; having certain personal traits; and knowledge of his discipline area. In response to comments by participants, we asked directly what the characteristics of the facilitator were that contributed to their success in the project. These ideas will be further expanded upon under two broad themes of cultural and personal characteristics and discipline-related characteristics.

¹⁵ Kōrero: words, ideas, written or spoken

¹⁶ Kupu pāngarau: mathematical words

¹⁷ Kupu: words

¹⁸ Pānga i waenganui i tēnei: the relationships between this

¹⁹ Pukapuka: books

²⁰ Te āo Māori: the Māori world

a) Culturally responsive and personal characteristics

Their responses indicate that, in addition to strong numeracy facilitation expertise, facilitators working with kaiako in wharekura must be culturally responsive and empowering:

His ngāwari²¹ nature, aye, just ... ahakoa he Pākehā²², aye, there's something about his wairua²³ that, um, that I find really comfortable, you know; he said, "do you want me to do the uiui²⁴ on you?", and I said, "yup, yup, you can do that, I feel fine." Somebody else, you know, another mathematician wanting to do that to me, I go, "no ... what are you looking for?" And then the kids also felt that way when he came in; we'd finished the maths and I was saying to him, "ok, you need to go now 'cause I need to move on", he goes, "oh, I might just stay", and I'm going, "ok ...", and he stayed, and he joined in the conversation (which was not about maths) with the kids and the kids really responded and appreciated him, so his ngāwari nature makes tons of difference. Aye. He's so easy to get on with. (Kaiako)

And he knows when to be quiet too, aye. That's one of the things I really noticed, too, is that I talk a lot and it's just noise in the kids' heads. And watching him, he gives them time to think. (Kaiako)

I think he, he also, well for me, he empowers me. To actually do what I'm doing, you know, and he doesn't make me feel like oh, you know, kōtiro me mahi koe i tēnei.²⁵ But actually, you know, ka whakanuia i ngā wā katoa ka kitea a ia²⁶... and he likes maths. (Kaiako)

When he came to me one time, and he said, "Now, where are you?" And I was just like ... and he said, "Well, I think that it's probably been a waste of time for you and do you want to give up?" And I was like mmmmm. And he said, "Well, I don't want to give up, shall we start again, we'll throw it all away and we'll start again, eh." And I was like, "oh, is that alright? You know ... it's July now." And he was like, "there's nothing wrong with starting it now, you're just becoming comfortable with the strategies now; let's become comfortable with the planning" ... and I didn't feel stink. (Kaiako)

Facilitator characteristics consistent with te ao Māori begin with the cultural knowledge that one needs as a visitor to wharekura, including how to behave appropriately in terms of protocols; to have flexibility; to know when to let others take the lead; to have knowledge of and use te reo Māori; and to be respectful as well as engender respect and trust:

[At the initial hui] two or three of the teachers got defensive because they had no other strategies. So we said, "Oh well, you're going to have to be ... kaupae tuarima²⁷" and they were very unhappy about this because they felt that they'd been judged as being bad at maths. That brought out kōrero about Poutama Tau not being about judgment at all, but just saying, well, this is where you are now. It actually makes no comment about your ability. (Facilitator)

Having a background within wharekura and understanding issues for kaiako in wharekura was identified as important. This background and understanding included the facilitator establishing relationships (where possible) with kaiako and personal commitment to Te Poutama Tau, kaiako, and Māori students:

So that [not being about judgment] freed people up to be less insecure, more secure about where their content knowledge was, and then to make progress with it. So, before teachers can make progress with their own content, there's actually these other things, these other personal issues of whakamā²⁸ and feeling you're being judged. We've got to get those out of the way before we can make progress with their content. (Facilitator)

²¹ Ngāwari: accommodating, kind

²² Ahakoa he Pākehā: although he is Pākehā

²³ Wairua: spirituality, way of being

²⁴ Uiui: diagnostic interview

²⁵ Kōtiro me mahi koe i tēnei: Girl, you should do this.

²⁶ Ka whakanuia i ngā wā katoa ka kitea a ia: He uplifts you every time you see him.

