"Who helps me learn mathematics, and how?": Māori Children's Perspectives

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Ahakoa rongo, kāore i rongo
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This study set out to explore the perspectives of Māori children attending kura kaupapa Māori schools. Forty year 5–8 children in three kura were interviewed individually in te reo Māori to ascertain their perspectives towards learning pāngarau/mathematics. The findings show that the children were aware of a number of sources of support, should they need help with their mathematics. The children had strong views about their teacher's role, strategies for learning, and working with others.

Background

In traditional Māori society, education was oral, thematic, and holistic (Barton & Fairhall, 1995; Riini & Riini, 1993). Children enjoyed the support of a variety of their community members to fulfil their potential for learning (Hemara, 2000). As educational patterns have shifted to a Western form of schooling, Māori children's underachievement in mathematics has become evident (Barton & Fairhall, 1995; Forbes, 2002; Garden, 1996, 1997; Knight, 1994; Ohia, 1995).

Initiatives have been developed and implemented to help address Māori underachievement in mathematics. These include Te Poutama Tau, a professional development programme for teachers in te reo Māori based on the English-medium Numeracy Development Projects (NDP). This programme has been implemented in some Māori immersion settings.

The views of Māori children can contribute to greater understanding about their learning in mathematics. Some Māori children in English-medium schools have provided insights regarding teacher support while learning mathematics (Taylor, Hāwera, & Young-Loveridge, 2005). However, research that considers Māori children's perspectives about learning mathematics in kura is limited. Children are major stakeholders in the business of learning in our schools, so it is important to listen to their understandings about their experiences (Forman & Ansell, 2001; McCallum, Hargreaves, & Gipps, 2000; Rudduck & Flutter, 2000; Young-Loveridge, 2005).

Children often have clear views about who supports their learning at school (Phelan, Davidson, & Cao, 1992). The roles they assign their teachers can significantly impact on their experiences during classroom mathematics sessions (Taylor, Hāwera, & Young-Loveridge, 2005). For example, if children have a view that only the teacher possesses relevant knowledge about what should be done in class, they may wait for that information to be conveyed to them (Alerby, 2003). On the other hand, children will take an active role in their mathematics learning if they perceive their teacher to be a mentor rather than a transmitter of mathematical knowledge (Taylor, Hāwera, & Young-Loveridge, 2005).

Having a range of problem-solving strategies is very helpful for children's mathematics learning (Bucholz, 2004; Thompson, 1999; Young-Loveridge, 2006). According to some writers, teachers need to take note of and help children develop their own mathematics strategies for solving problems (Heuser, 2005; Scharton, 2004; Smith, 2002). Involving children in explaining, listening to, and reflecting on a range of strategies will help them make better sense of the mathematics they engage with (Zevenbergen, Dole, & Wright, 2004).

Communication has been a major focus in mathematics learning for some time (Anderson & Little, 2004; Hunter, 2006; Ministry of Education, 1992). In order for children to gain the most from their learning in mathematics, they need to have meaningful interactions with those around them (Ittigson, 2002; Lyle, 2000). However, expectations may need to be made explicit to children so that they appreciate the value and purpose of such interactions (Campbell, Smith, Boulton-Lewis, Brownlee, Burnett, Carrington, & Purdie, 2001; Hunter, 2006). According to Christensen (2004), student discussions in pāngarau/mathematics in Te Poutama Tau classrooms have tended to be limited to short responses to recall questions involving calculations.

Close relationships with others in class may affect Māori children's participation and learning (Bishop & Berryman, 2006; Bishop, Berryman, Tiakiwai, & Richardson, 2003; Macfarlane, 2004). Working co-operatively with others has long been deemed a useful strategy for learners of mathematics (Terwel, 2003; Kumpulainen & Kaartinen, 2004). Tasks that require co-operative learning and the social construction of mathematics ideas are thought to be helpful for Māori (Hāwera, 2006; Holt, 2001). An integral part of this is positive interdependence, where participants perceive that common goals can only be achieved when all members attain their personal goals. Such a process encourages the sharing and justifying of ideas and the resolution of conflicting perspectives and solutions and hence stimulates higher cognitive processing (Johnson & Johnson, 1999).

