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Research Note

Barriers to diversity in the Aotearoa tech sector

Research conducted by

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[1] (NZ Tech, and New Zealand Digital Skills Forum, 2021)
[2] The New Zealand Government's Digital Strategy for Aotearoa is aiming to make digital and ICT exports the biggest export learner in Aotearoa. (New Zealand Government, 2022)
[3] (NZ Tech, 2023)
[4] (Grimes & White, 2019)
[5] (NZ Tech, and New Zealand Digital Skills Forum, 2021)

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Executive Summary

Tech is a fast-growing and high-value sector in Aotearoa.[1] With increasing workforce demands and competitive salaries, tech has the potential to provide stable, high-paying jobs to an increasingly significant proportion of New Zealand workers if we can capitalise on strong global demand for tech products and services.[2]

We know that only 5% of the digital tech workforce is Māori and 4.4% is Pacific, while women make up just 29% of the digital technologies workforce.[3] Workforce participation by tāngata whaikaha is less known; however, we know that limited digital accessibility is a major barrier for people living with disabilities.[4] We know that Māori, Pacific peoples and women are active users of tech, but their low representation in the sector suggests they are largely absent from its development.

Historically, immigration has been the primary source of new skills and diversity in the tech sector.[5] If the Aotearoa tech sector and vocational education system want to support a growing domestic tech workforce, both need to understand and address the significant barriers to entry and diversity in the tech workforce.

Barriers to inclusion exist from the household right up to the workforce. These can become compounded by multiple economic, cultural and accessibility factors.

Barriers are grouped according to the environment in which they occur:

- Domestic – household, wider family and community environment
- Primary and secondary education – primary, intermediate and high school
- Tertiary education – university, vocational and PTE programmes
- Workforce – employment in tech roles or within the tech sector.

While the focus of Toi Mai is on vocational education and workforce outcomes, it is crucial that we, and all involved in the digital technology future of Aotearoa, take a systems approach to analysing and addressing these barriers. This includes ensuring Māori have a central role in shaping digital technologies going forward.

For Toi Mai, this report is the beginning of a conversation on the diversity issues in the tech sector today and how government, industry and community might tackle these issues together. With that, it provides context to our upcoming research, policy advice and workforce development plans. It also provides key recommendations aimed at improving diversity outcomes at multiple levels.

Barriers at the domestic level

- There is strong correlation between socioeconomic barriers and digital literacy and access.
- Family and household pressures can stretch financial resources, further inhibiting access to quality connections and devices.
- Disabled people require additional accessibility support to bridge the digital divide, including for online safety.
- Less awareness of the opportunities and low representation of Māori, Pacific peoples, tāngata whaikaha and women in tech reduce the likelihood of exposure to tech careers.

Barriers in primary and secondary schooling

- The digital curriculum is still maturing, and many teachers require further experience and professional development to teach digital skills.
- Streaming and unconscious bias worsen education outcomes for Māori, Pacific peoples and whaikaha learners, while female learners require encouragement to take tech subjects.
- Whaikaha learners require greater understanding of their needs and encouragement to pursue educational pathways.
- Greater awareness of tech opportunities and the transferable skills desired in tech careers is needed to support tech pathways.

Recommendations to achieve equitable access to digital tech at the domestic and community level

1. Government Chief Digital Officer to coordinate efforts across government to tackle digital exclusion. This may include efforts to reduce costs associated with digital access, such as making internet connections more affordable or even free – as telephone connections once were. Government subsidies, free connections in community housing and universal digital access in community spaces are potential avenues for immediately improving digital access for all.
2. Local government to identify areas of digital exclusion and invest in libraries, community centres and marae in these areas, to ensure they can provide reliable internet connections, up-to-date devices and basic tech skills training. Funding for dedicated staff at libraries can help meet the demand for digital tech support, especially for tāngata whaikaha.

Recommendations to grow interest and improve pathways from primary and secondary education into tech

1. Ministry of Education to conduct focused research on the reasons Māori, Pacific and female learners are less inclined to take tech subjects. Additional research on the benefits of flexible learning environments, particularly for neurodivergent learners, will contribute to the Ministry's ongoing work to eliminate streaming from schools and encourage participation in STEM subjects.
2. New Zealand Qualifications Authority (NZQA) to publish insights reports that focus on equity of opportunity for senior secondary school learners to achieve in STEM-related NCEA pathways.
3. The Ministry of Education to support kaiako, teachers and career advisors to demonstrate tech pathways to students. Building on work like the new Tahatū career planning website, teachers and career advisors can help shift perceptions of tech for young people and whānau to emphasise the breadth of roles available and the skills in demand by tech employers, including communication, creativity, critical thinking and collaboration skills.

