

Māori Students in Science: Hope for the Future

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Abstract: As New Zealand transitions to an innovative and technological society there are numerous risks for its indigenous people. Having occupied the bottom end of the socio-economic ladder for 150 plus years, the struggle for upward mobility is intensifying with Māori more determined than ever to achieve a place in society that will enable them to live with cultural equality and socio-economic security. However, in order to attain their place in the new economy Māori must look to their science achievements both for understanding and for leadership. As this paper will show, Māori accomplishments in science within the universities must be considered a qualified success although Māori are highly under-represented in all aspects of degree completions in the science arena and the more advanced the degree is, the greater the under-representation. However, considering that in the last fifty years the number of Māori science graduates has risen from virtually zero the current numbers are encouraging with hope for the future. It is true that at the very highest level Māori have yet to make their mark and at the Ph.D. level Māori are also highly under-represented, but with appropriate policy changes it would seem possible to bridge this gap between Māori and non-Māori. It is also of concern that since the year 2000 the rate of increase of both Maori and non-Māori graduations in the sciences seems to have reached a plateau, which suggests some kind of major but unexpected shift concerning the training of science students within the universities.

Keywords: Māori doctoral degrees; Māori education; science degrees; technological capacity

Introduction

When Europeans first arrived at these shores over 200 years ago, they brought with them the technological sophistication of the industrial revolution. Māori were quick to adapt European technology to their own purposes especially in the areas of commerce (Petrie, 2006) and military science (Ryan & Parham, 2002). The advantages of European education were obvious and many Māori availed themselves of such education through the Mission Schools established around 1818. Māori soon proved to be voracious learners and by the middle of the 19th century were actively involved in commerce (Petrie, 2006) and by the early 20th century deeply engaged in politics and public life (Condliffe, 1971). Highly educated men like, Sir Maui Pomare, Sir Apirana Ngata, Te Rangihiroa, Sir James Carrol, to name but a few, burst upon the scene only to disappear in the fullness of time leaving only their memorials; no one stepped in to fill their shoes. How is it possible for such a brilliant beginning to end with a whimper; something must have happened.

Some scholars point to government policies that forced Māori into agricultural and domestic labour (Simon, 1993). The racist paternalism rampant within the governments of the first half of the 20th century in New Zealand, deliberately chose to make Māori a source of labour and domestic servitude. As the Director of Education said in 1931 (and as quoted by Hill, 2004, p. 182), the state chose for Māori, “a type of education that will lead the lad to be a good farmer and the girl to be a good farmer’s wife.” At a time when Māori were seeking greater control of their own lives Pākehā were seeking total assimilation (Simon, 1993), and by implication total transfer of Māori lands to Pākehā control. Regardless of motive, in the early part of the last century the government changed the rules of the game, educational policies promoted practical skill development for Māori and moved to exclude Māori from higher education (Simon, 2007) and to what Poulantzas (1978) referred to as ‘knowledge-power’.

Educational policies very quickly turned Māori into a nation of labourers providing sweat for the national growth. For 50 years, from around 1910, there were few Māori university graduates and it seems unlikely that this could have arisen from simply a downturn in native intelligence. Following the success of Ngata and his colleagues the expectation was that more and more Māori should have followed in their footsteps seeking higher education as a foundation for prosperity and fulfilment. The educational gap between Māori and mainstream resulted, not so much from conflicts resulting from curriculum and delivery, but from government policies aimed at Māori assimilation as a labouring class. Today, we gasp in horror at the underachievement of Māori in education shaking our heads as if Māori were to blame for their lack of educational achievements.

Policy changed and today, more and more Māori are moving into higher education and there is no doubt that the trend will continue. Māori university graduates are becoming quite common at both ends of the degree spectrum, including doctorates. This improvement in Māori tertiary education has happened at a time when more and more graduates are needed to deal with the ever increasing complexity of our technological society. A technological revolution is underway; this time it is a revolution in communications, medicine, genetic engineering and biodiscovery. Can Māori embrace this new world of technology and science?

Unfortunately, this revolution is forced upon Māori at a time when their recovery from the debilitating effects of colonization and negative educational policies is as yet incomplete; Māori are still finding their feet in a world that can, literally, change overnight. Human capital invested in science and technology is an important driver that will allow Māori to benefit from technological achievement and productivity. Māori success in the universities is a major part of human capital investment for Māori and it is important to understand the performance of that investment because of its significance for the future of Māori society (Hook, 2007a,c).

