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TE HAUTAKA MĀTAURANGA O WAIKATO
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Vouchers and the Privatisation of New Zealand Education LIZ ELEY AND JOHN CLARK	3
Standards-based Assessment in English: Take 3 TERRY LOCKE	13
Poem: Untitled PIRKKO MARKULA	32
Qualifications, Critiques, and Reforms: The Rhetoric Surrounding the New Zealand Qualifications Authority IVAN HODGETTS AND DARRIN HODGETTS	33
Poem: Boarder's Leave Ending RACHEL WOOD	50
The Maori Language Science Curriculum in Aotearoa/New Zealand: A Contribution to Sustainable Development MILES BARKER	51
<hr/>	
SPECIAL SECTION: TEACHER EDUCATION AND TEACHING: TRENDS AND POSSIBILITIES	61
Introduction BARBARA HAROLD	61
Reviews of Teacher Education in New Zealand 1950-1998: Continuity, Contexts and Change NOELINE ALCORN	63
Research Trends and Possibilities in Teacher Education CLIVE MCGEE	77
Teachers Talk Back: Educational Theory and Teacher Education SUE MIDDLETON AND HELEN MAY	89
Stories to Live by on the Professional Knowledge Landscape D. JEAN CLANDININ	107
Remapping the Practicum in Teacher Education ROSIE LE CORNU (DOBBINS)	121
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The Effectiveness of a Māori-Focussed Teacher Education Programme FRED KANA	133
Poem: Day is Done TERRY LOCKE	138
Coping with the Dual Crises of Legitimation and Representation in Research RICHARD PRINGLE	139
Poem: Tracks JIM DENISON	151
Bright Future, Five Steps Ahead - Making Ideas Work for New Zealand: A Commentary HOWARD LEE AND GREGORY LEE	153
Ka Ora Kāinga Rua: Finding a Home in the Academy. A study into the Experiences of Four Maori Women in the Academy LAURA HAWKSWORTH AND PARE KANA	165
Neo-Liberalism and Constructions of Democracy: The Impact on Teachers' Work NESTA DEVINE	171
Producing an "Iwi-Meaningful" Doctoral Proposal: A Case Study BELLA TE AKU GRAHAM	181
"Coming to Know" in Teaching Physical Education: Moving Across Cultural Boundaries GEORGE SALTER	189
To the Fullest Extent of his Powers: C.E. Beeby's Life in Education NOELINE ALCORN	199
Poem: Junia DEBORAH FRASER	208
Poem: Tania DEBORAH FRASER	209
Poem: Otorohanga, 1966 DEBORAH FRASER	210
Book Reviews	211
Poem: Let's Hear It TERRY LOCKE	217

THE MĀORI LANGUAGE SCIENCE CURRICULUM IN AOTEAROA/NEW ZEALAND: A CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

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ABSTRACT *New Zealand's Māori language science curriculum, Pūtaiao i roto i te Marautanga o Aotearoa (1996), which followed Science in the New Zealand Curriculum (1993), was not introduced because of a need to convey meaning; all New Zealand Māori (currently about 14% of the total population) speak English. Nor did it arise primarily to promote science education. Instead, along with other Māori language curricula in Mathematics and Technology, developed in the 1990s, Pūtaiao was one of the responses to a growing public desire (resonating with legislation in the 1980s) to promote Māori language, culture and values in their own right. The writing of these Māori language curricula, however, took place in the absence of any detailed overview statement from government about their purpose. In the case of Pūtaiao, feedback to the writers from government was notable for directives that the structure of this new curriculum (like the pre-existing English language science curriculum) comply with the generic New Zealand Curriculum Framework, the document which initiated the whole process. The Framework's non-negotiable requirement that all curricula present content knowledge in separate strands, and that learning always be described in terms of a linear system of levels, posed considerable challenges for the writing team. The outcome is that, in its final version, Pūtaiao is basically a translation, with some rearrangement, of the English language document. Its strength is that, thanks to the Māori vocabulary for science terminology which its writing stimulated, Pūtaiao makes possible the extended use of Māori language in school science lessons. On the other hand, the received parameters of the Framework meant that Pūtaiao basically reflects little that can specifically be identified as Māori knowledge structures or epistemologies. This deficiency calls into question how far Pūtaiao will contribute to New Zealand's sustainable development - the making possible of genuine choices in the future. Prior to the 1980s, sustainable development in a bicultural context in New Zealand had been legislated for in terms of material assets, especially matters concerning land ownership. The case of Pūtaiao suggests that sustainable development through the use of an indigenous language in schools, in turn, raises even deeper-level issues of cultural ownership.*