[6] This recommendation has been proposed by NZ Tech in its latest Digital Skills Aotearoa report highlighting a decline in participation rates in NCEA tech subjects. (NZ Tech, 2023)

Barriers in tertiary education

- Financial and time pressures can present major obstacles to Māori, Pacific and whaikaha learners (particularly women within these groups) enrolling in tertiary courses.
- Pacific and Māori learners benefit from stronger social networks and mentorship to support their learning, including strong pastoral care systems. People not in education, employment or training (NEETs) to enter tertiary will also benefit from extensive pastoral care.
- Limited accessibility, assistive technologies and understanding of day-to-day challenges or stigma contribute to poorer outcomes for whaikaha learners.
- All groups require greater representation in tech education to envision careers in the tech sector.

Barriers in the workforce

- There are disparities between what employers expect from applicants and what applicants feel they can bring to roles, and Māori and Pacific peoples bring values and skills that are not always understood by employees
- Women in tech need greater visibility to shift perceptions of tech being a male industry.
- The tech sector's focus on hiring professionals from abroad reduces opportunities for local, diverse representation in the tech sector and pathways for young professionals.
- Many organisations still do not provide inclusive workplaces, either in terms of promoting Māori and Pacific values, knowledge and customs, or addressing diverse accessibility needs and strengths of tāngata whaikaha.

Recommendations to overcome barriers to participation in tertiary-level tech courses

1. Toi Mai to explore earn-as-you-learn opportunities with providers and employers to better enable learners facing financial or accessibility barriers to build tech skills and qualifications.
2. Ministry of Education to fund targeted subsidies to help bridge the gap for Māori, Pacific, tāngata whaikaha and women, who are more likely to struggle with tuition costs
3. Tech programme providers to continue to develop understanding of the physical and social barriers faced by whaikaha learners. Providers to build on their Disability Action Plans to consider the accessibility of their physical environments in tech spaces, labs, classrooms and lecture theatres, as well as the accessibility of digital resources.

Recommendations to lift participation and progression of underrepresented groups in the tech workforce

1. Toi Mai to promote good practice on inclusive hiring processes that appeal to diverse strengths and backgrounds, supporting progressive recruitment programmes like ReThink Tech Talent. Clear expectations in the recruitment process, and a better understanding of culturally specific qualities and diverse needs, will help both employers and employees.
2. Technology employers to partner with providers and Toi Mai to pilot earn-as-you-learn options, facilitating participation of women, Māori, Pacific peoples and tāngata whaikaha in the sector.
3. Peak bodies like NZ Tech and ITPNZ to partner with Toi Mai to develop and share good practice on cultural understanding and inclusivity among tech organisations. Better practices will lessen the burden of representation for minority groups within organisations and encourage individuals from underrepresented groups to enter the sector.

Introduction

As a new workforce development council, Toi Mai is charged with contributing to an education system that provides opportunities for all people in our specified industries to reach their full potential and capabilities, including those who have been traditionally underserved by the education system. In fulfilling this function, Toi Mai considers the skills, knowledge and qualifications that learners will need in future to achieve success for themselves and their communities. To support this mahi we have started to investigate the barriers currently faced by those not accessing training and work in our sectors.

This report covers barriers into the technology (tech) sector – a sector currently facing a severe talent shortage, particularly in senior roles. 79% of the companies recently surveyed by Toi Mai report facing recruitment challenges over the past 12 months.[7] The pipeline of talent into the industry is greatly affected by low numbers of people entering the sector with the right skills (compared to very high demand) and lack of emphasis on skills development within the sector.[8]

Historically, immigration has been the primary source of new skills and diversity in the tech sector.[9] If the Aotearoa tech sector and vocational education system want to support a growing domestic tech workforce however, both need to understand and address the significant barriers to entry and diversity in the tech workforce.

This research pulls together insights from government, industry and education providers to highlight the barriers to inclusion in the tech workforce for the following underserved communities: Māori, Pacific peoples, tāngata whaikaha (disabled and neurodivergent people), LGBTQIA+ and women.

This report is aimed at those who have the most power to remove the barriers to inclusion in tech training and the workforce: government, schools, teachers, careers counsellors, tertiary providers and educators, and tech employers.

The report is a foundation for future qualitative research with the groups listed above. It seeks to establish the context and relevant issues for upcoming research, policy advice and workforce development plans from Toi Mai. The next research phase will be a continuation of this conversation and will contribute further insights to our work. As discussed in the conclusion, the initial focus will be on the barriers facing tāngata whaikaha.

The report includes recommendations to address issues of digital access, learning and participation in the tech workforce, and examples of some initiatives already in place that can show the way for future action. The report concludes with a summary of findings and next steps in the research.

The tech sector in Aotearoa

Tech is a fast-growing and high-value sector in Aotearoa.[10] With increasing workforce demands and competitive salaries, tech has the potential to provide stable, high-paying jobs to an increasingly significant proportion of New Zealand workers if we can capitalise on strong global demand for tech products and services[11].

