Chapter 3
Te Rōpū Āwhina: A Model for Building Post-Secondary Māori and Pacific STEM Capability in Aotearoa/New Zealand

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Abstract Between 1999 and 2015, Te Rōpū Āwhina Whānau (Āwhina) at Victoria University of Wellington (VUW) substantially increased numbers of Māori (indigenous New Zealanders) and Pacific undergraduate and postgraduate students in the STEM disciplines. Underpinning Āwhina's success was its kaupapa and the creation of an inclusive whānau (family) environment that normalised high expectations, aspirations and achievements, collective success and reciprocity. The kaupapa (goal) of Āwhina was to produce Māori and Pacific STEM professionals who would contribute to Māori and Pacific community development and leadership. Importantly, the Āwhina kaupapa enabled non-Māori and non-Pacific students to contribute as whānau members.

Āwhina included concepts and ideas suggested for indigenous and minority student success in tertiary institutions. Given expected demographic changes over the coming decades, the future wellbeing of all New Zealanders will depend on the success of Māori, Pacific and other minority groups. Central to that is strengthening the STEM capability of Māori and Pacific students and the communities they come from.

In this chapter, we describe what Āwhina was, what it did and why. We provide evidence that Āwhina had a positive influence on Māori and Pacific success in STEM disciplines at VUW, and demonstrate that Āwhina almost closed the equity outcome gap in metrics such as degree completion rates. We also document Āwhina's history, including its struggle for survival, factors that threatened its successful continuation, and ways to mitigate those threats.

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3.1   Introduction

The population of Aotearoa/New Zealand is small (4.6 million (Statistics New Zealand, 2014, 2015b)), and increasingly diverse. Most of New Zealand's population (74%) are European, with Māori (the indigenous people of New Zealand, 14.9%), Asian (New Zealanders of Asian descent, 11.8%), and Pacific (New Zealanders descended from the indigenous peoples of Pacific Nations, 7.4%) comprising most of the remainder[1] (Statistics New Zealand, 2014). However, Māori and Pacific populations are expected to grow more rapidly than the European population with projected increases of 3.9%, 3.1%, and a decrease of 9.0%, respectively, between 2013 and 2038 (Statistics New Zealand, 2015a). Both Māori and Pacific people do not fare well in metrics of inequality when compared with New Zealand's European population for indicators such as smoking, obesity, unemployment, median weekly income and income distribution, access to the internet in the home, and proportion holding a Bachelor's degree or higher (Marriott & Sim, 2014). According to the 2015 OECD economic survey for New Zealand, Māori, Pacific, and low-income households are worse off than others for income, housing, health, and education outcomes (Carey, 2015).

Over a third of students currently in compulsory schooling identify as Māori or Pacific (Ministry of Education, 2015d), and these proportions are expected to increase over the next two decades (Statistics New Zealand, 2015a). However, outcomes in secondary (Ministry of Education, 2015a) and tertiary (Juhong & Maloney, 2006; Scott, 2005) education are not consistent with population demographics. For example, in compulsory schooling in 2014, the percentage of school leavers meeting university entrance requirements was only 14.5% for Māori students and 20.4% for Pacific students compared with 43.6% of European and 64.1% of Asian students (Ministry of Education, 2015c). At tertiary level Māori and Pacific students have attrition rates for Bachelors degrees of 43% and 48%, respectively, whereas New Zealand European or Asian students have attrition rates of 27% and 23%, respectively (Ministry of Education, 2014a). Relative to the total population, lower proportions of Māori and Pacific students complete undergraduate degrees, and the situation is worse at postgraduate level. These disparities exist to an even greater extent in science, technology, engineering, and mathematics (STEM) subjects, especially at postgraduate level (Ministry of Education, 2014b; Wilson et al., 2011).

Victoria University of Wellington (VUW), one of eight universities in New Zealand, is located in New Zealand's capital city, Wellington. Within its wider boundaries, the city has a population of around 470,000 people of which 8% are Pacific and 13% Māori (Statistics New Zealand, 2013). Approximately 19,000 students attend VUW, 80% of whom are European, 10% Māori, 5% Pacific, 13% Asian, with 5% identifying as 'other'[1] (Tertiary Education Commission, 2015). The university has

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[1] Non-exclusive ethnic categories.

nine faculties, including science, engineering, architecture, and design, referred to hereafter as the SEAD faculties, which cover STEM and STEM-related disciplines. Non-SEAD faculties include Law, Humanities and Social Sciences, Education, and Business.

Between 1999 and 2015 Te Rōpū Āwhina Whānau (Āwhina) in the SEAD faculties at VUW addressed disparities in tertiary STEM and STEM-related outcomes for Māori and Pacific students. After the retirement of the SEAD Deputy Dean Equity in December 2015, a fundamental change to SEAD equity programmes was instituted by senior VUW managers. To ensure the lessons of Āwhina's achievements are not lost this chapter tells the story of Āwhina, where it came from, what it was, what it did and why, and summarises some evidence of its impact on SEAD disparities at VUW. The chapter concludes with an exploration of factors that inhibit broader uptake of promising initiatives like Āwhina by tertiary institutions and which may also undermine their long-term sustainability, and suggests ways to mitigate these threats.

'Māori' is a collective term given to the indigenous people of New Zealand. Historically, Māori comprised numerous hapū and iwi (sub-tribes and tribes), each with their own identity reflected in their knowledge systems, dialects, values, and practices but the primary social unit underpinning Māori identity was, and remains, whānau (family). The term Māori was in use prior to the arrival of European colonisers, but its use today to collectively refer to the whānau, hapū, and iwi of the indigenous people of Aotearoa is a post-colonial construct (Wilson et al., 2011).

Beginning in earnest in the early eighteenth century, Aotearoa was colonised by European settlers, becoming a British Colony through the signing of the Treaty of Waitangi in 1840 between the British Crown and some (though not all) Māori chiefs throughout the country. The Treaty established protocols for Māori and Pākehā ('Pākehā' refers to all people of European descent) to live by. Importantly, it also established a set of rights for Māori that included self-determination and equality. However, despite the Treaty Māori were marginalised by colonisation, losing their ability to determine their own future. State-provided education was a primary tool for assimilation into the colonising culture. By the 1960s assimilationist policies, institutional racism, classroom bias, and Māori disengagement had generated glaring social disparities (Bishop & Glynn, 2003; Titus, 2001). More recently, education has been seen by Māori as a way to realise their aspirations and 'tino rangatiratanga' or self-determination; that is, to be Māori as defined by Māori (Penetito, 2004). This has led to the establishment of kaupapa Māori (by Māori, for Māori) initiatives, including Māori-medium schooling and Māori tertiary institutions or wānanga (Wilson et al., 2011).