Prior to the 1950s the only Maori scientist of note was Te Rangihoro an anthropologist who for many years directed the Bishop Museum in Honolulu, Hawaii (Condliffe, 1971). The progress that Māori has made over the last 50 years or so in the sciences as taught within the universities of New Zealand has been considerable (Hook, 2007c) rising essentially from non-existence to today where recently the scientific successes of Professor Michael Walker, a Māori of Whakatohea, have been singled out within the pages of "Science", (Bohannon, 2007) one of the most prestigious scientific journals in the world. There one of his colleagues Professor Joseph Kirschvink of the California Institute of Technology in Pasadena is quoted as saying of Walker, "If there is ever a Nobel Prize for magnetic field perception, Walker's name will be on it." The path to scientific achievement has been long but who can doubt that progress has been made.

This paper is an assessment of Māori performance in the sciences in the universities of New Zealand. How many are there, what are they studying, and how does the future look? Can Māori recover their enthusiasm for learning and scholarship exhibited so brilliantly by their *tūpuna* in the early days of colonization?

Science Degrees

In New Zealand universities, as with most other universities around the world based on the Oxford/Cambridge model there are five different degree levels (Table 1). Bachelor level degrees take around three years of study to achieve. After the bachelor degree there is often a split whereby some students then move into a Bachelors degree with Honours, or some move directly to Masters level study. The Honours degree and the Masters are usually the tickets needed for advancement to the next level, the doctoral level. Doctorates consist totally of research although occasionally some course work may be required, especially in the USA.

Beyond the Ph.D. level is the higher doctorate the awarding of which is based on substantial and original contributions to a field of study. The awarding of the higher doctorate is rare and in the period of 1994 to 2005 accounted for only around 0.06% of the science degrees awarded (Table 1).

Science degrees offered in New Zealand universities, beginning with the bachelors degree, are shown in Table 1; diplomas and certificates are excluded. As can be expected science graduation begins with the bachelor's degree for both Māori and non-Māori. Over the period of 1994 to 2005 (inclusively) there were 2,758 graduations of Māori in science. During the same period, for non-Māori there were 52,313, a substantially higher number. Māori accounted for 5.0% of the total student science population graduating with bachelor degrees or above. Comparing this figure of 5.0% with the target norm of 14% shows that Māori with respect to science degrees were under-represented.

The target norm is defined as that percent of the population that Māori comprise, but in the appropriate age-group (Hook, 2007b). The target norm is the figure that allows estimates to be made regarding over- and under-representation. Māori constitute 14.7% of the New Zealand population, therefore, one might think that for Māori 14.7% would be the target norm for determining under- or over-representation. However, the University student group consists of primarily the 15-64 age group. According to the 2006 census the number of Māori in that age group is 374,248 (QuickStats National Highlights: 2006 Census) and the total number of New Zealanders in the 15-64 age group being 2,664,762. Therefore, the percent Māori in the 15-64 age group is 14.0%; this then is the target norm assuming that the student population is made up primarily of the 15-64 age group. Perhaps a better target norm might be found in say the 15 to 59 year age group rather than the 15-64 age group, but the data was not readily available. Omitting the 60-plus age group from both Māori and non-Māori might tend to raise the target norm. The true target norm lies somewhere between 14.0 and 14.7%

Table 1. Comparison of science degree graduations of Māori and non-Māori 1994-2005, inclusively.

Science Degree	Māori Total	Māori Percent	Non-Māori Total	Non-Māori Percent
Bachelors	2,302	83.4	39,385	75.3
Bachelors with Honours	132	4.8	4,316	8.3
Masters	267	9.7	6,983	13.3
Ph.D.	57	2.1	1,599	3.1
Higher Doctorate	0	0	30	0.06
Total Students	2,758	100	52,313	100

For Bachelor Degrees Māori accounted for only 5.5% and for Bachelor Degrees with Honours, Masters, and Ph.D., Māori represented only 3.0%, 3.7%, and 3.4%, respectively, of the graduating science students. Again, Māori in all science degrees were highly under-represented and in the category of higher doctorates there were zero graduates. However, in the category of higher doctorates the percentage of non-Maori science graduates was extremely rare with only 0.06% of the graduates being in this category.