INTRODUCTION

From 1877, when the New Zealand Education Act established a national, free, secular and compulsory state-funded system of schooling (Simon, 1998), until 1996, all science curricula in New Zealand had been English-language documents. However, in 1996, at a time when Māori people comprised 14% of the New Zealand population, when only 26% of those professed to holding conversation in Māori language with ease (Statistics New Zealand, 1998); and when only about 2% of Māori people (usually elderly) spoke little English (Department of Statistics, 1997), a nationwide optional Māori language science curriculum was introduced by the Ministry of Education.

This paper explores why an indigenous Polynesian language, closely related to Cook Islands Māori, and more distantly to Tahitian and Hawaiian, was co-opted as a medium for teaching and learning science near the end of the 20th century, in a country where the English language terminology and thought patterns of science as an international enterprise had already freely penetrated. The material presented here is substantially a survey of public documents, but it also derives from my own experiences as a teacher educator (especially in institutions where the Māori science curriculum is in use), and from my close and long-standing professional contact with the co-ordinators of the Māori curriculum science writing process.

The paper documents the linguistic, political, philosophical and pedagogical issues which emerged during the writing of the Māori science curriculum (Ministry of Education, 1996) in the three years prior to 1996. It reports, as far as possible, on the subsequent educational impact and the practical classroom ramifications of the new curriculum.

THE RECENT FORTUNES AND STATUS OF MĀORI LANGUAGE

For the Māori language, the 1980s was a time of continued erosion, tempered by some hope. The decade saw a decline in the number of fluent Māori speakers: in 1978 there were 64,000 but by 1990 this had fallen to around 50,000 of whom 40% were aged 55 and above (Department of Statistics, 1990). However, a positive development was the opening in 1982 of the first Kōhanga Reo (literally "language nests", i.e. Māori language immersion early childhood centres), and currently there are approximately 600 centres catering for 40% of all pre-school Māori children (Te Puni Kōkiri, 1998).

Nationally, the decade saw significant changes of attitude towards Māori language, resulting from evolving recognition of the Treaty of Waitangi, New Zealand's founding constitutional document of 1840. By the 1980s the Treaty had moved from obscurity through to substantial recognition. In 1985, responding to a claim that the Crown had failed to protect the Māori language and that this was a breach of Article 2, the Waitangi Tribunal ruled that ". . . the 'guarantee' in the Treaty requires affirmative action to protect and sustain the language, not a passive obligation to tolerate its existence . . ." (Waitangi Tribunal, 1986). In response, the Māori Language Act of 1987 declared Māori an "official" language of New Zealand, and a Māori Language Commission was

set up in the same year to act as a policy forum and to offer technical service by undertaking language research (Department of Statistics, 1997).

The officially sanctioned, increasing public profile for Māori language (in the form of information and documents, job advertisements in newspapers, Māori language radio, etc.), together with the considerable numbers of fluent young speakers entering primary schools from Kōhanga Reo, had clear implications for a new curriculum framework which was proposed in the early 1990s, and which addressed the structure of New Zealand schooling for all five to 18-year-olds.

THE NEW ZEALAND CURRICULUM FRAMEWORK

The Māori language science curriculum of 1996, *Pūtaiao i roto i te Marautanga o Aotearoa* was therefore, not an isolated initiative specifically designed to promote teaching and learning in science. Rather, it was one of many developments in the context of a major overhaul of curriculum, the New Zealand Curriculum Framework (Ministry of Education, 1993a, b). Curiously, however, no specific and comprehensive statement of government intentions, guidelines or purposes for Māori language curricula was ever actually announced. Rather, the thrust to develop Māori language curricula was apparently an outcome of the Framework's general undertaking (in line with the revised official stance in the 1980s) to promote ". . . second language learning, te reo [i.e. Māori language] and ngā tikanga Māori [Māori customs] . . . It acknowledges also the value of the Treaty of Waitangi, and of New Zealand's bicultural identity" (Ministry of Education, 1993a).