The multiethnic, heterogeneous Pacific population in New Zealand has grown since the 1940s due to immigration policies designed to meet demands for unskilled labour (Ongley & Pearson, 1995). In the 2013 New Zealand census (Statistics New Zealand, 2014), the Pacific group included people from Samoa,

the Cook Islands, Tonga, Niue, Tokelau, Fiji, Kiribati, Nauru, Papua New Guinea, Solomon Islands, and Vanuatu. The four largest groups of Pacific peoples living in New Zealand are Samoan, Cook Islands, Tongan, and Niuean, with almost 2 in every 3 Pacific people born in New Zealand (Statistics New Zealand, 2014). In this chapter we use the term Pacific to refer to New Zealanders of Pacific origin, even though the term does not reflect the ethnic diversity within Pacific communities (Coxon, Anae, Mara, Wendt-Samu, & Finau, 2002; Ferguson, Gorinski, Samu, & Mara, 2008; Penn, 2010).

Over the last three decades neoliberal ideas, increasingly adopted by successive governments in New Zealand, Australia, Canada, the UK, and the USA, have substantially impacted policy agendas (Boston & Eichbaum, 2014; Roberts, 2007). Competition became the norm for individuals, state-owned enterprises, and public institutions, including compulsory education and funding for tertiary education and science. 'User-pays' policies were also applied to many areas including health and education (Roberts, 2007). However, the economic dividends hoped for by the government following the neoliberal reforms did not eventuate, generating instead greater income inequality and poverty. New Zealand's GINI coefficient (a common measure of inequality) has increased over the last 30 years to rank among the highest in the OECD (Boston & Eichbaum, 2014).

According to the 2015 OECD economic survey for New Zealand, equity in educational outcomes is weak, the level of income inequality is well above the OECD average, and the jobless poverty rate is high. In terms of New Zealanders' knowledge and skills, although the proportion of people with Bachelor's degrees or higher is increasing for all ethnic groups, the proportion for both Māori and Pacific is still 40% and 50% lower, respectively, than that of European New Zealanders (Marriott & Sim, 2014). Similarly, although the tertiary participation rates for all ethnic groups are increasing (Marriott & Sim, 2014), for Māori and Pacific the increase is mainly in non-degree qualifications (Ministry of Education, 2015b). Moreover, a key metric of educational success is qualification completion, rather than participation, yet greater proportions of Māori and Pacific students enrolled in Bachelor degrees do not complete relative to all students (Ministry of Education, 2014a). If the nation is to develop a highly skilled workforce to support predicted increases in employment in high knowledge areas this situation must change (McKinley, Gan, Jones, & Buntting, 2014).

There is also global recognition of the importance of diversifying the STEM workforce, with diversity acknowledged as bringing new perspectives to STEM fields (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce, 2011; O'Brien, Scheffer, van Nes, & van der Lee, 2015; Robinson & Dechant, 1997). For example, even though minorities are the fastest growing portion of the population in the USA they are underrepresented in STEM disciplines (Leggon & Pearson, 2009).

3.2   Āwhina: Capability-Building for Success

The outcomes achieved by Te Rōpū (the group) Āwhina (to support) whānau (family)[2] in the SEAD faculties at VUW are the result of a whakapapa (ancestry) of successful initiatives for underrepresented students established by the lead author Liz Richardson over several decades at secondary level in New Zealand and Britain. These included tertiary programmes at Waikato University (supported by Science Faculty Dean, Professor Ken McKay) and between 1999 and 2015 at VUW as the Deputy Dean (Equity) in the SEAD Faculties. The VUW position coincided with the appointment of Pro Vice Chancellor and Dean of Science and Architecture and Design, Professor Peter Englert who appointed Ms. Richardson to a senior SEAD role and tasked the SEAD Management Team to develop a strategic goal of producing Māori and Pacific scientists and engineers. Throughout his time at VUW Professor Englert supported and defended Āwhina and fought tenaciously for equitable outcomes for students. Āwhina was the first faculty-based mentoring programme established and funded by the SEAD faculties. Āwhina started with 16 senior Māori and/or Pacific students who asked their parents/kaumatua for a programme name and waiata (song, and a traditional means of Māori cultural expression).[3] In this case, the waiata was written to reflect the Āwhina kaupapa (goal). Another student provided a poutama (stepped pattern of knowledge and whakapapa (genealogy/ancestry)) logo. The SEAD Deputy Dean (Equity) played a leading role in the growth and development of the whānau until retiring on 21 December 2015, the day Te Rōpū Āwhina ended.

Āwhina was an on- and off-campus whānau (family) with a kaupapa of producing Māori and Pacific graduates in the SEAD disciplines who would become leaders in their communities. As Āwhina was kaupapa-, rather than whakapapa-based, Āwhina members could be of any ethnicity.

Underpinning the kaupapa of Āwhina were whānau values of high expectations, achievements, and aspirations; working and celebrating success collectively; and reciprocity through putting back into Āwhina and into the communities it represented. In short, Āwhina changed the culture of SEAD Faculties to enable Māori and Pacific students to succeed in SEAD disciplines at tertiary level.

Āwhina was resourced by the SEAD Faculties and embodied many of the concepts and ideas suggested for indigenous and minority student tertiary success (BEST, 2004; Hrabowski, 2014; Leggon & Pearson, 2009; Linn, Palmer, Baranger, Gerard, & Stone, 2015; Maton, Hrabowski, & Pollard, 2011; Tsui, 2007). For example, its leader was committed to long-term improvement of Māori and Pacific success in STEM disciplines with a position of influence in the SEAD faculties (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce, 2011; Guillory & Wolverton, 2008; Leggon, 2015; Maton et al., 2011).

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[2] In other words, the SEAD supportive family.