The general distribution of science graduate degrees was similar for both Māori and non-Māori indicating that the preferences exhibited by both groups for advanced study were not vastly different, although the percentage of Māori graduating with degrees higher than bachelors were several percentage points lower than non-Māori (Table 1). Bachelor Degrees in Science accounted for 83.4% of all Māori science degrees and for non-Māori it was 75.3% figures that reflect perhaps the current position of Māori in the sciences. However, being relatively new in the field of science it will take time to build the upper end of the science spectrum for Māori.

Māori Graduating with Science Degrees

During the time period of 1994 to 2005, inclusively, the number of Māori graduating with science degrees per year increased three-fold from 107 graduates in 1994 to 323 graduates in 2005 (Figure 1A).

Figure 1A. Maori Graduating with Science Degrees

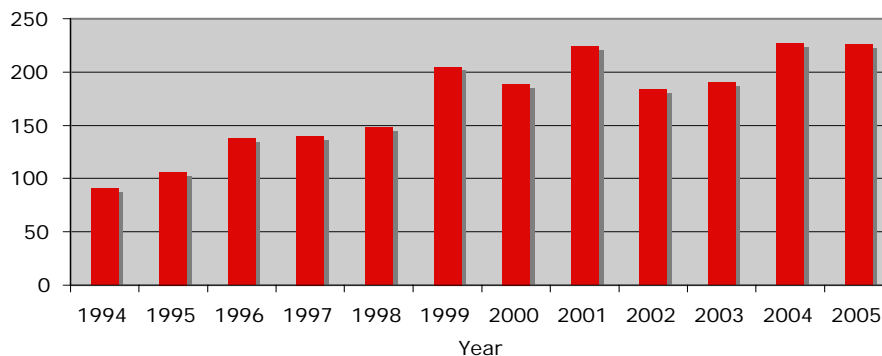


Figure 1B. Non-Maori Graduating with Science Degrees

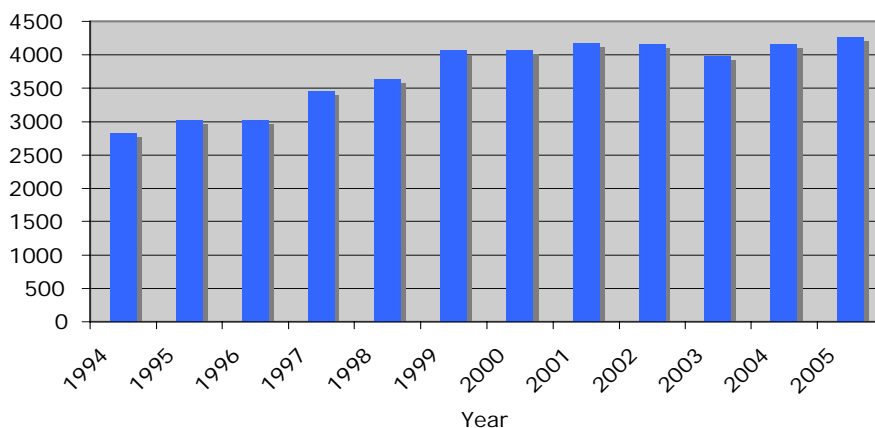


Figure 1. The number of Māori and non-Māori graduating with sciences degrees (bachelors, bachelors with honours, masters, and doctorates) from 1994 to 2005. 1A: Māori graduations in science. 1B: Non-Māori graduations in science.

During this same time period non-Māori science graduates increased only 1.6-fold from 3348 in 1994 to 5464 in 2005. The gap between Māori and non-Māori is still large, but decreasing with time if the trend continues.

Curiously, since 2000 both Māori and non-Māori graduations in science seem to have plateaued (Figure 1). Reasons for this flattening out of both curves is unknown and unexpected especially in view of the fact that the population of both Māori and non-Māori increased over this period. Hopefully, it does not reflect saturation of the educational system for science students or inadequate financial support within the universities themselves. Clearly some kind of limiting capacity has been reached that needs to be investigated and identified.