The tech sector has a direct role in our wellbeing and quality of life and plays a central role in how we engage with various private and public services – from banks and media outlets to census, voting and health services.[12] The impact of technology on education and work will be even more transformational in the coming decades with automation, digitalisation, artificial intelligence and virtualisation becoming standard modes of learning and working, potentially disrupting traditional industries and their associated skills. It is crucial that tech career training and pathways are open to all of Aotearoa so they can not only reap the financial rewards from the sector's growth, but participate in creating innovative, socially and culturally appropriate content, code, algorithms, user interfaces and products that address diverse needs.

[7] (Toi Mai and NZ Tech, Forthcoming)
[8] (IT Professionals New Zealand, and NZ Tech, 2021)
[9] (NZ Tech, and New Zealand Digital Skills Forum, 2021)
[10] (NZ Tech, and New Zealand Digital Skills Forum, 2021)
[11] (New Zealand Government, 2022)
[12] (MacLeenan, 2022)

For Māori, who te Tiriti o Waitangi has guaranteed the right to make decisions over their resources and taonga, accessing training and work in the tech sector is vital.

Photo by Makea Pokere

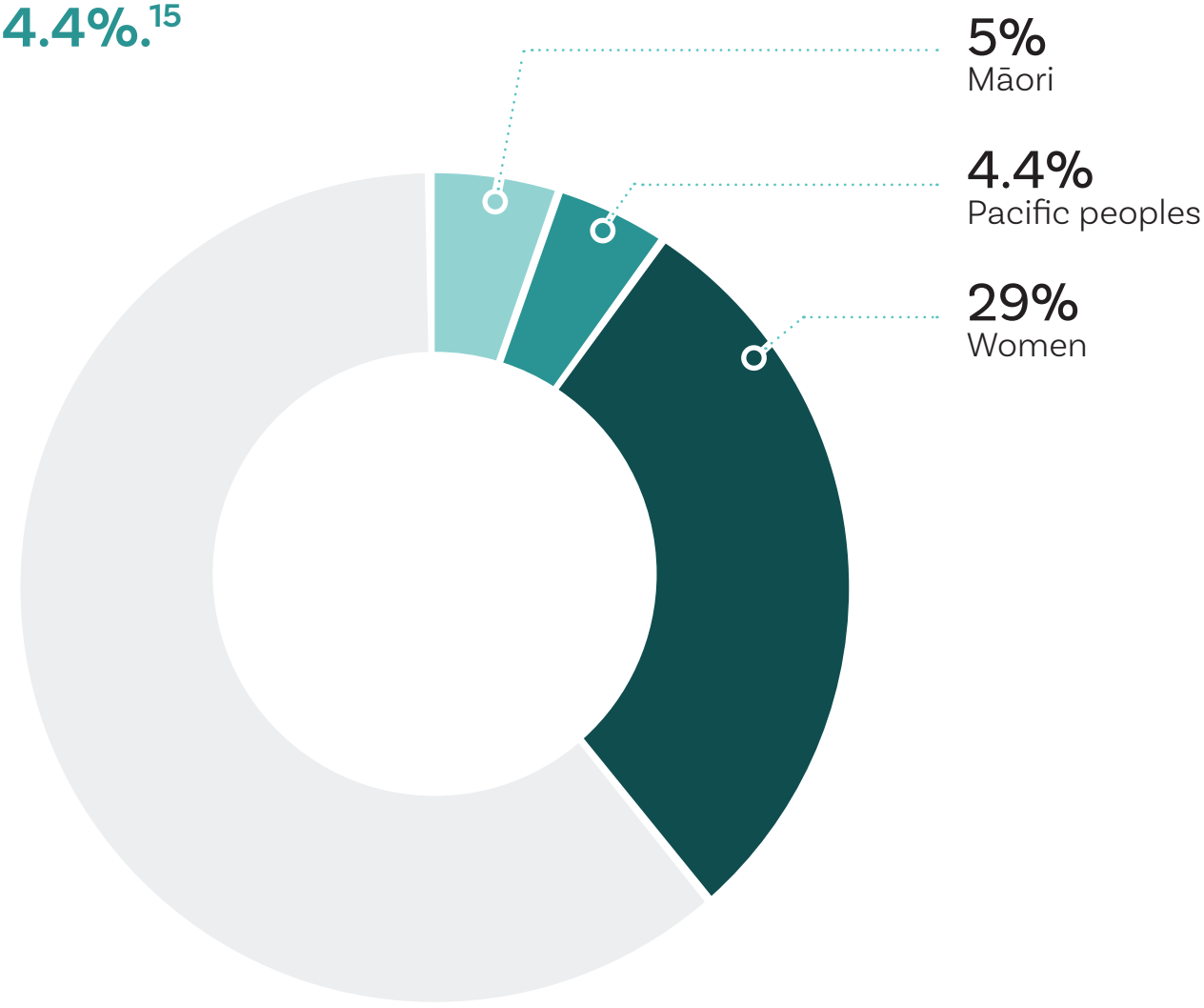
Māori expect and need to play a central role in shaping the use and development of technologies that store and use their digital data (data sovereignty).[13] An important distinction here is that data is much more than objective information for public or private use – it is a taonga to be cherished and protected.