Although there is considerable research on children's views of their learning at school, there is a paucity of information about children's perspectives regarding whānau/family support for their learning of pāngarau/mathematics. Atkinson (1999) suggests that parents who wish to support their children in schools may need exposure to recent developments in order to work with teachers and children to raise mathematics achievement. Te Poutama Tau emphasises mental calculation and a range of non-algorithmic strategies in number activities. Such emphases may be different from those learned by parents and extended whānau.

The purpose of this study was to explore the views of Māori children attending kura kaupapa Māori schools or wharekura about their perceptions of the support they receive when learning mathematics.

Method

Participants

This study focuses on the responses of 40 year 5–8 Māori children in three schools. Two schools were kura kaupapa Māori, catering for students from years 0 to 8, and one was a wharekura with students from years 0 to 13. All kura had participated in Te Poutama Tau, the Māori immersion component of the NDP, for several years prior to the study. Half of the children were from a decile 1 kura, and half were from decile 5. Twenty-three of the children were female and 17 were male. Table 1 shows the composition of the sample by year level and highest Framework stage on Te Mahere Tau (The Number Framework; see Ministry of Education, 2007) in mid 2006.

Table 1
Composition of the Sample by Year Level and Highest Framework Stage

Year level	Yr 5	Yr 6	Yr 7	Yr 8	Total
Highest Framework stage					
3	1				1
4	1	1			2
5	4	2		3	9
6	2	3		5	10
7		2	10	4	16
8		1	1		2
Total number of children	8	9	11	12	40

Procedure

Schools were asked to nominate year 5–8 children from across a range of mathematics levels. Children were interviewed individually for about 30 minutes in te reo Māori in a quiet place away from the classroom. They were told that the interviewer was interested in finding out about their thoughts regarding their learning of pāngarau/mathematics.

The questions this paper focuses on were part of a larger collection of questions that the children were asked to respond to. The questions of interest here were:

- Ki ōu whakaaro, he aha ngā mahi ā tō kaiako hei āwhina i a koe ki te ako pāngarau?
  (How do you think your teacher helps you to learn mathematics?)
- Pēhea ētehi atu tāngata? Ka āwhina rātou i a koe ki te ako pāngarau? Ko wai? Pēhea?
  (What about other people? Do they help you to learn mathematics? Who? How?)
- Kei te kāinga ētehi tāngata hei āwhina i a koe ki te ako pāngarau? Pēhea tō rātou āwhina?
  (Are there people at home who help you to learn mathematics? How do they help?)
- He aha tō hiahia i te nuinga o te wā – me mahi ko koe anahe, me mahi rānei ki te taha o ōu hoa? He aha ai?
  (How do you prefer to work most of the time – by yourself or with your friends?)

Audiotapes of interviews were transcribed by a person fluent in te reo Māori. Transcripts were subjected to a content analysis to identify common ideas coming through in the children's responses.

Results

Children's responses to the questions have been organised according to the various themes emerging from the data. Some examples illustrating the range of responses have been recorded below. The code at the end of each excerpt identifies the child as well as gender and year level.

Teacher's Role

The children were asked how their teacher helps them to learn mathematics: "Ki ōu whakaaro, he aha ngā mahi ā to kaiako hei āwhina i a koe ki te ako pāngarau?"

The most common response from children was to refer to strategies that their teacher had taught them (see Table 2).

Table 2
Children's Views Regarding Teacher Help

Shows strategies	Mathematics skills	When difficult	Teacher's behaviour	No help	No idea
16	3	3	8	1	9

Shows strategies

Sixteen of the 40 children mentioned that the teacher helped mostly by showing them a strategy or strategies to do the mathematics. These children placed great reliance on the teacher to supply them with the way/ways to do the mathematics:

> Ka mahi ia tētahi pātai pāngarau i runga i te papatuhituhi. Ana, ka pātai ia ki a mātou pēhea ka mahi tētahi rautaki mō tēnei whakautu. Ara, ka tarai mātou, ara, ka tuhi ia tētahi rautaki kia mārama mātou ki tētahi rautaki rerekē mō taua pātai. Āe. (K4–f7)
>
> (He does some mathematics questions on the board, and he asks us how would we use a strategy for this answer. We try, and he writes another strategy so that we can understand a different strategy for that question.)
>
> A, ka whakaatu mai ia i ētahi rautaki kia māmā ake te haere mō te pāngarau, ... kore tahi noa iho, āhua toru, āe, āe. (K38–f7)
>
> (He shows us some strategies so that the mathematics is easier ... not just one, about three, yes, yes.)