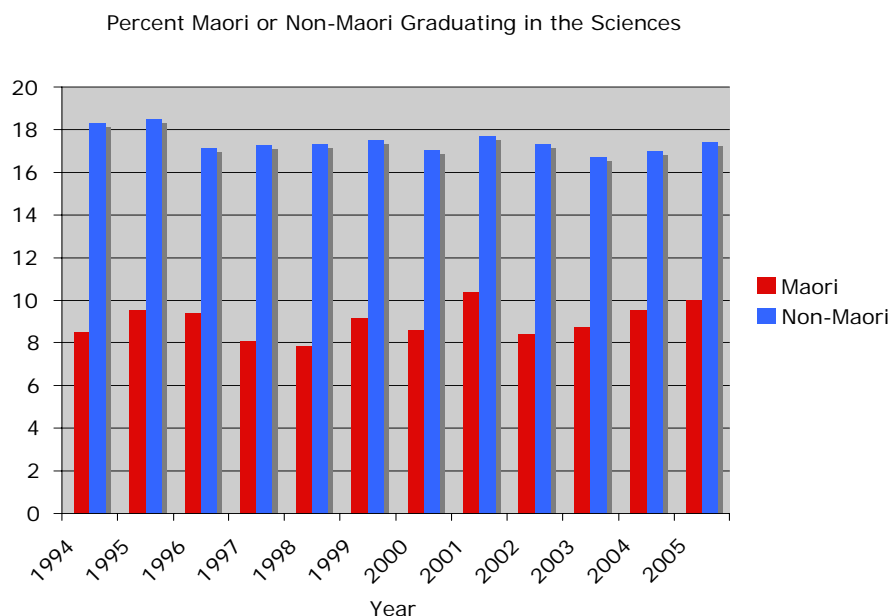


Figure 2. Percent of Māori and non-Māori graduating with sciences degrees (bachelors, bachelors with honours, masters, and doctorates) from 1994 to 2005, inclusively.

As seen in Figure 2, the percent of total Māori and/or non-Māori graduating with a university degree in the sciences is fairly constant ranging between 8 and 10% of the total degree graduations for Māori and between 16.5 and 18.5% for non-Māori. Thus Māori degree qualifications in science as a percent of total graduations (all degree subjects) is only around half that of non-Māori; however, these percentages remained fairly constant over the period from 1994 to 2005.

Fields of Study

The areas of study defined under the NZSCED codes as “science” are shown in Table 2. The distribution of Māori science graduates over these fields, for the period 2001 to 2005 are similar for both Māori and non-Māori. Both Māori (28.2%) and non-Māori (25.7%) favour the biological sciences over all other fields of study with the computer sciences a distant second at least for non-Māori and “other health” giving rise to the second most number of science graduates for Māori. The hard sciences of mathematics, physics, astronomy and chemistry have proportionately more non-Māori than Māori graduations although not markedly so. In the computer sciences, the second most favoured area of study for non-Māori (12.9%), Māori appeared less interested accounting for only 7.5% of the science graduations.

These trends indicate that whatever motivates non-Māori into the various scientific fields of study must also be valid for Māori excepting perhaps for those fields here listed as “other

health” (9.3% versus 3.4%, Māori versus non-Māori, respectively) and perhaps the field listed as “other agricultural, environmental and related studies” (0.3% and 0.05%. Māori versus non-Māori, respectively).

Table 2. Comparison of the percentages of Māori and non-Māori graduations with science degrees over areas of study 2001-2005, inclusively.

SCED Code	Field of Study	Māori	Non-Māori
101	Mathematical Sciences	5.5	7.2
103	Physics and Astronomy	1.6	3.1
105	Chemical Sciences	3.5	4.7
107	Earth Sciences	10.8	8.5
109	Biological Sciences	28.2	25.7
199	Other Natural and Physical Sciences	4.5	5.1
201	Computer Science	7.5	12.9
203	Information Systems	4.4	5.1
403	Building	0	0.5
501	Agriculture	2.4	2.5
503	Horticulture and Viticulture	0.4	0.4
505	Forestry Studies	0.6	0.6
509	Environmental Studies	1.6	1.3
599	Other Agriculture, Environmental and Related Studies	0.3	0.05
601	Medical Studies	1.1	1.7
603	Nursing	0.6	0.5
605	Pharmacy	0.2	0.2
607	Dental Studies	0.5	0.3
609	Optical Science	0.1	0.1
611	Veterinary Studies	0.9	1.8
613	Public Health	2.4	2.1
615	Radiography	0.9	0.8
617	Rehabilitation Therapies	1.1	1.1
619	Complementary Therapies	0.2	0.2
699	Other Health	9.3	3.4
907	Behavioural Science	10.4	9.5
	Unknown	0.9	0.6
Grand Total		100	100
Total Graduates		1062	20,962

Notes:

