Statistics for Bilingual Students in NZ Secondary Schools
He Mahinga Maramara Mo Nga Whanau Reorua

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1. Introduction

In 1985 there were four Maori/English bilingual units within existing secondary schools in New Zealand. In 1990 there are in excess of fifty, giving a total of more than 100 classes which are taught mathematics and statistics in a Maori environment. Not all these classes use Maori language for teaching, but this is becoming increasingly prevalent.

The rise of bilingual units in New Zealand has prompted a critical review of mathematics education. Some of the relevant questions are: What mathematics and statistics is appropriate for students in a bicultural society? What mathematics and statistics education will promote the development of a culturally just and equitable society? What are the cultural aspects of a mathematics and statistics education? What mathematics and statistics might be particularly relevant for Maori students?

In the last five years there have been workshops, considerable discussion, and research into these questions (Barton, 1990a,b; Begg, 1988; Knight, 1989; Ohia, Moloney and Knight, 1989, 1990).

This paper considers the changes in teaching statistics prompted by this new cultural awareness. First the bilingual classroom is briefly characterised, followed by a description of two forces for change: ethnomathematics and Maori cultural renaissance. The link with the emerging holistic, active approach to statistics is then detailed. Finally the issues of Maori vocabulary, teacher education and course assessment are discussed.

2. The bilingual classroom

Mathematics education in bilingual classes is now significantly different from that in other classes. Bilingual classes have different organisation, methodology, curricula and assessment.

Many bilingual classes are vertically grouped, particularly in junior forms, but also in some senior classes. Senior students may join non-bilingual classes in, say, mathematics, but they retain special roles as senior bilingual students. Such roles include leadership, responsibility for some junior groups, and equal relationships with staff and community.

Another organisational difference is that the timetable for such classes is often more flexible. Bilingual units operate separately from the rest of the school and may have the same teacher for more than one subject. Usually there is a home-room for the class.

The developing bilingual methodology is characterised by peer tutoring and group work. Often students of different ages will work together as equals or in a student/tutor relationship. Groups form and reform and group projects are common. Even when a whole class is being taught together it has more of a "family" character than a conventional class. This is a result of the close relationship between teacher and students through the teachers' knowledge of the students' home environment and good parental involvement.

The content tends to be more integrated across subjects in a way that is common in primary classrooms. This is heightened by having a home-room and one or two main teachers. In mathematics, statistics, and science, the curriculum has had to adapt to motivate students who identify these subjects as "Pakeha" (non-Maori) subjects. In statistics this can be achieved by initiating classwork in the Maori world by addressing local Maori concerns.

Assessment is still, ultimately, by national external examinations. However, the increase in project assessment is opening the way towards group assessment. This would reflect some of the strong community values in Maori society.

3. Ethnomathematics

At ICME 5 in Adelaide, Ubiratan D'Ambrosio first raised the issue of a cultural dimension to mathematics education (D'Ambrosio, 1985). The idea has since grown to the extent where, four years later, a whole day was spent at ICME 6 discussing Mathematics, Education and Society (Hirst, 1988).

Many ethnomathematical studies concern cultural artifacts which are analysed for mathematical content. More relevant research investigates structured knowledge that is culturally distinct. A framework for such study is given by Bishop (1989). However, the real issue concerns those cultural values which deal with technical knowledge, education, or (in the case of statistics) how information is analysed and applied. For example, writers such as Pere (1982) have suggested that Maori society considers knowledge, the learner, and the consequences of learning as inextricably linked (cf. the objectivity of Western scientific knowledge). Furthermore, the process of education is, like other daily functions, enmeshed in a spiritual world. Other values seem to point to

the importance of the process of learning rather than to the knowledge which is acquired.

Such values, when translated into classroom practice, are radically altering the way education is viewed. As we become clearer about cultural attitudes towards information processing we need to be prepared for further changes to statistical teaching. For example, the linking of learner, knowledge, and consequence creates an imperative for statistical skills to be used to promote community progress.

Maori concepts will also affect the way statistical learning is used and presented. In European academic tradition, particular modes of presentation are more acceptable than others. Observance of these modes is a prerequisite for academic advancement. We must recognise that other modes may also be acceptable and should not be discriminated against in a bicultural education system.

4. Maori renaissance

The Maori renaissance over the last ten years has been influenced by developments within Maori society, by changes in New Zealand society as a whole, and by international movements of indigenous people.

Within Maori society the growing wave of youth-led protest in the 1960s and 1970s was yet another aspect of protest which has been present since 1840 (when the partnership between Maori and British colonial government was established). From these protests came an awareness of the key role of language and the imminent danger of the total loss of Maori language. One result was the establishment of Kohanga Reo - Maori language immersion preschools. This immediately put pressure on the Department of Education to establish more bilingual primary schools. Bilingual secondary units and Kura Kaupapa Maori (the school equivalent of Kohanga Reo) have thus been set up in direct response to the demands of Maori communities.