Mathematics skills

Three of the children mentioned that their teacher helped them to develop particular mathematics skills:

> ... ki te kaute i ōku nama" (K15–m5)
>
> (... to count my numbers)
>
> Ina kāre koe i te mōhio i te rua whakarau rua, ka whakaako ia. (K29–f6)
>
> (If you don't know 2 x 2, he will teach you.)

When mathematics is difficult

Three others mentioned that the teacher helps when the mathematics is "difficult":

> ... ka āwhina a ia i a koe mēnā ka ngaro koe (K21–f5)
>
> (... helps us if we get lost)
>
> ... ka taea e ia ki te āwhina i a mātou i ētahi wā, mēnā e uaua te pātai (K13–f8)
>
> (...helps us sometimes when the question is difficult)
>
> ... kia mahi mai i ngā mea māmā ki ngā mea uaua (K45–m5)
>
> (...helps do the easy-to-difficult ones)

Teacher's behaviour

Eight children commented on the teacher's behaviour. The teacher was described as someone who:

> kōrero ngātahi (K23–f7)
>
> (talks with us)
>
> ki te whakamārama i ngā, he aha mātou me mahi (K21–f5)
>
> (explains what work we have to do)
>
> te tuhi i runga i te papa tuhituhi (K20–m6)
>
> (performs tasks like "writing on the board")
>
> mahi i ngā mea uaua ake mōkū (K39–m6)
>
> (provides me with "harder work")
>
> ka tohatoha ngā kurū, ngā hints, āe, ki a mātou ... (K35–m7)
>
> (shares clues and hints, yes, to us ...)

Teacher is no help

One child was adamant that the teacher did not help at all in his learning of mathematics (K14–m8).

No idea about the teacher's role

Nine of the children did not seem to have any view about how their teacher helped them with their mathematics learning. The idea of thinking about and discussing the role their teacher plays in their mathematics learning seemed to be something they had not previously considered.

Support from Friends

The children were asked about other people, whether or not they help them learn mathematics, and how: "Pēhea ētehi atu tāngata? Ka āwhina rātou i a koe ki te ako pāngarau? Ko wai? Pēhea?"

This gave them an opportunity to reflect on the contribution of their friends or peers.

Table 3
Children's Views Regarding Help from Others

Help from friends	No help from friends	No mention of help from friends
24	9	7

Help from friends

Twenty-four children mentioned that others in their class helped them.

Eleven of these 24 children said that their friends helped by showing them a strategy or a way to do their mathematics:

> Ka whāki mai rātou pēhea te mahi. (K29–f6)
>
> (They reveal to me how to do the work.)
>
> Ka kōrero mai rātou he aha tātahi rautaki pai ake. (K19–f8)
>
> (They tell me a better strategy.)

Four people viewed friends as peers who provided them with an answer:

> Ka kī mai i ngā whakautu. (K36–m7)
>
> (They tell me the answer.)
>
> ... te kī mai i ngā whakautu ... kāore i te pai, nā te mea e pīrangi ana au kia ako (K18–f8)
>
> (... tell me the answers ... not good because I want to learn)

Three saw friends as people who were able to explain the work to them:

> Mēnā kāre au i te mārama ētahi wā ka whakamārama rātou ki ahau. (K25–f7)
>
> (If I don't understand, they will explain it to me.)

Four children saw friends as people they could work with:

> Ka āwhina mātou katoa i a mātou. (K26–f8)
>
> (We all help each other.)

Two of the 24 were not specific about how their friends helped.

