

# Bicultural Perspectives in a Pre-service Mathematics Education Course

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This paper presents findings from a study in which the bicultural perspectives in a third year mathematics education course within the Bachelor of Education (Teaching) programme at Wellington College of Education were explored. The authors experimented with inclusion of a wide range of bicultural perspectives within lectures and tutorials and students' perceptions of these were collected. This paper canvasses College requirements and relevant research and compares with these the evidence and perceptions of bicultural perspectives.

Ahakoā he iti, he pounamu

Be it ever so small, it is as precious as the greenstone

The term 'biculturalism' as used in this paper stems from the relationship formed between Māori and the British Crown by the signing of the Treaty of Waitangi. The Treaty promised partnership and equity for the co-signatories. Hence, as a country with many cultural groups the bicultural relationship is seen by many as being the first and most important to protect and honour. Many believe that the framework for the recognition and dissemination of mathematical knowledge in New Zealand is, and has been, dominated by one cultural group (Barton & Fairhall, 1995; Dewes, 1995; Ohia, 1995). It does little to include, recognise or reflect the knowledge bases, values and beliefs of the other treaty partner.

Because of this our desire and commitment was to demonstrate in our own course the inclusion of bicultural perspectives<sup>1</sup> such as active partnership, Māori language, pedagogies, contexts, beliefs, protocols and values. This was in order to model ways that these can be acknowledged and reflected in the students' own teaching and in turn would help to ensure college requirements were met. We experimented throughout the course with a variety of bicultural perspectives and collected feedback to guide future practice. This paper discusses the students' perceptions of the ways in which we attempted to acknowledge this bicultural relationship in our teaching programme.

## Theoretical Perspective

The College requirements regarding the bicultural perspectives are expressed within the Charter of Goals and Purposes and the Bachelor of Education (Teaching) degree documentation (Wellington College of Education, 1993, 1997a, 1997b respectively).

The College Charter contains several references which obligate incorporation of bicultural perspectives in College courses such as:

The College believes that education and training enables people to: secure their personal, professional, cultural, and national identity...The College values partnership between Māori and Pākehā in accordance with the Treaty of Waitangi (Wellington College of Education, 1993, p. 3)

Such perspectives are also referred to in Outcome Five of the Programme Objectives/Graduate Profile of the qualification for the *Bachelor of Education (Teaching)* (Wellington College of Education, 1997a, Volume 1, p. 8).

All learning outcomes of the mathematics education course imply the use of bicultural perspectives. However, the two that do so most explicitly are “incorporate bicultural perspectives in curriculum decisions” and “use and evaluate a range of teaching strategies and resources that promote effective teaching and learning of mathematics for all children” (Wellington College of Education, 1997b, p. 66).

Further, this course endeavours to prepare students for teaching in compliance with the *National Education Goals* (Ministry of Education, 1999) and the national curriculum statement for mathematics, *Mathematics in the New Zealand Curriculum* (Ministry of Education, 1992). Both documents refer generally to the incorporation of bicultural perspectives within learning programmes, however neither gives specific requirements or guidelines as to how schools can achieve this.

Beyond the requirements of the degree, and those of the College and the Ministry of Education, many researchers have commented on the importance of reflecting the Māori culture and language within mathematics programmes. Ohia (1993, 1995), and Knight (1994), argue that mathematics teaching has not encompassed Māori experiences, language and culture and raise concerns about this lack of reflection of Te Ao Māori (the Māori world). They and others (e.g. Barton, 1986; Bishop & Glynn, 1999; Durie, 2001; Te Puni Kōkiri, 1993) suggest a range of ways to address reflecting the Māori world in mathematics learning. However the term ‘bicultural perspectives’ is not used in these writings.

Methods of including more indigenous and other cultural perspectives in education have been explored outside New Zealand. For example Michie (1999), Trumbull et al. (2001) and Villegas and Lucas (2002) have offered practical strategies consistent with those discussed in this paper.