[3] Hence the name 'Āwhina' and the Āwhina waiata were kaupapa-based and belonged *only* to Te Rōpū Āwhina whānau.
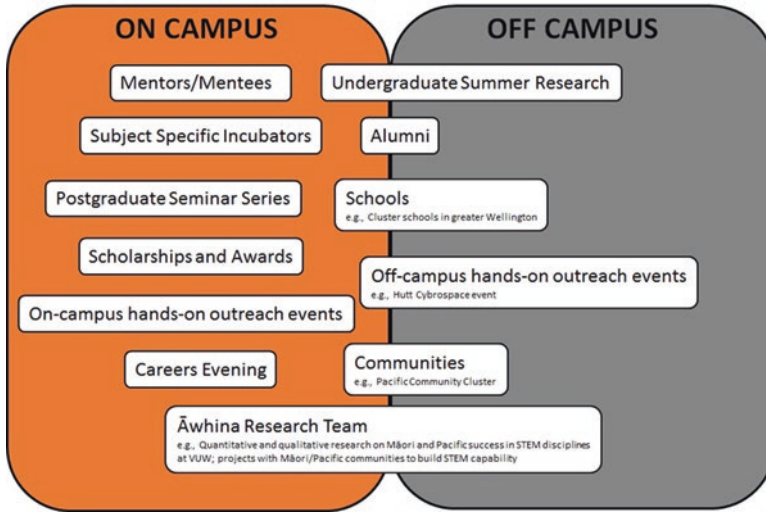
Fig. 3.1 Diagram showing the range of Āwhina activities

Other key aspects of Āwhina included a supportive on-campus whānau environment with a strong kaupapa; high expectations around grades and degree completions; aspiration for postgraduate study; collective success and reciprocity; community connectedness; peer support and mentoring; a (small) budget to cover staff costs, Āwhina events and outreach, scholarships, and casual and fixed-term staff; outreach; academic tutoring; dedicated Āwhina staff; and robust evidence to evaluate success. Importantly, Āwhina also had extensive interactions with, and strong 'buy-in' from, SEAD staff. Such staff were instrumental in assisting, influencing, funding and/or supervising Āwhina summer researchers, providing references for employment/ scholarships, assisting with scholarship applications, and helping students facing personal, financial, or academic challenges. Staff also attended Āwhina events, helped with outreach, and donated texts to the Āwhina library. The broad scope of Āwhina's activities and relationships is shown in (Fig. 3.1).

3.2.1   On-Campus Whānau

Āwhina's backbone was the on-campus mentor–mentee relationship. Both mentors and mentees (as well as their whānau) were supported by senior student and staff mentors, career and community mentors. In turn, Āwhina on-campus mentors worked with their 1st year and 2nd year mentees to build the academic momentum required to succeed, and to train their mentees to become mentors.

Mentors were high achievers in their subject areas, and often but not always, final year undergraduates or postgraduates. Mentors in their second year of study

also worked with 1st year mentees to fill gaps in subject areas where there were few mentors at 3rd year or postgraduate level, e.g., mathematics, engineering, computer science, biomedical science. The primary role of mentors was to be a first stop for academic help in their subject specialty areas, to assist mentees with the transition from high school to university, and to academically strengthen first and second year mentees.

Prior to the second trimester ending, new mentors were identified (1) by asking mentors to recommend mentees who would be good mentors, and (2) from mentee's first trimester grades (B+ grade or higher). Before the end of the academic year, prospective mentors were invited to have a kanohi ki te kanohi (face to face) discussion about becoming a mentor. This discussion was followed up just before the start of the first trimester of the following year to assess mentor commitment. All mentors were then invited to a meeting at the start of trimester 1 to welcome them for the year and prepare/brief them for their mentoring role. This meeting was also the first opportunity during the year for the mentors to come together as a whānau and for those who were new to get to know other mentors.

Potential mentees were given information kanohi ki te kanohi about Āwhina and where they could sign up. These notifications took place a number of times through the year, but the most crucial times were during orientation week, i.e., the week prior to the start of the academic year. During orientation most students were already on campus preparing for another year of study. A range of orientation sessions were held during this week, and senior Āwhina mentors spoke at selected sessions to let new SEAD first year students know about Āwhina, e.g., the SEAD new student orientation sessions, the new Pacific students session at the Pacific Orientation, and the new Māori students session at the Māori orientation. Core first year courses were also targeted by Senior Āwhina mentors who let all students know about Āwhina, its kaupapa and whānau values, what Āwhina did, and if students were interested, where they could find out more and sign up. Signing up to Āwhina required explicit agreement with its kaupapa and whānau values.

Once mentees joined Āwhina they were assigned a mentor in the same degree major by the Āwhina Office Team. Most returning mentors continued working with their existing mentees but would also take on new mentees where possible. Mentors made initial contact with their mentees to meet up kanohi ki te kanohi, and decide on a time to meet in the whānau rooms for regular study sessions. In addition, mentors were also asked to run a 1 h whānau room session during the week to help mentees and other whānau members with specific papers. Mentors and mentees were encouraged to work in the Āwhina whānau rooms when not in class, and to work with others doing similar papers. All whānau members were also reminded that the whānau rooms were 'business spaces' where they could ask for help from other whānau members and help others.

Mentors played a key role in transitioning mentees into the university environment, with mentors more likely to come from backgrounds similar to their mentees, giving them an understanding of, and ability to cope with, the unique pressures faced by Māori and Pacific and other minority students. The mentor/mentee

relationship was often long-term. For example, mentees would ask their mentors for advice before and after completing their degrees. Mentors helped ensure mentees had a suitable degree programme and had considered postgraduate study. Senior mentors were expected to 'step-up' and take on responsibilities for the running of Āwhina such as monitoring whānau room compliance, helping to organise outreach or special events, and co-ordinating mentors. Depending on levels of responsibilities, individual mentors received a modest stipend or award. In line with the Āwhina kaupapa, the expectations on mentors were high, with mentors expected to be positive role models at all times, to support one another, and to show leadership. These leadership experiences within Āwhina prepared them for leadership roles in the workplace, and in their communities.

3.2.2   Āwhina Incubators

Another important aspect of the on-campus Āwhina Whānau developed after 2012 were Āwhina Incubators, led by senior Āwhina mentors or SEAD academic staff. These were small Āwhina whānau groups in the same degree programme but at different levels who worked together to improve whānau outcomes. Incubators met for sessions lasting between 1 and 2 h on a weekly basis and for revision sessions in Trimesters 1 and 2 exam study breaks. Throughout 2015 Āwhina incubators existed for: biology, biomedical science, biotechnology, chemistry, computer science, engineering, environmental science, geology and geography, marine biology, maths, statistics, and psychology and were well attended.