- 1) "Science" qualifications include all qualifications coded to 'Natural and Physical Sciences' and qualifications with 'Science' in the title (excluding 'Social Science')
- 2) Bachelors of Health Science in specified practice areas have been excluded - e.g. Bachelor of Health Sciences (Nursing) or Bachelor of Health Science (Occupational Therapy)
- 3) Main subject has been identified on the basis of the subject that the students was enrolled in most at the level for which they graduated
- 4) Subject data is only available from 2000. Therefore, 2001 graduates main subjects are only based on one to two year's data.
- 5) Where it was not possible to match the graduation to subject enrolment data, the main subject as reported with the graduation was used (if available)
- 6) Main subject reported for the graduation was not used as a primary source due to incomplete coverage, especially at bachelors level.

- 7) *All subjects in the fields of 'Natural and Physical Sciences', 'Information Technology', 'Agriculture, Environmental and Related Studies' and 'Health' have been included. Building Science and Behavioural Science are also included.*

Bachelors

The distribution of graduating students amongst fields of study for Bachelor Degrees is shown in Table 3. Most graduations occurred in the category of “other”, followed by the Biological Sciences and then the Health and Medical Sciences. The “Other” field of study covers a whole host of scientific fields of study such as rehabilitation, building, and computer sciences. For non-Māori the greatest number of graduates with Bachelor Degrees occurred in that category called “other” (31.1%) whereas for Māori the highest percentage was found in the Health and Medical Sciences (28.1%). For non-Māori Health and Medical sciences ran second (18.8%). This shows a marked preference for the Health and Medical Sciences for Māori. Interestingly, while the Mathematical Sciences for non-Māori accounted for 8.4% of the Bachelor Degrees, Māori were not so far behind (4.4%) as to be discounted. In the other categories Māori showed similar trends to non-Maori.

Bachelors with Honours

The distribution of degrees amongst fields of study in the Bachelor with Honours Degree category (Table 3) resembled that of the Bachelors Degree with the Biological Sciences featuring strongly for both Māori and non-Māori. The “other” category ran closely similar for both Māori and non-Māori. The number of students completing honours degrees for Māori was far less than that of non-Māori (134, versus 4462 students). The target norm would suggest a more representative figure for Māori might be around 600. Thus in the Honours Degree category, Māori are substantially under-represented.

Masters

In the Masters area one might expect to see a similar pattern to that exhibited by the Bachelor Degrees (Table 3), and to a large extent this is so. With the Masters Degrees the distribution of successful students amongst the various disciplines resembles that of non-Māori. This time however, the “Other” category is the area of highest success with the Biological Sciences running a close second. Health and Medical Sciences now runs third with the percentage of students substantially reduced from that seen with the Bachelors Degrees. This would suggest that the Health and Medical Sciences are not seen as such an attractive area for higher level studies as the Biological Sciences.

Doctoral Degrees

There are two categories of doctoral degrees; one is at the Ph.D. level and the other is in the Higher doctoral degree category. Higher doctoral degrees include the Doctor of Science degree, but in Table 4 only those who have achieved their higher doctoral degrees by examination are included; honorary degrees are not included. In this Higher doctoral degree category Māori performed very poorly with no degrees being conferred over the period, while non-Māori received 30 such degrees.

At the doctoral level the distribution of successful candidates amongst the areas of study is somewhat different from that of the lower degrees. While the Biological Sciences again are found at the top for both Māori and non-Māori the second most successful category is the Chemical Sciences followed by Physics and Astronomy. With the Mathematical Sciences Māori produced only three Ph.Ds during this time period studied, non-Māori produced 115, a substantial difference in the mathematical sciences.

In the doctoral stakes Māori are highly under-represented with only 57 successful candidates over the 1994 to 2005 period. To be on par with non-Māori an expectation of around 228 would need to be met.

Table 3. Percentage of science students graduating with Bachelors, Bachelors with Honours, and Masters degrees over areas of study 1994-2005, inclusively.