When embedded meaningfully, te Tiriti o Waitangi provides a framework for the prosperity of all peoples in Aotearoa, no matter their background or abilities. The principles of tino rangatiratanga, equity, active protection, partnership and options provide a foundation for inclusion in the design and evolution of digital technologies for all.[14]

Tunohopu Marae by Makea Pokere

[13] (Taiuru, 2022)
[14] (Taiuru, 2022)

Despite all the benefits and opportunities provided by the tech industry, The *Digital Skills for Tomorrow, Today* report found that in 2023 only 5% of the digital tech workforce was Māori, while Pacific peoples represented only 4.4%.[15]



Women made up just 29% of the digital technologies workforce.

The participation rates of tāngata whaikaha is less known. However, Internet NZ reports that disabled people face greater digital exclusion than almost all other groups.[16] Participation of LGBTQIA+ people in the tech workforce is even harder to gauge.

Limited access to internet and devices at a domestic level is a known issue for many groups, which was brought into sharp relief by the surge in online learning and working through the COVID-19 lockdowns. However, a lack of access is only part of the story. Low numbers in the tech workforce are mirrored in education more generally, with Māori, Pacific and female participation in all Science, Technology, Engineering and Mathematics (STEM) fields falling across education stages. While we know that Māori, Pacific peoples and women are active users of tech, their low participation suggests they are largely absent from its development.

Taken together, barriers exist from the domestic environment right up to the workforce. These barriers are systemic, requiring close attention and action at all levels. The groups identified in this report are in themselves highly diverse and represent myriad individual identities. In cases where an individual represents multiple groups, barriers to entry are compounded. Due to the complexity of the issue, we consider it important to map out how multiple barriers appear across key life stages.

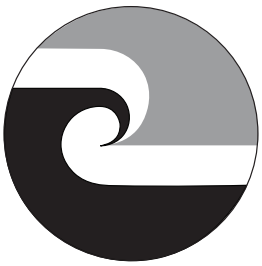
This report addresses the following questions:

- Which groups are most underrepresented in the Aotearoa tech sector and why?
  - What factors in the domestic environment keep learners from continuing in education?
- How does digital inclusion or exclusion influence pathways into the tech sector?
  - How does access to internet and devices affect tech pathways?
- What barriers exist within primary and secondary education?
  - How do these barriers impact entry into tertiary education?
- What does the tech sector need to do to support a more a diverse workforce?
- How can people not in education, employment or training (NEETs) group be reached for introduction into the workforce?
- What cultural bias or blind spots could be contributing to the diversity issue?
- What are the benefits of more diverse tech learners and workforce?
- What are the examples of initiatives that encourage greater participation of underrepresented groups?

[15] (NZ Tech, 2023)
[16] (Grimes & White, 2019)

Groups currently underrepresented in the tech sector

This report outlines the most significant barriers for some groups in Aotearoa. The groups identified in this report are:



Māori or tāngata whenua

LGBTQIA+ or rainbow community
– includes lesbian, gay, bisexual, queer, intersex, asexual, non-binary, takatāpui and gender diverse people

Pacific peoples or tagata Pasifika
– people with Pacific Islands origins or heritage

Women, young women or girls

Tāngata whaikaha, which includes disabled and neurodivergent people *– people living with long term physical, sensory, neurological, psychiatric, learning or other impairments who, due to social barriers, may not experience full and effective participation in society.[17] Neurodivergence includes people whose ways of thinking may appear different from what is considered neurotypical. Neurological difference could include autism, dyslexia or attention-related disorders[18]*

Women represent the largest grouping in this report. Making up more than half of the population, women also intersect each group identified here. The barriers to entering tech faced by Māori, Pacific peoples, LGBTQIA+ and tāngata whaikaha can be felt differently (and more strongly) for women who identify with those groups. As Te Mahere Whai Mahi Wāhine: Women's Employment Action Plan highlights, compared to men, women are more likely to do unpaid work, be underemployed or take unpaid leave to raise children.[19] Pay inequity for women is also a widely known problem in all sectors, including tech. While women are experiencing a recent growth in tech participation today,[20] building representation for all women in tech work and education remains a pressing issue.

How we identified the barriers

Barriers into the tech sector have been identified through a combination of literature review, preliminary stakeholder engagement by the Toi Whānui (Enabling Technologies) team[21] and input from Toi Mai staff working on technology and diversity topics. They are grouped according to the environment in which they occur.