3.2.3   Āwhina Whānau Rooms

Although all students were invited to be part of Āwhina, only those who signed up to Āwhina and its kaupapa and whānau values could access the Āwhina whānau rooms. Āwhina had four whānau rooms funded by SEAD and physically located within SEAD schools and faculties to bring together and normalise the relationship between Āwhina whānau members, staff, and other students. The rooms provided secure 24/7 accessible study spaces for mentors to work with their mentees, and for whānau members to work in groups or study individually. Computer workstations were available in each room, along with printing facilities. Whānau rooms were dedicated study spaces with strict rules for activities that could occur, and an expectation that the whānau would abide by those rules. Large notice boards inside the room displayed Āwhina undergraduate and postgraduate students' posters of presentations at national and international conferences. The outside wall of the whānau room added another dimension by providing up to date information about Āwhina to whānau and passers-by.

3.2.4   Āwhina Budget

Āwhina had a modest budget that covered the salary and operational costs of 1–2 (1999–2010) or 2.6 (2011–2015) full-time permanent staff to provide the continuity required in a capability-building area. The leadership role was at a senior and influential level (Deputy Dean) within SEAD, providing the autonomy necessary to sustain a culture of success for minority and indigenous students.

The Āwhina budget also covered Āwhina Awards and Scholarships, casual staff, conference travel to present, and Āwhina functions. Costs associated with the whānau rooms were covered by the eight SEAD schools in the three faculties.

3.2.5   Āwhina Scholarships and Awards

A portion of the Āwhina budget was used to support Āwhina whānau members with awards and scholarships. Āwhina Awards helped Āwhina mentors and mentees complete degree programmes, while the main objective of Āwhina postgraduate awards was to increase progression to, and completion of postgraduate studies. Both Āwhina Awards and Āwhina Postgraduate Awards acknowledged whānau members who made significant contributions to Māori and Pacific development and leadership through their work with Āwhina whānau members and their communities. Āwhina Scholarships helped postgraduate Āwhina whānau with their studies, assisting with activities such as attending conferences to present their research, travel for field work, and other research costs. Āwhina whānau who received scholarships were exceptional mentors and role models that demonstrated a commitment to the Āwhina kaupapa such as contributing to Āwhina outreach, mentoring and supporting other whānau members, and attending Āwhina events. The Āwhina budget also supported Āwhina Summer Research Scholarships which exposed undergraduate 2nd and 3rd year students to the research environment by providing a stipend for 10 weeks of research over the university summer break. Through Summer Research Scholarships, students established relationships with supervisors who often became their postgraduate supervisors. Āwhina fully funded or co-funded (50:50) the Summer Research Scholarships with SEAD Schools.

3.2.6   Āwhina Library and Study Resources

The Āwhina library included a small, well-stocked collection of current prescribed course textbooks, many donated by SEAD staff, or koha (gifted) by Āwhina graduates. Other resources for whānau members included scientific calculators to use and past exam papers for revision. Previous Āwhina Summer Scholarship reports were also available for borrowing.

3.2.7   Āwhina Website

The Āwhina website established in 2000 brought together on-campus whānau activities and outreach, and off-campus outreach events, kept whānau updated and raised the profile of Āwhina in the community. Significantly, the website engaged directly with Āwhina students and their communities, low decile secondary schools, pupils, parents, and supporters. The website was created and maintained by Āwhina staff and mentors despite pressure to adopt a corporate approach.

3.2.8   Āwhina Resources

Āwhina whānau members also produced a number of outreach and on-campus resources to support secondary school pupils, parents, and teachers including: 'Te Whata Kura Ahupūngao', bi-lingual (Māori and English) multimedia online Physics Resources; three inspirational booklets (Cybrospace Journeys to Success, Cybrospace Journeys to Success Reloaded, and Cybrospace Journeys to Success Revolutions) that profiled emerging Māori scientists, engineers, architects, and designers and provided useful tips for tertiary study; the 'STEP into STEAD' (STEAD = SEAD + Technology) DVD where mentors 'busted myths' around what it takes and who succeeds in SEAD subjects and created the 'If we can do it so can you!' challenge to rangatahi (youth). Over 20,000 booklets were distributed to school pupils and teachers, communities, marae, supporters, and Āwhina whānau members. These resources were funded by Te Puni Kōkiri (Ministry of Māori Development); The Māori Education Trust; and Professor Sir Paul Callaghan, Professor of Physical Sciences and founding director of the MacDiarmid Institute for Advanced Materials and Nanotechnology at VUW. We acknowledge their generosity and significant contributions to building future leaders.

3.2.9   Āwhina Postgraduate Seminars

From 2003 onwards Āwhina Postgraduate Seminars (APGS) became the vehicle to support rapidly increasing numbers of postgraduate whānau members, providing a regular forum for presenting their research to the whānau. Presentations covered a broad range of SEAD disciplines including transport and open space planning (geography), development of 5G wireless technologies (engineering), pain experience (psychology), Von Staudt Calculus & Rank 3 matroids (maths), the development of Church Pacific Architecture in New Zealand (architecture), chemical defence in plants (chemistry), and many more.

The APGS was open to all whānau members. Final year undergraduates were encouraged to attend as this helped to reduce barriers to postgraduate study by

exposing whānau members to the postgraduate environment. Āwhina students were also encouraged to do research of relevance to them and their communities.

3.2.10   Āwhina Birthdays

Āwhina Birthdays were the largest and most popular event in the annual calendar, and, along with Career Evenings, were compulsory for all whānau members. Birthdays evenings began with a whakatau (informal Māori greeting) and singing of the Āwhina waiata. An Āwhina mentor Master of Ceremonies (MC) ensured the event kept to time and introduced guest speakers (often alumni, but not always). The focus of the evening was to strengthen Āwhina whānau connections, acknowledge Āwhina whānau successes, and have some fun. This was achieved by bringing together food, entertainment from mentors and mentees (in which everyone participated), guest speakers, and presentations from Summer Research students. The event ended with a photograph for the Āwhina website.

3.2.11   Āwhina Alumni

Many Āwhina alumni kept in contact after leaving VUW, creating opportunities in the workplace for student internships, employment, and scholarships. Local alumni participated in annual careers evenings, sharing their knowledge and experiences of the job market, workplace, career development, and networking.