A New Zealand study of *multicultural* aspects of mathematics teacher education (Patadia & Thomas, 2002) found that although the educators were strongly aware of the multicultural nature of New Zealand society, multicultural aspects did not feature strongly in their programmes. Further no formal specific guidelines for inclusion of such perspectives were identified within the study. A similar lack of specific guidelines for inclusion of *bicultural* strategies in teacher education exists.

Thompson (1992) discussed how teachers’ knowledge and beliefs of mathematics affected their conceptions of how it should be presented, and the difficulty of making distinctions between teacher beliefs and knowledge in this regard. Also discussed were ways in which teachers might communicate unintended messages and meanings to their students.

Possible implications of inadequate incorporation of bicultural components in mathematics education programmes include students believing their own mathematics teaching need not include bicultural perspectives, students being unaware of strategies to include bicultural perspectives in their teaching and Māori students perceiving that mathematics is not a subject for them. All of these may contribute to the continuation of a performance gap on traditional measures between Māori and non-Māori children in mathematics.

## Methodology

The eleven-week course, which included weekly one-hour lectures and two-hour tutorials, was taught by the authors of this paper and one other lecturer. The course had 140 students and one of the five class groups was a Māori medium class<sup>2</sup>.



Incorporating Māori concepts and contexts into the New Zealand curriculum and incorporating Pākehā concepts and contexts into the Māori curriculum.

To provide an aspect of the Māori culture and Te Reo (language) into the mathematical strands. Through mathematical waiata (songs), activities and talking about the Māori culture in NZ and how it is part of everyday life in NZ.

Teaching skills and mathematical knowledge that benefit both Pākehā and Māori as much as possible.

Including equal allocation of English/Māori i.e. language, learning experiences, instructions. Recognising the unique Māori/European heritage of NZ.

Not seeing maths as a European knowledge but Māori as well.

Giving two perspectives in such a way as to respect things that are taonga (treasures) in both cultures. Incorporating the different learning styles and strategies.

Knowledge of resources available to incorporate biculturalism. Incorporating Māori contexts in class. Protocols. Different bicultural teaching styles.

It is a way of looking at mathematics through Māori culture.

Using teaching strategies such as tuakana/teina (reciprocal teaching) and te wheke (holistic) strategies when teaching maths.

Using Māori legends and stories as a base to work from. Looking at different aspects such as numbers, shapes etc in the lessons. Depending on children's age, children responding in Māori. Singing maths based songs in Māori.

Teaching within the context of tikanga (culture) and underlying values of Māoridom. If Te Reo is to be included in maths lessons then it has to be within the context of whanaungatanga (relationships), whakanui (celebrating), honohono (sharing) etc as Te Reo is taonga.

The wide range of definitions clearly indicated that no shared definition existed after eight weeks of the course. However the responses showed that all groups were able to give a working definition despite the lack of explicit definition within the course. The responses indicate aspects of students' beliefs but do not indicate the level of application of these beliefs in practice. Further research would be required to determine the authenticity of the responses, in particular whether they were what the students felt they *should* be writing, and how deeply these values and beliefs are internalised and embedded in their understanding and practice.

*Perceptions of the bicultural content of the course.* Students listed a wide range of bicultural perspectives. Responses related to the course structure (Table 1) and the course content (Table 2). The responses are generally direct quotes from the completed questionnaires. Alterations in wording have been made in a small number of places for simplicity or to avoid repetition.

Table 1  
*Bicultural Perspectives Identified by Students Within the Course Structure*

	Bicultural Perspective Identified by Students
Protocols	Use of karakia (prayer) and waiata (song) to begin each lecture [and the tutorials of the Māori medium class.] [Exposing all 3 <sup>rd</sup> year students to the bicultural perspective.]
Pedagogies	[Shared presentations/teaching approach (tuakana-teina).] [Strategies for teaching in Kura Kaupapa Māori (Māori medium schools) and mainstream schools.] Values and beliefs, working as a group, storytelling, addressing learning styles, use of cultural artefacts, use of whakatauāki (proverbs).
Course Assessment	[Inclusion of bicultural perspectives in assignments.] [Ability/encouragement to write assignments in Te Reo Māori.]
Readings	Readings which address bicultural issues.
Personnel	Having a Māori lecturer.