Environments are ordered by life stages, from a child's early exposure to tech at home or school, right up to entry into the tech sector workforce as an adult or young adult. While Toi Mai only directly influences vocational education and workforce areas, we consider it important to take a broad view by including the domestic environment and primary and secondary education.

An overview of barriers can appear as a deficit-centric approach to analysing the sector's diversity issues. This is partly due to the identification of significant social inequities commonly faced by these groups. We consider it crucial to identify clearly and frankly how barriers can stack up against some groups due to multiple social, economic and cultural factors. To balance this, recommendations for addressing these barriers and examples of initiatives underway follow the analysis of barriers in this report.

Identifying systemic barriers should in no way overshadow positive outcomes these groups are achieving in tech education and employment. A key goal of this research going forward will be to shift from a "deficit narrative" to a "strength narrative",[22] characterising the collective experiences of each underrepresented group and demonstrating ways to improve their pathways into the sector based on their own strengths and desired outcomes.

[17] (Office for Disability Issues, 2016)
[18] (DivergenThinking, 2021)
[19] (Ministry for Women, 2022)
[20] For example, Decoding Diversity reported 23% of people in the tech sector were women in 2017 (Ministry for Women, 2017), while NZ Tech reported 29% in 2023 (NZ Tech 2023).
[21] Toi Whānui (Enabling Technologies) is a new sector title incorporating "Innovative technology platforms, products and services for industry and end-users" (Toi Mai, 2022a)
[22] (New Zealand Treasury, 2019)

Photo by Zane Muir from Unsplash

01

Domestic environment

Household, wider family and community environment

The home and community contexts are where young people likely gain their first exposure to tech, either through mobile devices, computers or gaming. Family, whānau and hapū members, friends, church or community groups, and community services like libraries can all influence early engagement with tech. However, socioeconomic factors can also restrict access to, and skills in, digital technologies.

The primary factor inhibiting access to technology in the domestic sphere is low income

Low income can lead to digital exclusion through:

- stretched disposable household income limiting funds to access an internet connection or quality devices
- over-crowded houses requiring devices to be shared amongst multiple family members, limiting the time young people have to explore this technology. This is true even where houses are crowded for non-economic reasons, such as some cultures choosing to live in multi-generational households (for example Pacific peoples)[23]
- increased pressures on family members to take on immediate low-paid work to supplement household income, rather than defer gaining higher earnings through higher education study
- digital access easily falling further down the list of priorities in low-income households that are caring for disabled people. This is borne out in data that shows that disabled people are twice as likely to lack essential digital skills.[24]

While Māori and Pacific peoples generally rate well overall in terms of essential digital skills, research by Motu shows these groups have a higher rate of no internet access.

The rate of no internet access is 12.23% for Māori and 12.23% for Pacific peoples. For European New Zealanders it is 8.89%.[25]

Photo from Yoobee South Seas on location shoot Otara Nov 2022

[23] (Ministry for Pacific Peoples, 2020)
[24] (Bank of New Zealand, 2021)
[25] (Grimes & White, 2019)

For Māori, population distribution can play a part, with high populations of Māori living in regions like Te Tai Tokerau, East Coast and Eastern Bay of Plenty where poor digital infrastructure and less access to higher paying jobs limit access to connections and devices.[26]

In general, income disparities remain for Pacific and Māori people when compared to other New Zealanders. In 2020, Pacific peoples' income was reported to be $7,500 less than the median income for all New Zealanders.[27] This disparity can greatly affect disposable income for things like devices and internet. Meanwhile, Māori aged 25–34 had an unemployment rate of 6.9%, with 19,350 people underemployed in 2022.[28] The unemployment rate for Pacific peoples aged 25–34 was similar at 6.3%.[29] Digital exclusion attributed to location and income can have adverse long-term effects as services become increasingly digital and rangatahi are excluded from pathways into the growing digital tech job market.

A lack of exposure to tech careers limits involvement of all underrepresented groups

Early pathways to learning can also be inhibited by a lack of exposure to tech careers among friends and family. This is especially so in households where the primary source of income is from a benefit or traditional manual sectors like manufacturing, construction and service work. A lack of awareness of the opportunities on offer in tech and of the wide range of skills desired by the sector limits aspirations for diverse groups to enter tech roles.