No help from friends

Nine out of 40 children stated specifically that they received no help from their peers with their mathematics learning. In fact, five of these children were very clear in their view that they were so strong mathematically compared to others in their class that it was their peer group who expected help from them, rather than the other way round:

> Ētahi wā ka whai rātou i ōku mahi. (K38–f7)
>
> (Sometimes they follow my work.)
>
> Kāo, ka hiahia rātou i ahau ki te whakaako i a rātou. (K40–f5)
>
> (No, they want me to teach them.)
>
> Ka whai rātou i ahau. (K17–f6)
>
> (They follow me.)

No mention of help from friends

Seven of the 40 children made no specific mention of friends at school helping them with their mathematics.

Support from People at Home

Another question that children were asked to respond to was about people at home who help them learn mathematics, and how they help them learn: "Kei te kāinga ētehi tāngata hei āwhina i a koe ki te ako pāngarau? Pēhea tō rātou āwhina?"

Table 4
Children's Views Regarding Help at Home

Strategies	Mathematics skills	Questions	Various ways	Not sure how	No help
9	8	8	9	5	1

Thirty-nine out of the 40 children interviewed responded immediately that there were people at home who help them with their mathematics learning. These included mothers, father, grandparents, siblings, as well as uncles and aunties.

Strategies

Nine of these children commented on how people at home helped them with strategies to learn.

> Ka homai rātou te rautaki kia māmā ake. (K29–f6)
>
> (They give me the strategy so that it's easier.)
>
> Kāre rātou ka kī te whakautu, ka kī rātou ētahi rautaki mōku, āe. (K38–f7)
>
> (They don't tell me the answer, they tell me some strategies.)

Mathematics skills

Eight out of the 40 children were quite specific about the mathematics that those at home helped them with:

> Ka kore au e mārama i ngā mahi tau ā ira ... ka whakahoki ētahi mahi kāinga, ka āwhina rātou i a au. (K27–f8)
>
> (If I don't understand decimals ... I take home some homework, they help me.)
>
> Ki te kaute me ahau, and ki te whakaako i ahau he aha ngā tangohia me ngā whakarea me ngā honohono. (K21–f5)
>
> (To count ... to teach me subtraction, multiplication, and addition)

Questions

Eight children mentioned being asked to answer questions:

> Ka whiu pātai ki au. (K16–f6)
>
> (They ask me questions.)
>
> Ka whakaatu ia ētahi pātai, ā, ka whakautu au, and mēnā kāre he tika me haere tonu au kia whiwhi i te mea. (K42–m7)
>
> (She shows me a question, I answer it, and if it's not right, we keep going until we get the one.)
>
> A, ia rā whānau ka kī a ia, ka hoatu au ki a koe rima tekau tāra, mēnā ka taea koe te mahi i ēnei pātai tahi rau i roto i tēnei rā ... tino uaua, arā, ka awhi i ahau. (K39–m6)
>
> (On each birthday, he gives me $50 if I can answer 100 questions on that day ... very difficult and he helps me.)

Other

Two children talked about family members who gave them clues but not the answers:

> ... ka whoatu i ngā hints (K35–m7)
>
> (... gives hints)
>
> Mā te kī ko tēhea te nama tata ki te mea tika (K20–m6)
>
> (By saying the number close to the right one)

Five felt that they were given help generally with their homework. Two children mentioned that there was help at home for them, but they didn't use it.

Not sure how they helped

Five children were not sure how people at home helped them learn mathematics.

No help at home

Only one child said there was no one at home to help her.

Preferred Way to Work

Later during the interview, the children were asked how they preferred to work most of the time, by themselves or with friends: "He aha tō hiahia i te nuingā o te wā – me mahi ko koe anahe, me mahi rānei ki te taha o ōu hoa? He aha ai?"

Table 5
Children's Preferences Regarding Working Alone or with Friends

Always work with friends	Work alone except for difficult ones	Always work alone
16	8	16

Sixteen children out of 40 indicated that they would prefer always to work with their friends. Fourteen of these thought that this would be helpful for their own learning:

> Nā te mea ka taea rātou ki te āwhina i ahau (K11–f5)
>
> (Because they can help me)
>
> Ka taea koe te ako. (K23–f7)
>
> (You can learn.)
>
> He māmā ake. (K37–f7)
>
> (It's easier.)