3.2.12   Āwhina Careers Evenings

Annual Āwhina Careers evenings began in 2009 and were popular with current whānau members, alumni, communities, and supporters. Victoria University Careers staff were staunch supporters of Āwhina, attending all Āwhina careers events, sharing their knowledge and alumni contacts, and assisting mentors to prepare for interviews. As with Birthdays, Careers evenings began with a whakatau and singing the Āwhina waiata. An Āwhina mentor MC introduced guest speakers. This was followed by supper and a 90-min expo that gave students an opportunity to question a wide range of employers (private and public sector, and entrepreneurs). Students often secured internships, summer scholarships, and positions from these events. Presenters received a kete (bag) containing koha and Cybrospace booklets. The event ended with a photograph of everyone who attended. Many who attended supported the Āwhina kaupapa and encouraged colleagues to participate in further annual events. Their commitment helped to develop an excellent Āwhina Careers database.

3.2.13   Āwhina Outreach

Āwhina outreach activities were important to the academic success of Māori and Pacific pupils. They provided pathways for secondary school students into STEM disciplines, and opportunities for Āwhina mentors to gain teaching experience and put back to their communities. Outreach activities happened both on- and off-campus and required significant effort, often involving a large team of mentors and staff to create, pack, and transport the resources before events, run events, and then transport, unpack, and store the resources after events. The Āwhina kaupapa of 'giving back' was central to Āwhina whānau outreach success as was the 'if we can do it so can you!' message.

3.2.13.1   On-Campus Outreach

These events brought rangatahi from intermediate and secondary schools on to campus where they met and worked with mentors and staff and were exposed to the tertiary SEAD environment, opening up options for tertiary STEM studies.

A good example of a large on-campus event was the all-day *Te Rōpū Āwhina hands-on 'Cybrospace'* event at VUW sponsored by Te Puni Kōkiri. Approximately 750 rangatahi (years 7–13, aged 11–18) and whānau from 32 North Island secondary and intermediate schools attended the event. Participants explored a range of exciting and challenging activities in architecture, biological sciences, marine sciences, chemistry, computer science, design, earth sciences, engineering, physics, and psychology at three of the university campuses. Students were transported by bus between campuses and spent 45 min on each of the activities.

Smaller outreach events on campus were the yearly *Cluster Schools on campus Rangatahi in Cybrospace* events where approximately 120 students from Āwhina Cluster Schools came on to campus to take part in all day hands-on SEAD activities with Āwhina mentors and SEAD staff in the second trimester break (in the 3rd school term). These involved 6 groups of up to 20 students rotating around 6 different SEAD activities, spending 30 min at each. In 2015 the activities included developing game strategies (mathematics), a virtual reality experience with the Oculus Rift (engineering), learning how to track wildlife (biology), examining the UV blocking properties of sunscreen (physics/chemistry), viewing features of rock-forming minerals in section under the microscope (geology), and the 'egg drop challenge' where students designed a structure to protect an egg from breaking when dropped from 5 m (architecture and design).

Summer Cybrospace Wānanga were residential 3–4 day events for a maximum of 40 years 12 and 13 (16–18 years old) students from regional schools to participate in hands-on activities equivalent to 1st year university study in SEAD laboratories prepared and run by SEAD staff and senior Āwhina mentors. Notices were sent to Principals with a request to forward information to senior staff. Rangatahi were selected by their teachers. Parental permission was required along with a template completed by them and returned to the Āwhina Office. Āwhina and iwi covered all

costs. Subject disciplines included: physics, chemistry, biology, mathematics, statistics, architecture, design, psychology, marine biology, engineering, computer science, geography, geology, and environmental science. Specific activities included participation in a laboratory class where sea urchins were spawned, gametes fertilised, and developmental stages observed. This was followed by a field trip to look for invertebrate egg masses on the rocky shore. Another activity involved designing a pendant using digital technology (2D computer aided design software), which was then laser cut from acrylic. Students formed design teams to create pre-specified structures from supplied materials. Of the rangatahi who participated in Summer Cybrospace Wānanga, 40% enrolled in university study, with over 60% of these students enrolling at VUW.

3.2.13.2   Off-Campus Outreach

Off-campus community outreach took place when Te Rōpū Āwhina was invited to be part of community events to encourage the transition to higher education, and inspire rangatahi to consider careers in STEM disciplines. Events happened anywhere from the beach to the marae (meeting ground). Examples included Āwhina involvement in the 'Te Tai Timu Trust: Turning the Tide' wānanga (learning/lesson) held in Hawkes Bay. Te Tai Timu Trust runs programmes to motivate rangatahi to become future rangatira (leaders). Between 50 and 70 tamariki (children) and rangatahi aged 7–16, travelled from all over the country to participate in a 5 day wānanga, develop water safety skills, and become kaitiaki (guardians) of the ocean. Āwhina mentors ran biology activities such as DNA extractions and marine-related hands-on science. Āwhina also supported the Wairarapa Rural Education Activities Program (REAP), a programme that facilitates workshops highlighting career opportunities to Wairarapa (a region of New Zealand) school students. Teams of Āwhina mentors from the schools of Architecture and Design, Chemistry, Physics, and Biology ran hands-on activities relevant to their areas of expertise. Architecture and Design mentors worked with students to build cantilevered structures that support a small weight, and students also took part in the 'egg drop' challenge. The chemistry activity involved making flubber (a stretchy substance introducing some properties of polymers and non-Newtonian fluids), while students extracted DNA from fruit for the biology activity. For physics, students learnt about waves. Another large event held in Auckland City, involved Te Puni Kōkiri, Ngāti Whatua (iwi Māori holding manawhenua (territorial rights) in the Auckland area), and Āwhina in an 'Atamira: Māori in the City' expo celebrating Māori creativity and enterprise that was attended by over 100,000 people. Āwhina mentors and SEAD staff focused on, and developed, hands-on SEAD activities as part of the expo.

Āwhina ran its own regular well-attended outreach events off-campus in local communities ('*Cybrospace' events*), the main focus being to expose young people to opportunities in SEAD disciplines. Between 500 to over 1000 school students attended on the day, and as usual the key message was: 'If we can do it, so can you!' For example, the successful *Hutt Cybrospace* full-day event in early 2015 involved

over 550 years 9 and 10 students (13–14 year olds) and was partially funded by Hutt City Council. A similar event held in 2010 sponsored by Ngāti Toa (one of the iwi Māori holding manawhenua in the Wellington region) and Te Puni Kōkiri attracted almost 1100 (mainly Māori and Pacific) rangatahi. The event involved SEAD activities created and run by Āwhina mentors and SEAD staff and a harakeke (flax) activity run by pupils from an Āwhina Cluster school.