Subject	Bachelors		Bachelor with Honours		Masters	
	Māori	non-Māori	Māori	non-Māori	Māori	non-Māori
Agricultural, Horticultural and Animal Sciences	3.3%	3.6%	6.0%	6.5%	3.0%	3.6%
Biological Sciences	17.6%	18.2%	18.7	16.6%	28.3%	22.0%
Chemical Sciences	6.3%	7.2%	11.2%	16.4%	7.4%	8.1%
Earth Sciences	4.0%	2.6%	1.5%	1.0%	3.7%	3.7%
Environmental Science	1.3%	1.6%	3.0%	0.8%	4.5%	3.5%
Health and Medical Sciences	28.1%	18.8%	8.2%	5.4%	11.9%	13.2%
Information Sciences	2.1%	3.4%	2.2%	2.1%	1.1%	1.9%
Mathematical Sciences	4.4%	8.4%	4.5%	8.3%	3.0%	5.7%
Other	25.1%	31.1%	35.8%	36.9%	33.1%	33.6%
Physics and Astronomy	1.8%	2.9%	6.0%	5.3%	3.0%	4.3%
Sports Science	5.9%	2.2%	3.0	0.8%	1.1%	0.5%
Total successful candidates	2,448	42,779	134	4462	269	7056

Notes:

- 1) "Science" qualifications include all qualifications coded to 'Natural and Physical Sciences' and qualifications with 'Science' in the title (excluding 'Social Science')
- 2) Bachelors of Health Science in specified practice areas have been excluded - e.g. Bachelor of Health Sciences (Nursing) or Bachelor of Health Science (Occupational Therapy)
- 3) Main subject has been identified on the basis of the subject that the students was enrolled in most at the level for which they graduated

As the data show, Māori are substantially under-represented in the sciences although not so far behind mainstream as to be impossible to catch up. In terms of graduations in science over the period 1995 to 2005 Māori are under-represented by roughly one-third that of mainstream. However, considering that Māori did not really begin tertiary studies in substantial numbers until the early seventies quite clearly Māori have come a long way in a very short time. Also, during this period of 1995 to 2005 the total number of science graduations doubled and it would not be unreasonable to hope for another doubling to occur over these next 10 years.

Such an increase may be difficult to achieve in view of the fact the growth in science graduations seems to have slowed for both Māori and non-Māori since around the year 2000. Reasons for this slow-down are not clear, but could lie within government policies and practices and/or the teaching of science within the universities. Another possibility is that the

teaching of the sciences in secondary schools may have undergone some kind of discouraging alteration possibly around 1992. Despite these speculations, the point is that the number of science graduations in the universities seems to have become relatively stagnant.

Table 4. Numbers of science students graduating with Doctoral degrees over areas of study 1994-2005, inclusively.

Subject	Ph.D.		Higher Doctorate	
	Māori	non-Māori	Māori	non-Māori
Agricultural, Horticultural and Animal Sciences	0	45	0	0
Biological Sciences	29	622	0	2
Chemical Sciences	12	413	0	4
Earth Sciences	4	84	0	0
Environmental Science	2	26	0	0
Health and Medical Sciences	0	61	0	5
Information Sciences	0	11	0	0
Mathematical Sciences	3	115	0	0
Other	1	55	0	19
Physics and Astronomy	6	165	0	0
Sports Science	0	7	0	0
Total successful graduations	57	1,601	0	30

It is suggested that the government needs to examine its policies and universities their practices in order to change this situation. While policy change within government might assist, especially financially through the offering of scholarships and fellowships to encourage Māori into science, most of the work will probably have to come from the universities themselves. One of the most effective tools might be the development of mentoring programmes for budding Māori scientists as well as programmes that can provide fellowship and support to those engaged in the hard grind of a science degree. Some of these approaches, such as the Capability Building Programme of Ngā Pae o te Maramatanga (<http://www.maramatanga.co.nz/>) are currently being used at the University of Auckland and it will interesting to see what kinds of success have been achieved. For Māori, cultural sensitivity and familiarity might be a good place to begin because, as discussed previously (Hook, 2006; 2007) the dissociation of culture from education has not always been conducive to Māori learning.

Summary and Conclusions

Examination of educational data kindly provided by the Ministry of Education has led to the conclusion that Māori are under-represented in the successful completion of science degrees in the universities of New Zealand and the more advanced the degree the greater the deficiency. However, considering the distance that Māori have covered over these last 50 years, from virtually zero science graduates to hundreds today, the situation is not grounds for despair. At the very highest level Māori have yet to make their mark and at the Ph.D. level

Māori are still highly under-represented. The deficiencies are not unmanageable but should, nevertheless, be treated as urgent. Financial assistance by government scholarship schemes might help and the engagement of Māori students with the Crown Research Institutes for mentoring and coaching might provide the impetus for greater engagement of Māori with the sciences.

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