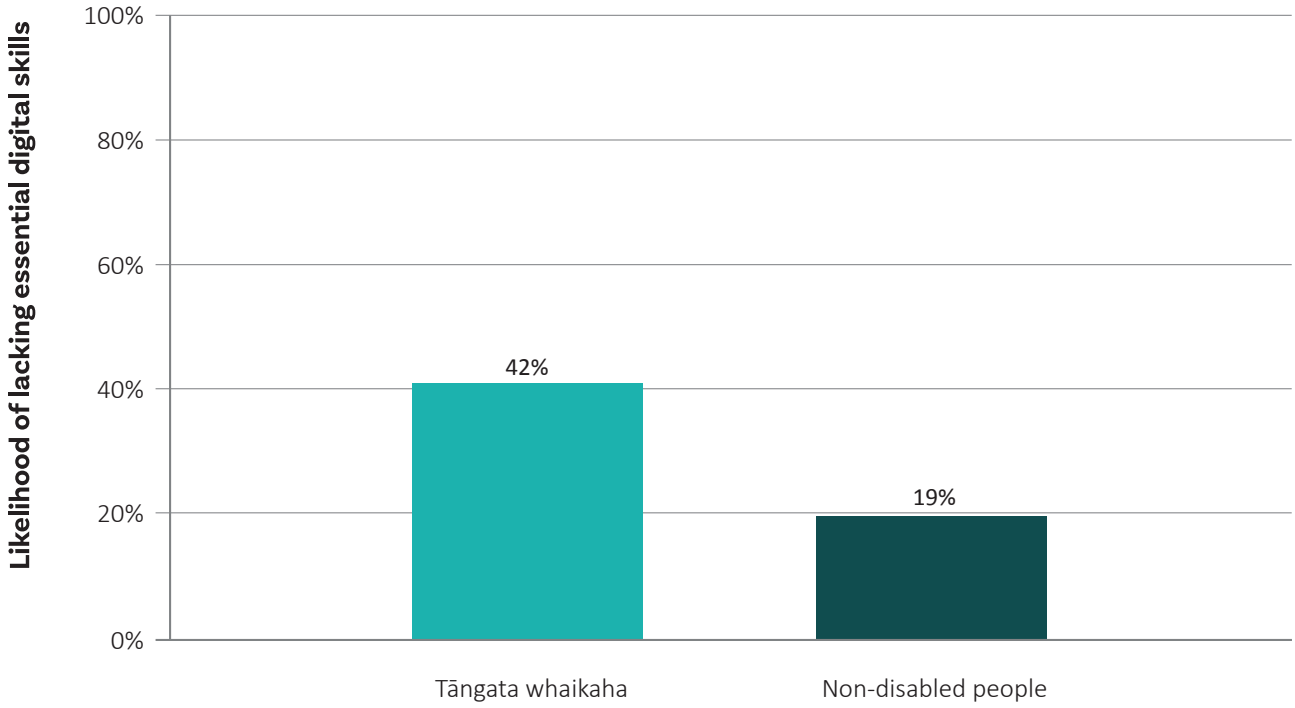
Whānau, community and peers are likely to base career advice on their own experience and may not yet understand the variety and volume of roles in burgeoning sectors like tech. This understanding is further limited when families lack engagement with tertiary education or professional networks. This may be even more pronounced outside the major cities where much of the tech sector is concentrated.[30]

For households that have always relied on manual work for income, there can be a wariness around 'new' roles in tech. Subsectors like creative tech, Esports, game development or cybersecurity may not yet fit dominant perceptions of viable or stable jobs when compared to known and visible roles in services, primary industries and trades, or high-paying roles in medicine, law and accounting. In some cases, an interest in tech may be negatively associated with online bullying or long hours alone at a computer.

[26] (Bay of Plenty Regional Skills Leadership Group, 2022)
[27] (Ministry for Pacific Peoples, 2020)
[28] (Ministry of Business, Innovation & Employment, 2021a)
[29] (Ministry of Business, Innovation & Employment, 2021b)
[30] (Toi Mai, 2022a)

Tāngata whaikaha are more likely to face digital exclusion leading to wider inequities

Tāngata whaikaha have lower rates of employment and earn a median $451 per week compared to $1,000 for non-disabled people.[31] They are also twice as likely to lack essential digital skills compared to non-disabled people (42% and 19% respectively), meaning they have a lower chance of embarking on pathways to tech subjects and careers.[32]



[31] (Stats NZ, 2022)
[32] (Bank of New Zealand, 2021)
[33] Insight provided in personal communication by Whaikaha Ministry of Disabled People

Overall, tāngata whaikaha face perhaps the highest rates of digital exclusion compared to other New Zealanders,

likely affecting their access to pathways into technology courses and work. However, this digital exclusion can have far deeper impacts. During the COVID-19 pandemic, many people who relied on face-to-face interaction for disability support services, home care, and general social connection and interaction were disconnected and isolated due to inability to access internet. This also led to inequities in the distribution of relevant information, especially regarding plans for the continuation of disability support services and the health and safety measures being implemented specifically for disabled people.[33]

Photo by Mart Production from Pexels

Photo by Taylor Flowe from Unsplash

02

Primary and secondary education

Primary, intermediate and high school

Outside the domestic environment, primary and secondary schools remain the best environments to gain early digital tech skills and exposure to careers.