Āwhina also designed and delivered the *Māori whānau in Science Day* which was held on 22 September 2008 at the Banquet Hall in the Beehive (New Zealand Parliament) in Wellington. Funded by Te Puni Kōkiri and timed to coincide with the launch by the Minister of Māori Affairs of the first Cybrospace Journeys to Success booklet, it attracted over 250 rangatahi Māori and whānau, the Prime Minister, and other Members of Parliament. The event was expo style with small groups of students rotating through physics, chemistry, architecture, design, biology, geology, psychology, maths, computer science, engineering, and mechatronics activities. Other events run by Te Rōpū Āwhina in partnership with communities included a science wānanga for whānau at the opening of Pukemokimoki marae. Excitement for science was generated by concentrating on themes relevant to Māori communities including sessions on DNA/whakapapa and the marine environment.

3.2.14 Āwhina Cluster Schools

Given disparities in educational outcomes evident in compulsory secondary schooling (Ministry of Education, 2015a), particularly for science and mathematics at year 9 (i.e., 13–14 year olds) (Chamberlain & Caygill, 2013), Āwhina developed the first local Āwhina Cluster School in 2009, with four cluster secondary schools established in the greater Wellington area by 2015. Selection of Cluster schools was based on two criteria: (1) commitment by the school (Principal, science teachers) to work with their Māori and Pacific students and Āwhina, and (2) schools were low to mid-decile (high to mid deprivation), and drew students from areas of high deprivation.

The primary focus of the Āwhina Cluster Schools was on academic success at secondary level which was achieved by one or more teachers who took responsibility for the Āwhina cluster and worked with a select group of students on a regular basis (either weekly or fortnightly). Cluster students were also Āwhina whānau members. At the start of each year a launch was held at the school, typically in the early evening to enable the maximum number of school students and their whānau to attend. Cluster launches involved the School Principal (or delegate), the (school) staff responsible for the Āwhina cluster, and welcomed students and their parents, outlining the importance of STEM-related disciplines for future post-secondary study and careers, and encouraging students to persist with STEM subjects and make the most of being part of the Āwhina Cluster. Āwhina mentors and staff also introduced themselves, talked about their own journeys to success in their specific STEM areas, and

stressed the 'If we can do it, so can you!' message. Throughout the year cluster school students worked with their teachers and Āwhina mentors on top of their normal science classes. Students came onto campus for the annual *Cluster Schools Rangatahi in Cybrospace* events toward the end of the VUW teaching year.

3.2.15   Pacific Community Cluster

In 2010 Āwhina encouraged and supported the development of a Pacific Community Cluster. Āwhina mentors worked with years 11–13 (15–18 years old) Pacific students every second Saturday during the second university trimester corresponding to the third and fourth school terms (the New Zealand school year has four terms). Students in years 11–13 were targeted by the cluster as this is when students undergo formal national assessment in New Zealand's education system.

3.2.16   The Āwhina Research Team

The Āwhina Research Team (ART) mentored emerging Māori and Pacific researchers to develop partnerships with their communities through relevant research. In 2014 the ART, in partnership with iwi, secured external funding for 2 projects to build iwi and hapū marine and freshwater science capability. The ART published quantitative and qualitative research contributing to a robust evidence-base (Richardson et al., 2014; Richardson et al., 2017; Wilson et al., 2011), some of which will be summarised later. The ART disseminated Āwhina results through international and national publications and presentations, and community meetings. For example, in 2014 ART members presented in Japan as part of an indigenous panel in a human rights themed session on indigenous youth at the 18th ISA World Congress of Sociology—'Facing an unequal world—Challenges for global sociology'. In 2015, ART members also presented at the 17th Biennial International Study Association of Teachers and Teaching Conference (ISATT) conference in Auckland, New Zealand.

Other publications are in preparation, including results from postgraduate Māori–Pacific, undergraduate Māori, and undergraduate Pacific completion rate analyses.

3.2.17   Āwhina Biennial Survey

Survey questionnaires have been distributed to Āwhina students biennially since 1999 with the last survey carried out in 2013. Students were informed of the Āwhina Biennial surveys by word of mouth, email, and notices placed in the Āwhina whānau

rooms on campus. The surveys were voluntary, anonymous, and conducted online, comprising open and closed questions. Students responded to questions about their lives both inside and outside university, and the impact of university on their lives now, and into the future. Survey sections included demographic information, academic interest, financial issues, learning support, Āwhina, off-campus resources and activities, and future educational goals. The results of the biennial survey were one component of the evidence-base of Āwhina, and helped to inform practice.

3.2.18 *Āwhina Koha*

All whānau members contributed in some way to the success of the whānau. Āwhina staff, students, and community members, and Āwhina Research Team members provided koha (gifted time) to develop and run Āwhina events, undertake research relevant to Āwhina, mentor, support, and advocate for whānau members.

3.3 Successes of Āwhina Whānau Members

Robust evaluation is a central component of the Āwhina kaupapa for at least three reasons. First, resources are scarce in a small country like NZ, and it is important that equity initiatives show they are effective in reducing disparities. Unfortunately, while significant public equity funding has been allocated to NZ universities, there is little published evidence of effect. Second, even initiatives with robust evidence of success, or at least of promise, can be improved. Third, successful equity programmes need to be sustained over a long period to achieve and then maintain equitable outcomes. Evidence suggests that this requires strong commitment at both programmatic and institutional level, and this can change over time as staff leave or retire.

Starting with only 16 mentors and 99 mentees in 1999, by 2015 Āwhina had 116 mentors and 229 mentees. Since Āwhina began there have been significant absolute and relative increases in Māori–Pacific (MP) undergraduate and postgraduate degree completions (Richardson et al., 2014). For example, up to 2015 Āwhina had almost 1200 Māori–Pacific degree completions, including 33 PhDs, 9 Postdoctoral fellows, and 9 science/maths/computer science teachers. Āwhina graduates also work in many areas, e.g., the Tertiary Education Commission and New Zealand Qualifications Authority, with 4 employed by their iwi, including one Chief Executive. Āwhina has secured $8.4 million of nationally and internationally contested scholarships for its whānau members.

Āwhina has almost closed the equity outcome gap according to a recent analysis from the ART seeking evidence of an Āwhina effect (Richardson et al., 2017). The analysis used a completion rate metric, based on completions and durations of study derived from a long-term audited VUW post-1991 student record dataset for

undergraduate qualifications expected to take about 3 years, e.g., a bachelor's degree. Completion rates were defined as aggregated completions divided by aggregated study time for all students (successful or not) in several strata including ethnicity, faculty group, and (16) 5-year blocks starting from 1995. Medians and credible intervals (uncertainties) were computed from posterior Bayesian completion rate estimates in each stratum then standardised to remove variations in study time across faculty group, ethnicity, and year block.