In New Zedaland society as a whole Maori have always been over-represented in health, welfare, labour and justice statistics. Harsher economic conditions in the 1980s have made these inequities more visible in our society. In addition, the Waitangi Tribunal has been established to hear Maori grievances, and the Treaty of Waitangi is now recognised as a basis for legal decisions. Combine these developments with the awareness generated by 1990, the sesquicentenary of the signing of the Treaty, and we have a country beginning to come to terms with some of the issues of indigenous rights.

Thus New Zealand is reflecting the worldwide emancipation of indigenous groups. New Zealanders are well aware of events in Africa: the rise of Zimbabwe, and the South African situation. The latter led to major social violence in this country during the Springbok rugby tour of 1981. This event linked Maori and Pakeha together in protest on racial issues and was the origin of much Pakeha awareness of Maori grievances. Recent events in New Caledonia and Fiji affect us closely as a Pacific nation. Links are also made with the Aborigines in Australia and with the American Indians.

5. Statistics education

How do indigenous peoples' rights relate to statistics education?

The Kohanga Reo movement was an expression of the fact that education is the only way to cultural and political freedom. Writers concerned with the sociology of education have argued comprehensively that control of the education system represents control of society, for example, Illich (1972) and Friere (1970, 1972).

In the 1990s an important aspect of education is the processing, analysis and interpretation of data. Information is a key product. Understanding and manipulating it are vital skills. Statistical education is vital for those wishing to take a strong place in society.

Recognition of these factors has led to the publishing of the Radical Statistics books in Britain and elsewhere (for example, Radical Statistics Health Group (1987)). The recently published American text by Marilyn Frankenstein (1990) is another example.

In New Zealand there is intense research activity associated with claims before the Waitangi Tribunal and court actions based on Maori land claims. These highlight the complementary needs for skilled information analysts and an increased sophistication amongst the general population to understand and support this work.

The bilingual education system provides an ideal vehicle for such an education. Not only does it justify an emphasis on Maori statistics, but it also allows such information to be analysed in an environment appropriate to Maori society. There is no point conducting statistical research if its results will be ignored by those it affects due to culturally inappropriate methods or presentations.

At junior secondary level statistics is taught as part of mathematics. In bilingual classes this is often part of a multidisciplinary programme where mathematics links with social studies, Maori and English programmes.

The current review of senior secondary mathematics has provided the opportunity to write a parallel syllabus for bilingual students. Included in this are statistical modules at Forms 5, 6 and 7. These modules are oriented towards group projects on community issues. A necessary part of the work is the presentation of results in a forum outside school. The work may include action based on the recommendations - this is part of the learning process in line with the value put on learning and its consequences detailed above.

6. Supplementary issues

6.1 *Vocabulary*

Work on Maori mathematical and statistical vocabulary has been underway for five years. A wordlist has been published (Barton and Cleave, 1989) and is currently under review by a group of mathematicians and the Maori Language Commission. The process of vocabulary development is also the subject of study at Victoria University in Wellington.

There do not seem to be any serious problems with vocabulary although the translation of the syllabus involves creating a new meta-language. The grammar of

mathematical or statistical discourse is another matter and is being investigated.

6.2 *Teacher education*

Mathematics teachers of bilingual classes are either fluent Maori speakers with little mathematical background or mathematics teachers with few Maori skills. There are less than ten teachers with both skills. Teacher education in this area is only just starting with the first formal course available in 1991.

The growth of bilingual units will accentuate this problem over the next few years. The proposed senior bilingual statistics courses must be taught by dual-skilled teachers. Teacher availability will be the limiting factor for the establishment of these courses.

6.3 *Assessment*

At present, assessment by national examination acts as a monocultural gate-keeper to technological development. Maori parents want success for their children in these traditional terms because that is the only way to progress to higher education. The alternative of a parallel, Maori assessment runs the serious risk of not being acceptable to those who provide jobs or access to education.

Another path is to change the assessment so that it is not culturally discriminatory, either by changing the content and language of the examinations, or by changing the nature of the assessment. The modular structure of the new mathematics syllabus will allow such a change. Each module can be assessed appropriately and the same award made.

7. Conclusion

Statistics education for bilingual classes is important for political reasons. Maori students must have an equal share in the benefits of information education, and Maori people need such an education to complete the process of regaining cultural equity in Aotearoa.

Statistics education must reflect the Maori values put on the process of learning in order for it to be "owned" by the students as a relevant subject for study, and so that the results of statistical research will be accepted and used by Maori society.

Development of bicultural statistical education is hindered by a lack of knowledge on the part of most statistics teachers of the values concerned and how they might be incorporated into a statistics course. The monocultural school environment and assessment procedures slow the acceptance of such changes in bilingual classrooms.

Despite these difficulties, progress is being made. This time of change provides an opportunity for exciting learning by us all: students, teachers and educationalists alike.

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