In the style of other similar national framework documents in the United Kingdom (Department for Education, 1995), the United States (National Research Council, 1996) and Australia (Australian Education Council, 1994), the New Zealand Curriculum Framework defined a number of so-called essential learning areas - Mathematics, Science, Language and Languages, Technology, Social Sciences, Health and Physical Well-Being, and The Arts. Each of these seven areas was to be ramified by several learning strands, each anchored by a set of achievement aims, and learners would progress from year 1 to year 13 through eight levels of achievement.

The English language science curriculum statement *Science in the New Zealand Curriculum* (Ministry of Education, 1993c), referred to below as SITNZC, was one of the first to be developed within the Framework (Table 1), and a contract between the Ministry of Education and a selected team of two coordinators was drawn up to develop a Māori language science curriculum statement in May 1993.

Table 1: The December 1998 state of development of English language (upper) and Māori language (lower) curricula within the seven essential learning areas of the New Zealand Curriculum Framework.

Mathematics in the New Zealand Curriculum	Science in the New Zealand Curriculum	English in the New Zealand Curriculum	Technology in the New Zealand Curriculum	Social Studies in the New Zealand Curriculum	Health and Physical Education in Zealand Curriculum	The arts in the New Zealand Curriculum
Final 1992	Final 1993	Final 1994	Final 1994	Final 1997	Draft 1997	Draft 1997
Pāngarau i roto i te Matauranga o Aotearoa	Pūtaiao i roto i te Matauranga o Aotearoa	Te Reo Māori i roto i te Matauranga o Aotearoa	Hangarau i roto i te Matauranga o Aotearoa	Tikanga-ā-Iwi i roto i te Matauranga o Aotearoa	Hauora i roto i te Matauranga o Aotearoa	Ngā Toi i roto i te Matauranga o Aotearoa
Final 1996	Final 1996	Final 1996	Draft 1998	Draft 1998	In Prep. 1998	In Prep. 1998

WRITING *PŪTAIAO*: HOW THE PROCESS OCCURRED

The co-ordinators, Elizabeth McKinley and Pauline Waiti, who were supported by an advisory/support group, held a large number of regional meetings with interested parties, and they received frequent advice from the Māori Language Commission. Initially, in the absence of government directives, those involved debated what form *Pūtaiao* should take, and what function it should serve. Following these meetings, a team of 14 writers (each of whom had a consultative reference group) prepared material which was submitted, under a demanding timeframe, to a Policy Review Group in the Ministry of Education (McKinley, 1996). The process of feedback and further writing culminated in a draft curriculum being launched in October 1994, and after trialing and slight revision, the final version, *Pūtaiao i roto i te Marautanga o Aotearoa* (Ministry of Education, 1996), referred to in this paper as *Pūtaiao* became widely available in late 1996.

An initial inspection of the 126-page *Pūtaiao* document shows that its layout is basically the same as SITNZC. Each double page addresses a particular learning level within a given learning strand, and it specifies achievement objectives, possible learning experiences, and assessment examples. Obvious differences, compared with SITNZC, are the English translations in the margins near key terms in Māori, the designating of the particular learning level in terms of a primordial epoch (Te Pū, Te More, etc.), and the absence of sample learning contexts (omitted, apparently, because of time constraints). Other, more general, unique features of *Pūtaiao* are: the opening tauparapara (incantation) which indicates how Te Ao Wairua (the spiritual world) and Te Ao Kikokiko (the physical world) are inextricably bound in Te Ao Māori, the

incorporation of whakatauki (proverbs), the use of decorative kowhaiwhai (painted scroll patterns), and a comprehensive Māori-English dictionary.

WRITING *PŪTAIAO*: ASSESSING THE IMMEDIATE OUTCOMES

This section assesses three positive, then three negative features of the writing process itself and the final form which the document took. A discussion of the longer range outcomes, i.e. the subsequent use of the curriculum in classrooms, will follow.

Because the Māori language curricula in mathematics, science and Māori language itself were the first to be devised under the Framework, the consultation processes which the coordinators set up were a unique and largely beneficial opportunity for Māori people to problematise the purpose of the whole exercise, to confront the power relations which underpin the process, and to engage with issues of contestation and ownership (McKinley & Waiti, 1995).