Teachers who are excited about the opportunities and benefits brought about through technology can pass on their excitement to their students by normalising tech in the classroom. This involves applying tech skills to non-tech specific subjects and increasing participation of students at all levels.

Teachers' abilities to meaningfully engage with learners and their families, and to demonstrate the viability of pathways into tertiary, are fundamental to learners feeling confident to enter vocational or university education in technology studies. The University of Auckland Starpath Project found that education success for lower decile students was closely linked to degree subject choice and focused support they had along their high school learning journey.[34]

However, there are still many barriers at the school level, meaning underserved learner communities either do not take technology subjects at secondary school or are not encouraged or supported to engage with post-secondary technology study or training.

Nationally, the number of students taking NCEA digital tech standards fell between 2015 and 2019.[35] Recent data for digital technology enrolments for secondary learners shows an increase of nearly 3,000 students between 2020 and 2021. Nonetheless, for female, Māori and Pacific students, we still see relatively low participation. *Digital Skills for Our Digital Future* reports that in 2019, 39% of learners taking NCEA technology at school were girls, with only 14% Māori and 9% Pacific.[36] This is despite Māori currently making up 25% of all New Zealand school learners and Pacific peoples making up 9.8% across all age groups.[37]

[34] (Kiro, et al., 2016)
[35] (NZ Tech, and New Zealand Digital Skills Forum, 2021)
[36] (NZ Tech, and New Zealand Digital Skills Forum, 2021)
[37] (Education Counts, 2022)

Success in tech at school is closely linked to effective delivery of the digital curriculum and positive engagement with learners

- There is high variability in quality, application and uptake of the digital curriculum in schools. Delivery of digital technologies content in schools is still maturing.
- There is varied teaching quality, especially for STEM subjects. Not all teachers are trained and technologically confident enough to facilitate subject delivery.[38]
- Where subjects are not siloed, such as in primary education, integration of digital technologies in various subjects is proving effective. However, in secondary education subject areas are less integrated due to the NCEA framework.
- Some whaikaha learners cannot access the additional assistance in classrooms and at home that is needed to support use of devices and digital platforms. Census data indicates that disabled students are also less likely to have internet access at home.[39]
- Grouping students by perceived ability (known as streaming), either due to limited teaching resources or in an attempt challenge more 'able' students, has had the adverse effect of sorting learners by "ethnicity, socioeconomic background, gender or disability".[40] This has impacted some groups long term, creating poorer outcomes across all subjects, as well as blocking pathways into areas like STEM. Streaming generally affects retention in secondary education and progress to tertiary.
- Biased academic counselling occurs. Some Māori and Pacific students have reported low teacher and community expectations of them, indicating that in some cases learning success was curtailed before they had the chance to explore their own learning aspirations.[41]
- Anecdotally, we also hear that teachers encourage technologically competent girls into more academic pathways rather than tech pathways, which are considered more 'trades' oriented.
- Young women and girls have historically felt discouraged from taking STEM subjects, with the overwhelming assumption being that males prefer or perform better in these subjects.[42]

While quality and uptake issues are not unique to the underrepresented groups, evidence suggests they are at most risk of being left behind as tech subject delivery progresses. Even in schools where delivery of the digital curriculum is well established, use of digital technologies may still be limited, especially for low-income households that cannot prioritise buying devices for children.[43] Anecdotal evidence from the Manaiakalani programme suggests that in some cases where devices were provided for students in need, internet access continued to be a problem at home.

Strong numeracy and literacy are important factors to progressing into tertiary education, but not all groups are attaining similar outcomes in these subjects. In general, senior secondary learners from disadvantaged backgrounds are reported to show poorer performance in mathematics than those from advantaged backgrounds.[44] A similar trend was reported in 2018 for literacy subjects, with Māori and Pacific senior students achieving lower reading scores on average than New Zealand and OECD averages in senior secondary schooling.[45] While numeracy and literacy performance is not a direct indicator of success in fields like tech, these results can impact progression into tertiary or other training providers, as well as the learner's confidence in meeting the challenge of further study. Research from 2010 and earlier even suggests that Māori and Pacific students may benefit more from "e-Learning-rich environments".[46]

Unfortunately, students who struggle in numeracy may rule out STEM careers before they are even aware that tech roles involve broader skillsets than just those associated with coding and engineering. Communication, creativity, critical thinking and collaboration – transferable skills which can be developed through the latter school years and in tertiary – are now highly sought after by tech companies. These same skills are valued in Māori and Pacific cultures, for example, and neurodivergent learners can be adept at problem solving and creativity. Improving awareness of the greater range of roles and skills pathways for all learners includes showing them how their non-maths strengths can apply to a range of tech roles.