Completion rate dynamics were probably impacted by several factors but, focusing on just the dynamics of disparity, SEAD MP and non-MP posterior completion rates tracked upwards and converged, consistent with an Āwhina effect. In contrast non-SEAD MP and non-MP posterior completion rates increased before 2007 then declined, but overall there was little change in the ethnic disparity gap.

A similar analysis of postgraduate qualifications expected to take about 2 years shows a trend of decreasing completion rate disparities in the SEAD faculties, but increasing disparities in the non-SEAD faculties (Richardson et al., 2017). Figures 3.2 and 3.3 provide results for an important subset of such qualifications: the Master of Science (MSc) and Master of Arts (MA) degrees. SEAD MP and non-MP MSc completion rates tracked upwards and converged (Fig. 3.2a), consistent with an Āwhina effect and a reduction in disparities (Fig. 3.2b). In the non-SEAD faculties, non-MP MA completion rates increased steadily but MP rates declined after 2004 (Fig. 3.3a), leading to an increase in completion rate disparities during that period.
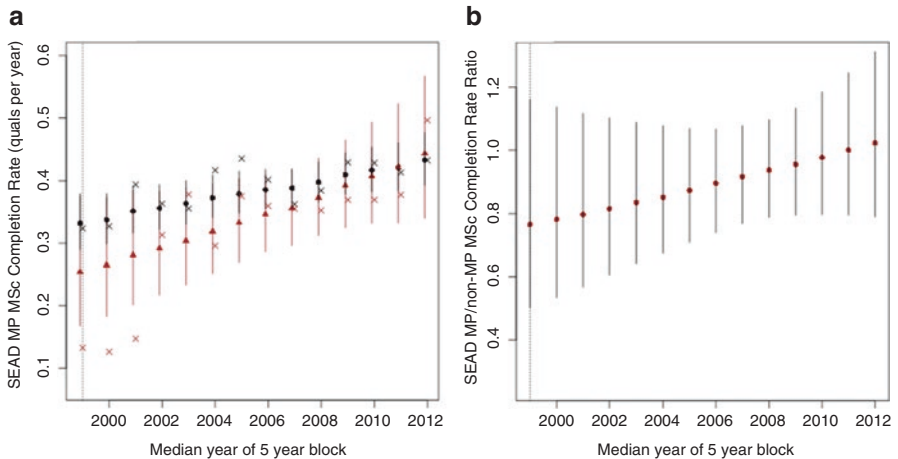

Fig. 3.2 (**a**) Bayesian completion rate estimates for MSc postgraduate degrees in the SEAD faculties for combined Māori–Pacific (MP) students (*triangles*), and all other students (*circles*). The *dotted vertical line* denotes the start of Āwhina. Crosses show empirical completion rates. (**b**) MP-to-non-MP rate ratios
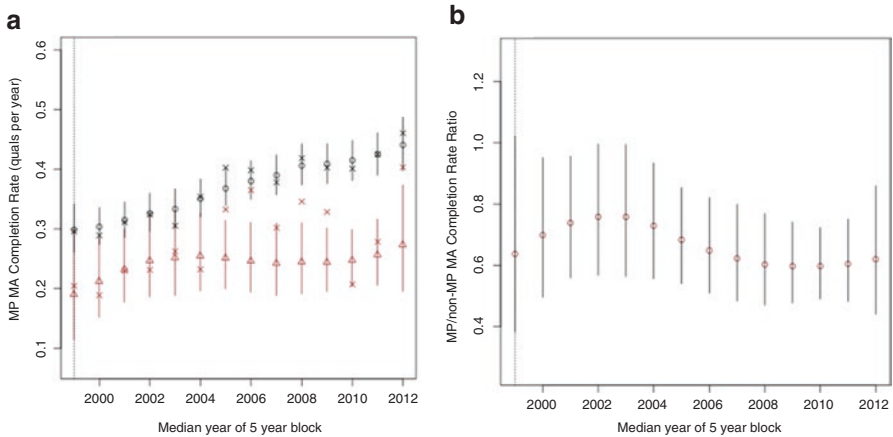
Fig. 3.3 (**a**) Bayesian completion rate estimates for MA postgraduate degrees in the non-SEAD faculties for combined Māori–Pacific (MP) students (*triangles*), and all other students (*circles*). The *dotted vertical line* denotes the start of Āwhina. Crosses show empirical completion rates. (**b**) MP-to-non-MP rate ratios

3.4 Lessons from the Āwhina Experience

Āwhina was one of a handful of initiatives worldwide with robust evidence of success. Key Āwhina characteristics included its kaupapa and strong whānau values, calibre and commitment of staff, broad autonomy to decide/implement the kaupapa (i.e., change the institutional culture), close connections with communities, seniority and permanence of leadership role, stable, and adequate resourcing, and a robust evidence-base. Academic and cultural support was embedded in culturally relevant practices and principles of Māori and Pacific communities, placing value on positive indigenous identities, relationships based on the notion of whānau, and reciprocity. Āwhina shared important characteristics with similar successful initiatives elsewhere, for example, the University of Maryland Baltimore County's (UMBC) Meyerhoff Scholars Program, the Leadership Alliance, and the National Consortium for Graduate Degrees for Minorities in Science and Engineering ('GEM'), where key elements for success include strengthening knowledge and skills, the provision of financial, academic, professional, and social support, network facilitation and professional socialisation, and bridge experiences to transition from one level of educational or professional achievement to another (Leggon & Pearson, 2009).

Diversification of the STEM workforce is critical to NZ's future social, environmental, and economic wellbeing, and there is good evidence from Āwhina and elsewhere about how to achieve that goal. Why then are similar programmes not ubiquitous within NZ, and their long-term sustainability a matter of community, institutional, and national concern? Put another way, given there are promising solutions to address ethnic disparities in tertiary success, and tools for evaluating

their success, continued tolerance of disparities reveals something important about the nature of NZ institutions. To suggest possible future areas for investigation and debate, we turn first to international evidence, in particular from the USA. The USA faces similar issues with regard to diversifying the STEM workforce where at a national level there is recognition of the benefits and importance of diversity for business, government, and academia which underpins efforts to increase underrepresented minorities in STEM (Committee on Equal Opportunities in Science and Engineering, 2013; Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce, 2011; Maton, Pollard, McDougall Weise, & Hrabowski, 2012; National Science and Technology Council, 2000).