²⁷ Kaupae tuarima: stage 5

²⁸ Whakamā: shyness, embarrassment

Personal traits that enabled kaiako to feel comfortable with the facilitator include: being able to give positive and affirming feedback; the wairua of the facilitator; having a sense of humour; humility; being inclusive and sharing; persevering and expecting others to persevere; being empathetic, available and approachable; and being ngāwari. The need for the facilitator to be of Māori heritage was not mentioned, and therefore it can be inferred that this was not seen as essential. Kaiako, when asked whether being Pākehā was an issue, stated it was not.

The facilitator also shared his views on the characteristics needed for his role:

You need to be infinitely patient and to put people first if you want them to grow. (Facilitator)

b) Discipline-related characteristics

The characteristics identified by kaiako as important for facilitators included: holding and sharing a passion and knowledge about pāngarau alongside knowledge of how Te Poutama Tau fits into a broader view of mathematics; and passion about the importance of the project for Māori students.

The message I keep on about all the time really, is that Te Poutama Tau is not about numeracy but about pāngarau. I want to use it as a vehicle to get teachers into thinking about getting into the real meat of what pāngarau is really about. I think that's important if they're [going to be] able to support students in getting to those higher levels of pāngarau. (Facilitator)

One of the things that he does, and in his quiet way, so you know all of this electronic stuff ... the resources he's given us on our [data sticks], it's a lot of that stuff he's developed and he just quietly goes oh, here you go. It's huge stuff that he's done; that's quite special to what he does, he just freely gives it. Like, "Take it, take it." And one time he gave it to me, and then he said, "Do you like any of them?" I was, "I like this one and this one." And so, "Well, print it out", and we sat there and make the, all these resources straightaway, we made the games up straightaway. Ten minutes later, we had three games, three new games. (Kaiako)

Recommendations

This study set out to explore the usefulness of various modes of delivery of a pilot project for delivering professional development of Te Poutama Tau to wharekura teachers of pāngarau and the effect that it had on raising teachers' content and pedagogical knowledge and exploring teachers' practice.

It found that while there were constraints that impacted on the delivery of the project, the overall results were positive. The main recommendation is that the momentum of the pilot project should be sustained through the following:

- Ongoing support should be provided to kaiako who took part in the 2007 wharekura support project so that they can consolidate and extend the advances made in pāngarau teaching.
- Further wharekura and kaiako should have the opportunity to benefit from a similar support project.
- Opportunities for links between the 2007 and 2008 cohorts of kaiako participating in the project should be explored.
- The combination of modes of delivery (hui, in-school visits, video conferencing, and email communication) should be maintained.
- The selection process for facilitators for curriculum support projects in wharekura should include consideration of the essential facilitator characteristics found through this study.

Further Questions

Further areas for exploration that emerged from the analysis of this study included:

- How can social networking (using web-based person-person linking) be used to build a network of kaiako between cohorts and within cohorts, and how effective is this mode of delivery when used alongside hui, in-school visits, and video-conferencing?
- Can sharing of video recordings of kaiako practice be used to develop kaiako pedagogical and content knowledge?
- What are the effects on kaiako pedagogical and content knowledge of interactions within and between development groups and other national networking?
- What is the impact on classroom kaiako and taurira²⁹ practice and achievement of the pāngarau support development?

Further analysis of specific aspects of culturally responsive facilitator practice and of the impact on teacher content and pedagogical knowledge of the interaction of the combined delivery modes would also be useful.

Concluding Comments

This evaluation found that the support project was an effective means of assisting with the government's focus on reducing inequalities in the education sector (Ministry of Education, 2006). Both kaiako and facilitator described kaiako content and pedagogical growth as a result of being part of the project:

This far down in the programme, I'm a lot more confident because I know the strategies and have more chance to practise them, yeah, plus I can find them straightaway in the book now and I know, well, now I know which book I'm using. (Kaiako)

I can see now how it all fits together so that I can really get the students learning, and they know it as well. They know if they want to figure something out, they can get out some resources, materials, to help them get a handle on it. (Kaiako)

The project has allowed kaiako, who previously had nobody else in their kura to talk with about pāngarau, to form a collegial network that builds a "professional community that supports new ideas and practice at the same time as challenging existing ones" (Timperley et al., 2007). The provision of expert facilitation consistent with te ao Māori was important in encouraging and enabling kaiako to recognise their own agency in effecting transformation with their students' results, in keeping with the whakatauki chosen specifically to reflect these strengths and concepts.