A second positive feature of *Pūtaiao* is the substantial number of new scientific terms in Māori. These were constructed according to the ground rules of the Māori Language Commission, viz. that the new terms be short, transparent, and (within the bounds of international nomenclature, and avoiding extreme purism) not loans from English (Harlow, 1993). The reallocation of words which have dropped out of colloquial speech for a new purpose as specialist terms in science - for example, *ngota*, formerly "fragment", for "atom" - is one ploy used to promote Māori as a contemporary, viable language. The only moderate incidence of dialectical differences in Māori language assisted this process, and the act of generating new vocabulary has opened up valuable debate about meanings and concepts in science itself.

Thirdly, the timely appearance of *Pūtaiao* made it much more possible to extend immersion in Māori language into the previously daunting context of school science lessons. By 1996 the success of *Kōhanga Reo* had resulted in the development of 43 Kura Kaupapa (i.e. primary schools where the principal language is Māori), and four secondary Kura were planned (Statistics New Zealand, 1998).

A first major criticism of *Pūtaiao* is that, being basically a translation from English, and carried out under strict governmental oversight, it represents the co-option of Māori language for regulation and control. If it is accepted that curriculum development is an inherently political process (McKinley & Waiti, 1995), then it can be argued that the ideas which underpin *Pūtaiao* are consistent with previously held (and sometimes iniquitous) ideas held about Māori, and that only the language through which the ideas are conveyed has changed (McKinley, 1995).

Secondly, *Pūtaiao* has been criticised for shrinking away from what Laudan (1983) called "the demarcation problem"; the general question of what qualifies as *scientific* knowledge. While SITNZC has an integrating strand (which cross-threads the contextual strands, described below) called "Making Sense of the Nature of Science and its Relationship to Technology", in *Pūtaiao* this has become merely Hangarau, (technology). This means that *Pūtaiao* does

not engage in the "nature of science" debate at all. McKinley (1995) argues that by not exploring the issue, *Pūtaiao* leaves unchallenged what Harding (1993) claims is a common assumption, viz. that the knowledge of indigenous peoples is closed, pragmatic, utilitarian, value-laden, indexical, and context-dependent. In McKinley's view, this leaves a traditional (or positivist) view of science, "a discourse of scientism", as the pervasive model in *Pūtaiao*. It is noted, however, that the question of "Māori science" and "western science" was raised early in the *Pūtaiao* consultations (McKinley & Waiti, 1995), but pressure of time resulted in no formal statement emerging about the complex issue (Roberts, 1996) of the general status of "Mātauranga Māori" (roughly translated as "Māori science").

Thirdly, the structural divisions of *Pūtaiao* (the levels and the strands), which were inherited from the Framework, have been seen as inimical to the interconnected and integrative nature (Pere, 1981; Salmond, 1985) of traditional Māori learning processes. That learning does not proceed by the acquisition of ". . . logically organised packages, mastered in all-or-nothing fashion (but rather) it expands in irregular spurts, sidetracks, inconsistencies and misconceptions" (Elley, 1996) is a criticism that can be made of all educational frameworks based on sequential levels of achievement. However, this format seems to be especially incompatible with traditional Māori social structures (Orbell, 1996). As one Māori teacher put it: "We don't live in levels; we live in whanau (i.e. families)". Unlike the question of levels, the number of contextual learning strands (which consultative groups overwhelmingly felt should differ from the English version) did prove to be negotiable with the Ministry of Education. If science content did, in the words of one participant, have to be "carved along the joints, like a crayfish", then the division should at least partially reflect the Māori sense of connectedness, through wairua (spirit) and whakapapa (genealogy), between living things and Papatūānuku (the Earth). The outcome was that the Māori curriculum has three contextual strands, rather than four. The achievement objectives for the strand "Making Sense of the Planet Earth and Beyond", which relate to earth science and astronomy, were distributed partly into "Ō Mataora" (comparable with "The Living World") and partly into "Ō Ahupūngao" ("The Physical World") respectively. "The Material World" became "Ō Kawekawe".

In summary, *Pūtaiao* is basically a translation, with some rearrangement, of the English language document. Its strength is that, thanks to the Māori vocabulary for science terminology which its writing stimulated, *Pūtaiao* makes possible the extended use of Māori language in school science lessons. On the other hand, the received parameters of the Framework, already made concrete in the English language science curriculum, meant that *Pūtaiao* basically reflects little that can specifically be identified as Māori knowledge structure or epistemology.