The other two children felt that learning maths with others was helpful for their friends rather than for themselves:

> Kia mohio hoki ō hoa ki ngā whakautu (K24–m7)
>
> (So that your friends will know the answer)
>
> Kia pai ake, kia tūturu ōna mōhiotanga (K13–f8)
>
> (So that his/her knowledge is better and more secure)

Help with Challenging Mathematics Only

Eight children thought working with others was useful but only when working on "harder" or more difficult mathematics; otherwise it was better to work alone:

> Um, mēnā he tino uaua te pātai, ka haere ki tētahi o ōku hoa ki te mahi rautaki, āe, mēnā he māmā ngā mea katoa, āe, mahi ko koe anake. (K38–f7)
>
> (If it's a difficult question, I'll go to one of my friends to work on a strategy. Yes, if it's all easy, work by yourself.)
>
> Mēnā kāore koe e mōhio pēwhea te mahi pāngarau, taea te mahi tāu hoa taha, āe, mēnā e koi rawa koe, āe, taea te mahi tō ake taha. (K31–m8)
>
> (If you don't know how to do the mathematics, you're able to work with your friend. Yes, if you're really sharp, you can work by yourself.)

Sixteen out of the 40 children stated that they always liked to work alone, and a variety of reasons were given. Five felt that their friends talk too much:

> Mahi ko au anake ... ka kōrero rātou. (K14–m8)
>
> (Work by myself ... they talk.)

Five thought that their friends would "copy" or "steal their answers":

> Kia kore ia ka titiro ki ō mahi pāngarau, me te tinihanga (K15–m5)
>
> (So they don't look at your work and cheat)

Another five felt that there were other advantages to working independently:

> Kia taea ki te eke ki tērā taumata (K35–m7)
>
> (So that I can get to the next level)
>
> E pīrangi ana au kia mahi ko au anake, kia kore au e bored. (K18–f8)
>
> (I like to work alone so that I don't get bored.)
>
> Nā te mea, ētahi wā he āhua rerekē ngā whakautu, arā, ka whakamahi i taua whakautu engari ka hē, arā, he tika tōku, koirā te take ka mahi au ōku ake, nā te mea ina he hē, he pai. (K26–f8)
>
> (Sometimes the answers are a bit different, and when I use that answer it's wrong and mine was right. That's why I like to work by myself, because if it's wrong, that's OK.)

Only one of these children could not articulate a reason for preferring to work alone.

Discussion

It was pleasing to see from the children's responses that they were aware of a number of sources available to them, should they require support for their mathematics learning. Most children thought that there was help readily available for their mathematics learning, from their teachers, their friends, and/or their families.

Many children indicated that the teacher played an integral part in their mathematics learning by providing them with particular strategies and help when they were experiencing difficulty. The children seemed to regard their teacher as the person who was responsible for controlling and determining their mathematics programme. Their responses indicated that they thought very little input was required of them. Could this perception of the teacher's role and the consequent modes of participation by the children impose some limits upon children's mathematics learning?

Te Poutama Tau emphasises the need for children to learn a range of strategies to support the development of number ideas. The idea that there are different and acceptable ways of finding a solution was clear to these children. However, there was little evidence to suggest that children were being encouraged to generate mathematics ideas or strategies of their own (Heuser, 2005; Scharton, 2004; Smith, 2002). Communication with the teacher or peer group seemed to be restricted to explanations of strategies that had originated from the teacher. Like Christensen (2004), this study found that interactions in pāngarau/mathematics did not seem to involve the children in major discussions about key mathematical ideas.