Table 2  
*Bicultural Perspectives Identified by Students Within the Course Content*

	Bicultural Perspective Identified by Students
Language	Use of Te Reo Māori ,Greetings in Te Reo Māori Titles in lectures in Māori and in English Use of both languages in counting, time, dates and months
Design	Rafter patterns used on powerpoints and lecture notes
Activities	Activities and resources which draw from Māori contexts Use of traditional fishing and gardening calendar Mātāriki (Pleiades star formation) for Māori New Year Examples in algebra and geometry such as tukutuku (meeting house craft), poutama (example of tukutuku) and drawing of shapes from instructions in Te Reo Māori Use of Māori legends, Use of number chants Patterns of the wharehūi (meeting house), Activities from 'Figure it Out' <sup>3</sup> , Statistics drawn from different cultures Planning for a noho marae (overnight stay at a meeting house)
Planning	[Planning samples from kura kaupapa Māori and mainstream schools.] Unit plans in Te Reo Māori. Use of cross-curricular links.

Many of the perspectives shown in Tables 1 and 2 were only identified by one single individual or group. There are many possible reasons the students did not identify more. These include the students' responses were drawn from memory close to the end of term. There was much simultaneous new learning in lectures and tutorials including mathematics

content and pedagogy and therefore the bicultural perspectives may have been lost in the mix. Some aspects may have been seen as a ‘New Zealand’ perspective rather than as a ‘bicultural’ perspective, such as using birds with Māori bird names within an algebra activity. Some bicultural perspectives such as the use of stories and artifacts may not have been recognised as being bicultural. Aspects of the mode of course delivery (e.g. lectures, individualised assessment) may not be compatible with maximising biculturalism. Possibly it is not until the students are in situations where they are committed to or *must* incorporate bicultural perspectives that they will make the most of their learning opportunities in this area and incorporate bicultural strategies into their own teaching. The students’ lack of *recall* of perspectives does not necessarily imply lack of future use of such aspects.

Full analysis of the data gathered from lecturers is not included in this paper due to lack of available space for adequate explanation. However, aspects from this analysis are included to allow some comparison of student and lecturer responses.

The lecturers identified many more bicultural perspectives than the students (Table 3).

Table 3

*Bicultural Perspectives Identified by Lecturers But Not by Students*

Bicultural Perspectives Identified by Lecturers but not by Students	
Course Structure	the philosophy expressed in the opening paragraphs of the course information, pedagogies such as use of review, metaphor, artifacts, linking new learning to the familiar, educating through exposure (Hemara, 2000), games, drawing from materials written by Māori, participative learning and making opportunities for fun.
Course Content	drawing from a range of web-sites for pictures, maps and information from Māori contexts, classroom displays of posters showing art work by Māori, activities drawing from Māori contexts, Mātāriki calendars, and use of story books published in both languages

Lecturers’ responses were generally more specific than the student responses. For example, the bicultural content identified by lecturers but not by students from a one week section of the course were: phases of the moon, sentence structures for the date and how to tell the time in Te Reo Māori, a song using Māori measurement terms, five bicultural learning experiences, and Māori units of measurement.

The differences between what was *recalled* by students and what was *noted* by lecturers was in part due to the differences in data collection methods used for the two groups. However the results indicated that the bicultural perspectives must be made more explicit, a view endorsed by the students’ suggestions for future practice.