Acknowledgments

Hutia te rito o te harakeke, kei whea te komako e ko, kī mai ki ahau he aha te mea nui o te ao, māku e kī atu, he tangata, he tangata, he tangata.

Nō reira e āku nui, e āku rahi, koutou e pukumahi ana i mua i te mura o te ahi, e mihi kau ana, e mihi kau ana. Tēnā rā koutou i tere whakaae ki te tangi o ngā pononga nei kia whai wāhi i roto i te arotakenga o tēnei mahi whakahirahira e tū nei hei toka tū moana mō a tātou kaiako, nō reira ka puta ake hei oranga mō a tātou tamariki, mokopuna, kāore he mutunga o ngā mihi ki a koutou. Otirā ki te tohunga o te pāngarau kia eke ai a tātou tamariki ki ngā tihi o ngā maunga, arā ko koe tēnā kua whāngaia. Ki a koutou i whakahuatia te moemoeā kia whakatinana ai, e hika mā, mei kore koutou, kua aha kē tātou?

²⁹ Taurira: student

To you who stand before the flames of the fire, we stand humbly before you and greet you. You who so readily agreed to take part in this evaluation research of this project, which provides a solid rock for our teachers to stand on should the seas be rough, and do so that our young might reach their potential in life, there is no end to our thanks to you. Also to the facilitator who has fed our teachers in order for them to help our children in their search for excellence, our thanks, and to those of you who spoke the dream so that it might be given substance, e hika mā, if it were not for you, what would we do?

Heoi anō rā, tēnā koutou, tēnā koutou, huri noa, tēnā rā tātou katoa.

References

- Anthony, G., & Walshaw, M. (2007). *Effective pedagogy in mathematics/pāngarau: Best evidence synthesis iteration [BES]*. Wellington: Ministry of Education.
- Bishop, R., & Glynn, T. (1999). *Culture counts: Changing power relations in education*. Palmerston North: Dunmore Press.
- Christensen, I. (2004). *An evaluation of Te Poutama Tau: Exploring issues in mathematics education*. Wellington: Ministry of Education.
- Cunningham, C. (1998). *A framework for addressing Māori knowledge in research, science and technology*. Keynote address to Te Oru Rangahau Māori Research and Development Conference, 7–9 July, 1998, Massey University.
- Ministry of Education (2006). *Ngā haeata mātauranga: 2005 annual report on Māori education*. Wellington: Ministry of Education.
- Sowder, J. T. (2007). The mathematics education and development of teachers. In F. K. Lester (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 157–223). Reston, VA: NCTM.
- Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007). *Teacher professional learning and development: Best evidence synthesis iteration [BES]*. Wellington: Ministry of Education.
- Trinick, T. (2005). Te Poutama Tau: A case study of two schools. In *Findings from the New Zealand Numeracy Development Project 2004* (pp. 80–88). Wellington: Ministry of Education.
- Trinick, T. (2006). Te Poutama Tau: A case study of two schools. In *Findings from the New Zealand Numeracy Development Projects 2005* (pp. 103–113). Wellington: Learning Media.
- Trinick, T., & Parangi, P. (2007). *Te Poutama Tau evaluation report*. Wellington: Ministry of Education.
- Trinick, T., & Stevenson, B. (2005). An evaluation of Te Poutama Tau 2004. In *Findings from the New Zealand Numeracy Development Project 2004* (pp. 56–65). Wellington: Ministry of Education.
- Trinick, T., & Stevenson, B. (2006). An evaluation of Te Poutama Tau 2005. In *Findings from the New Zealand Numeracy Development Projects 2005* (pp. 34–45). Wellington: Learning Media.
- Trinick T., & Stevenson, B. (2007). Te Poutama Tau 2006: Trends and patterns. In *Findings from the New Zealand Numeracy Development Projects 2006* (pp. 44–53). Wellington: Learning Media.