Although the children had learned that there can be multiple strategies to reach solutions, none of them mentioned the possibility that these strategies could be the basis for in-depth problem-solving or investigative work that was academically engaging and mathematically challenging (Bastow, Hughes, Kissane, & Mortlock, 1984; Colomb & Kennedy, 2005; Maxwell, 2001; Ministry of Education, 1992; Terwel, 2003). It is clear that open-ended tasks that appeal to children's different experiences and levels of thinking are important (Ittigson, 2002; Terwel, 2003). According to *Mathematics in the New Zealand Curriculum* (MiNZC: Ministry of Education, 1992), such open-ended problems place more emphasis on the process of problem solving and require persistent and sustained engagement over a period of time (Bastow et al., 1984; Colomb & Kennedy, 2005; Maxwell, 2001). This approach to mathematics has been shown to be beneficial for Māori learners (Hāwera, 2006; Hemara, 2000).

In recent years, there has been much emphasis on mathematics learning as a social activity (Ernest, 1994; Hunter, 2006; Ittigson, 2002; Ministry of Education, 1992). However, the benefits of working co-operatively or collaboratively in mathematics (Terwel, 2003; Johnson & Johnson, 1999; Kumpulainen & Kaartinen, 2004) were not always apparent to these children. Although more than half of them

thought that it could be helpful to work with their friends, many expressed a strong preference for working by themselves on mathematics tasks for fear of distraction, being cheated on, or their individual progress being hampered. Some children recognised the advantages of collaboration when the mathematics was more challenging, wanting to share the responsibility for solving problems set by the teacher. Hunter (2006) argues that the benefits of working together should be made more explicit to children if they are to value co-operative and collaborative mathematical experiences at school. This is consistent with the notion of mathematics as a social activity and with Māori concepts of ako (reciprocal learning and teaching) and whānaungatanga (relationships) that enhance learning for Māori (Macfarlane, 2004). However, it is important to remember that the practice of discussing, reasoning, and playing with ideas when learning mathematics is not equally "natural" for all students (Lubienski, 2007). Teachers need to be aware that some students may need more support than others in adopting discussion-based approaches to their mathematics learning.

It was overwhelmingly clear that these children were aware of having strong support at home to help with their mathematics learning. This support involved giving children strategies, answering questions, and clarifying particular mathematics ideas. There was no evidence of conflict between the learning of particular mathematics strategies at school and the support that was available at home. This could indicate that the children have become accustomed to the idea that there can be more than one way to find a solution to a mathematics question and fully accept that notion. Families clearly have a powerful influence on children's learning. Could more opportunities be created to take advantage of this support to help address underachievement of Māori in mathematics? This might involve sharing recent initiatives and emphases in mathematics learning with whānau, thereby helping to address a key aspect of the NDP strategy; that is, strengthening links with the community (see Ministry of Education, 2001).

This study indicates that these Māori children participating in Te Poutama Tau think they have considerable support from teachers, friends, and whānau with their mathematics learning, should they want it. Teacher-taught strategies were viewed as the ultimate authority in the mathematics programme. Despite the emphasis on listening to and building on others' ideas in Te Poutama Tau, the children seemed to have few expectations that they needed to contribute to the construction of their own mathematics ideas. Many also seemed unaware of the possible benefits of collaborative learning, even though this has been a successful strategy used by Māori in earlier times (see Hemara, 2000).

Recommendations

This study has raised issues for educators of Māori children. Improving the mathematics achievement of Māori children is an ongoing focus. We suggest that the following ideas be considered:

- more exploration and development of ideas by children to enhance their ability to make sense of mathematics
- help for children to participate in and appreciate demanding mathematical discourse
- inclusion of more challenging problem-solving and investigative tasks
- utilising and building upon children's ideas for their mathematics programme
- ensuring that tasks requiring collaboration are included in mathematics programmes
- creation of more opportunities for the use of the strong whānau support available for mathematics learning
- further research to explore ways of continuing to enhance mathematics learning for Māori children.

Ngā Mihi

Hei whakamutu ake tēnei wāhanga o te rangahau, ka mihi ake ki ngā whānau, ngā mātua, ngā tamariki i whakaae kia uru mai ki tēnei rangahau. Mā te mahi pēnei ka mārama pai ai te huarahi, ka hiato ngā whakatupuranga.

Nō reira, ngā karanga maha, ka nui te mihi.

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