*Students’ suggestions for further incorporation of bicultural perspectives.* Students’ ideas indicated their commitment to develop their expertise in this area and afford many highly visible, useful and practical ideas for course development. The ideas will help lecturers to consolidate this aspect of the course. Students’ ideas included:

- [Maths noho marae], Maths tutorials on the marae (meeting area);
- [Guest speakers, Commitment from all lecturers to be bicultural educators];
- Having a full time Māori (mathematics) lecturer;
- Visiting a total immersion classroom and videos of bicultural classroom teaching;
- Integration with other curriculum areas, for example maths in Te Reo Māori courses;
- Identifying bicultural perspectives in lecture notes;

- Using resources for the ‘Te Reo challenged’, and more Māori resources;
- Having more opportunities in tutorials to make, find, use and discuss implementation of bicultural perspectives, having a whole tutorial focussed on bicultural perspectives;
- Having more practice using Māori numbers and instructions;
- Having a translation sheet of maths terms and waiata and karakia; and
- Demonstration of a lesson and how to use bicultural perspectives within it.

*Students’ feelings about the amount of bicultural content in the course.* Students were asked to indicate their feelings about the amount of bicultural content in the course by indication on a continuum from ‘not enough’ to ‘too much’. The Māori medium class felt that not enough bicultural content was included. Over the whole student group, both extreme views of ‘too much’ (expressed by one person) and ‘not enough’ (5 responses) were expressed, but generally students affirmed the proportion of bicultural course content they perceived to be within the course.

## Conclusion

The findings indicated that students were able to give some definition of ‘a bicultural perspective’ in mathematics and that they were able to identify a wide range of bicultural perspectives within both course content and structure. The perspectives recalled by students and identified by lecturers varied greatly in number and specificity.

From the analysis of students’ and lecturers’ perceptions of bicultural perspectives we feel that we are meeting the relevant College requirements and providing examples consistent with those advocated by researchers to our capabilities. However lecturers need to be more explicit in their use of bicultural perspectives for students to be able to recognise, acknowledge and draw from all such perspectives of the course.

This study is part of an ongoing course review and development process. To enhance the bicultural perspectives of our course, the wide range of suggestions made by students can be considered. In addition more resources and learning experiences that have bicultural emphases can be targeted and incorporated. Course notes can include more detailed lists teaching and learning methods which research suggests are conducive to a bicultural classroom.

The inclusion of bicultural perspectives within a college of education pre-service course is only one way of attempting to enhance the bicultural perspectives of graduates’ subsequent mathematics teaching. Our belief is that classroom teachers can be assisted in providing bicultural classroom programmes through exposure to biculturally rich pre-service courses, particularly when such perspectives are given greater prominence. However, conclusions about future classroom teaching and learning of graduates cannot be directly drawn from the findings of this research.

This research lends some credence to the view that a national response to the development and implementation of guidelines for bicultural strategies in teacher education would be valuable. Such development would help ensure student and graduate teachers receive guidance and assistance to incorporate bicultural perspectives in their own mathematics programmes.

This paper focuses on findings from a *mathematics* education pre-service course but similar issues are also relevant within other curriculum areas. Further questions raised by this study include: how would our results compare to those from a similar study into other mathematics education programmes and courses from other curriculum areas? Does a pre-

service programme rich in bicultural perspectives lead to ‘biculturally rich’ classroom programmes? If so, how? If not, why not? What influences, encourages, and discourages students’ success in creating bicultural programmes? What are student teachers’ knowledge of, attitudes to, and confidence in the use of bicultural perspectives? What would be the findings of a study into the incorporation of multicultural perspectives?

These are difficult questions but their answers are likely to facilitate mathematics programmes more rich in bicultural perspectives, thus contributing to appropriate recognition of The Treaty of Waitangi.

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<sup>1</sup> A range of views of the meaning of the term ‘bicultural’ exists. In this paper the term ‘bicultural perspective’ is used to represent aspects of our course, which draw from European and Māori worlds.

<sup>2</sup> Students are able to choose to study within the Māori medium class. These students complete the same degree but where possible this class has Māori tutors who can incorporate Te Reo and tikanga Māori (Māori language and culture).

<sup>3</sup> Published by Learning Media Ltd. for the Ministry of Education  
([http://www.tki.org.nz/r/maths/curriculum/figure/index\\_e.php](http://www.tki.org.nz/r/maths/curriculum/figure/index_e.php))