An informative example is provided by UMBC, a majority European-American institution, which has created an environment of inclusivity, excellence, and success for students of all backgrounds. According to Hrabowski (2014), the key to UMBC's success is that each staff member takes responsibility for solving the problem of minority group underrepresentation. Evaluation evidence on the effects of the Meyerhoff Programme at UMBC led to significant gains in governmental and private foundation resources for successful equity initiatives. At the time, few intervention and student enhancement programmes were rigorously evaluated. Ultimately, the success of the Meyerhoff Programme attracted significant national attention as a proving ground for developing talented minority STEM students for graduate/medical school. Interestingly, the success of majority student STEM majors also increased, as did the success of students having higher test scores and high school grade point averages. In short, the Meyerhoff Programme transformed the institution. UMBC is now nationally recognised as an example of inclusivity for all students. This would not have happened without the evidence of the Meyerhoff Programme's effectiveness, and the influence of Freeman Hrabowski (W. Pearson Jr., personal communication, 14 October, 2015). Institutional change is therefore possible, and it is clear at a national level that robust evaluation is an important element in making such change possible. At an institutional and programmatic level there is also evidence that (1) the leader of an equity initiative must be demonstrably committed to the long-term reduction of disparities in STEM disciplines, and have a position of influence in the institution, and (2) the institution must have strong, high level commitment to the equity initiative over the long-term (Allen-Ramdial & Campbell, 2014; Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce, 2011). However, key challenges remain around the elimination of institutional barriers. For institutions to be truly committed to equitable outcomes and success for all students, the institutional culture and climate needs to reflect the diversity of individuals making up the student body (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce, 2011; Whittaker & Montgomery, 2012). Long-term assessment of programme effectiveness is another area in need of further attention, requiring longitudinal data (Leggon & Pearson, 2009). Thus, while there is no doubt much work is still to be done in the USA to eliminate STEM disparities in post-secondary education and the workforce, there appears to be a growing understanding of how that can be achieved. As in this country, progress toward that goal probably depends at least in part on how tertiary

institutions respond to that evidence, and the development of policy tools to accelerate their response. Some features of US universities such as tenure may be helpful in that regard. However, tenure has been increasingly undermined in the USA as increasing proportions of new faculty are employed on short-term contracts with no tenure-track (Head, 2011). Still, tenure provides faculty with the freedom and autonomy necessary to pursue work in areas of significance and interest to them. As such, tenure plays an important role in some successful US STEM initiatives for under-represented minority students (M Gaines, pers. comm., 27 January 2016).

Even though lessons from Āwhina are broadly consistent with those from successful US programmes, the situation in NZ is much less clear. At a national level, there is public recognition of the importance of MP success in tertiary STEM disciplines (Chauvel & Rean, 2012; Tertiary Education Commission, 2012), but little from business (Sutton, 2014). In addition, apart from Āwhina, there are no NZ examples of properly evaluated tertiary equity initiatives, and there are no examples of culture change at institutional level. This situation is likely to persist in the medium term if, as seems likely, equity initiatives cease to be effective within the SEAD faculties at VUW.

Undoubtedly there are powerful barriers to eliminating tertiary STEM disparities. First, the commitment of tertiary sector leaders to removing tertiary disparities is open to question: while most universities (and the TEC) have long had equity objectives enshrined in strategic documents (Ministry of Education, 2002), and section 181 of the Education Act 1989 places particular emphasis on University Councils having a duty to maximise the education potential of groups in those communities that are underrepresented among its student body, the sector appears to be unresponsive to national or international evidence, and/or unwilling to make the necessary changes. Second, the impact of the neoliberal experiment in NZ after the 1970s has fundamentally changed the nature of universities (Shore & Davidson, 2014) and may have rendered them less responsive to equity issues, as has been suggested in Australia (Schofield, O'Brien, & Gilroy, 2013). Indeed, it would be surprising if NZ universities reversed the national trend toward increasing inequality in areas important to the wellbeing of Māori and Pacific without fundamental changes to the culture of those institutions. One consequence of the neoliberal experiment is that university staff are increasingly on short, fixed-term contracts with no certainty of employment (Tertiary Education Union, 2015), leading to a growing 'underclass' of academics, i.e., in precarious employment (Nadolny & Ryan, 2015). However, evidence from successful initiatives makes it clear that stability of programme leadership and staffing is necessary to build the body of knowledge required for success. Third, the performance-based research fund (PBRF), which concentrates on Western research priorities (Broughton et al., 2015), marginalises research that is of primary relevance to NZ (Curtis, 2015), tangata whenua (Roa, Beggs, Williams, & Moller, 2009), and Pacific communities. The PBRF, established in 2002, assesses and funds tertiary education organisations based on their research performance to 'ensure that excellent research in the tertiary education sector is encouraged and rewarded' (Ministry of Education, 2013). Not surprisingly, therefore, the Āwhina Research Team has been unable to secure NZ funding to undertake research in programme

evaluation. Furthermore, the PBRF diverts attention away from activities such as mentoring and teaching that are key elements of Āwhina's success (Boston, Mischewski, & Smyth, 2005).

Given that promising initiatives and methods for their evaluation exist (e.g., Te Rōpū Āwhina, at least until 2015), policy responses at a national level can be devised. For example: (1) significant financial penalties for institutions that fail to reduce disparities; (2) provision of long-term external funding for equity initiatives *having robust evidence of success*; (3) institutions required to evaluate success of equity initiatives using best practice methods and metrics, peer reviewed by external experts; (4) dedicated funding for research aimed at improving equity initiatives and methods of evaluation; (5) public funding for international conferences tasked with sharing experiences and lessons from promising programmes, methods of evaluation, and training of future leaders; (6) a permanent panel of national and international experts to investigate and monitor the provision and maintenance of effective equity initiatives, methods for their evaluation, commissioning of relevant research, and training of future leaders.

Undoubtedly, these policies require significant changes to tertiary institutions and other key actors in the tertiary sector. Such changes are long overdue. In regard to diversification of the STEM workforce, it is time the interests of the country, and in particular of its Māori and Pacific communities, take precedence over entrenched sectoral interests, particularly when everyone benefits as a result. We hope that the lessons from the Āwhina experience summarised here will contribute to that change, and help train the next generation of leaders who accept the responsibility of ensuring that it happens.

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