PŪTAIAO AND THE FUTURE

The two years following the introduction of *Pūtaiao* into classrooms in early 1997 have been times of continued curriculum implementation in New Zealand (Table 1), and there has been little specific feedback on the use and effectiveness of any of the Māori language curricula. At this stage it is clearly much too early to be sure that the classroom implementation of Māori language curricula in the late 1990s, built on the changed national stance in the 1980s, will effectively and permanently revitalise Māori language in the next millennium. Indeed, the effort may have come too late. Overall, the proportion of fluent Māori speakers has continued to drop: by 1995 the number had fallen to around 10,000 of whom 44% were over 60 years of age (Department of Statistics, 1997). Although enrolments in Kura Kaupapa have increased six-fold over the period 1990-1996, this still represents only 2.3% of all Māori students, who in turn, now make up nearly 20% of all New Zealand school students (Statistics New Zealand, 1998). This means that probably not more than 2% of all science students in New Zealand are using *Pūtaiao* at present.

This paper has argued that *Pūtaiao* had its origins in more general cultural concerns, rather than in specific aspects of either science or science education. Nevertheless, it is reasonable to look to *Pūtaiao* to augment science-related outcomes. These might include: contributing to informed community decision-making via enhanced scientific literacy; maximising economic returns from the pool of human talent contributing to science-based ventures; and injecting diversity into the way the scientific community defines and solves complex scientific problems. Again, it is much too early for an assessment.

In the longer term, issues of language development in New Zealand will undoubtedly be debated in an increasingly multi-cultural context. It is estimated (Prasad, 1999) that by the year 2046, Māori people in New Zealand will comprise 20% of the population (they currently comprise 14%), but the proportionate rise in Asian people (from 4% to 12%) and those from other Pacific Islands (from 5% to 12%) will be even more rapid. It will be in this evolving and increasingly complex cultural mix that Māori language will make its contribution.

PŪTAIAO AND SUSTAINABLE DEVELOPMENT

The term "sustainable development" has been in use at least since the early 1970s (Fensham, 1999) but it was generally not taken into account by educationalists worldwide until the late 1980s (Saez & Riquarts, 1999). For example, in New Zealand the term is now making its way into official educational material (Ministry of Education, 1999, p.12). What is meant by "sustainable development" has continued to evolve during the 1990s (Tarasova, 1999) - there are now more than 60 definitions to be found in the international literature (Judes, 1999, quoting Marien 1996) - but perhaps the definition in most common usage is that "sustainable development is

development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

According to this definition, it can be argued that the introduction of a Māori language science curriculum qualifies as sustainable development because it promotes the meeting of needs in future generations. In fact, the needs which Heyn *et al.* (1997) articulated - "sustainable development . . . expands choice, reduces poverty, enhances equity, promotes participation, and protects and restores the environment" - are all potentially addressed by *Pūtaiao*. The possibility of optionally available bilingualism in education does, by definition, expand future choice in diverse societies. There is evidence from situations as different as Alaska (Middlecamp & Baldwin, 1995; Kawagley *et al.*, 1995) and Samoa (Lee Hang & Barker, 1996) that science learning in an indigenous language can reduce the poverty of students' thinking. If the knowledge partiality of previous English language science curricula has unconsciously disadvantaged and alienated indigenous peoples (McKinley, 1996), then the Māori curricula can be expected to enhance equity. The development of *Pūtaiao* promoted participation by Māori in complex issues as they engaged in the responsibilities of a negotiated process (McKinley, 1995). Further, the contribution of Māori traditional knowledge to protecting and restoring the environment would seem to have a greater chance of legitimation.

The circumstances which led to the development of Māori language curricula in New Zealand - the 1985 ruling that the Treaty of Waitangi guarantees the protection and sustaining of Māori *language* - is a significant comment on the relative importance of *non-material* aspects of the term "sustainable development". Hitherto, the implementation of Article 2 (see Orange, 1987, p. 1, 257-258) had been debated in terms of *o ratou wenua, o ratou kainga* ("their land, forests and fisheries"); now, for the first time, the full significance of *o ratou taonga katoa* to Māori people was being contested. *Taonga katoa* (literally "all treasures") comprises artefacts but, most fundamentally, it also encompasses all those subtle and intangible aspects of language, belief and customs which underpin a whole way of life. It was the sustainable development of these which endured the longest period of official neglect in New Zealand.

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