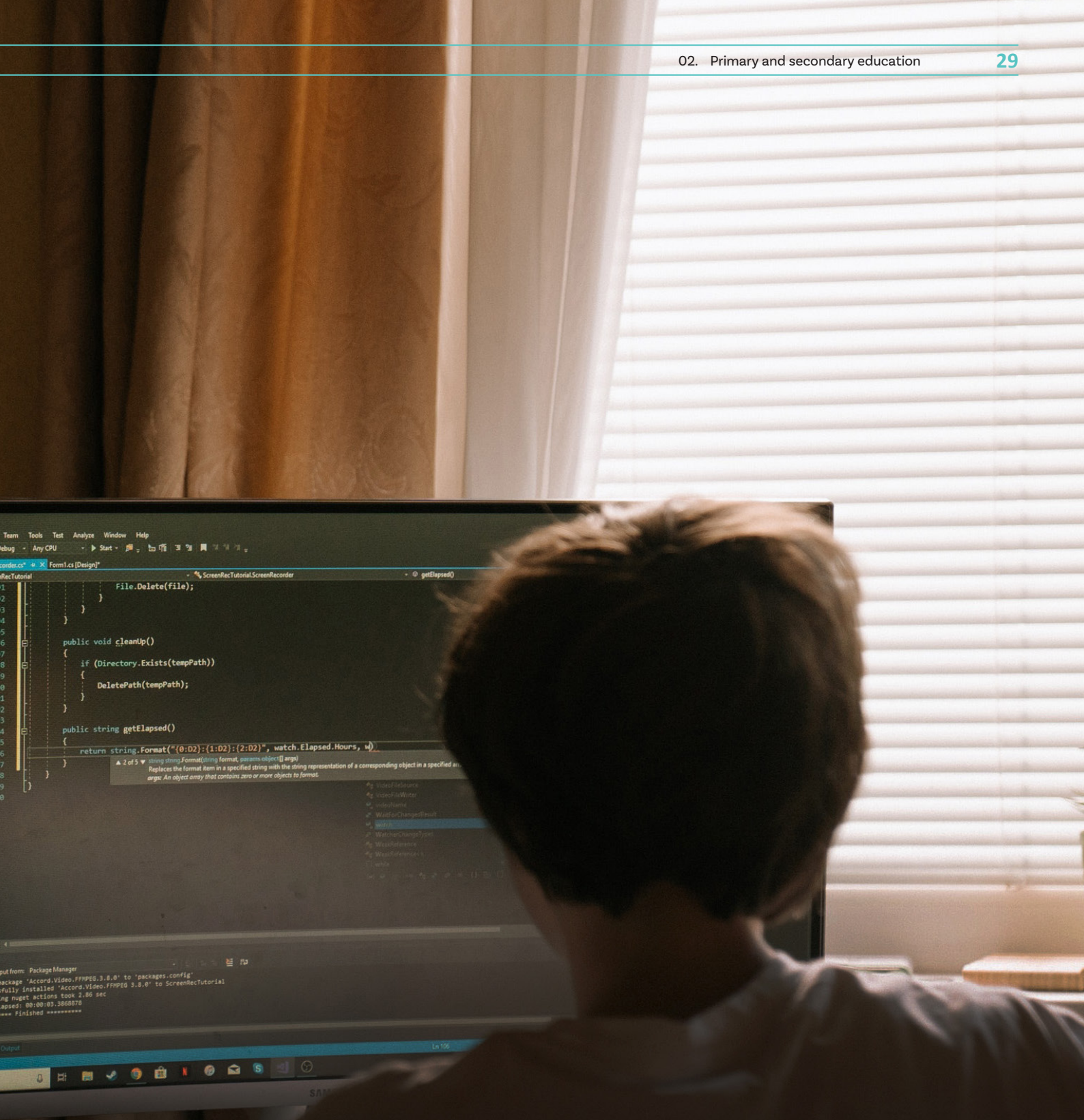
[38] (New Zealand Council for Educational Research, 2020)
[39] Census (2018) data shows that 77% of disabled people have access to the internet, compared to 92% of non-disabled people. (Stats NZ, 2020b)
[40] Ministry of Education, 2021)
[41] (Kiro, et al., 2016)
[42] (Addison, 2022)
[43] (Wylie & Bonne, 2016)
[44] (Ministry of Education, 2018a)
[45] (Ministry of Education, 2018b)
[46] (Valintine, Future of Education: 2022 and Beyond, 2022)

Whaikaha learners can feel discouraged from pursuing educational pathways

Te Ihuwaka (Education Evaluation Centre) reports that around 11% of New Zealand children under 15 years of age have a disability.[47]

Despite such a large proportion of our school-age students having additional needs, numerous barriers remain throughout their educational journey, starting at enrolment and continuing to university entrance.

[47] (Stats NZ, 2014)
[48] (Te Ihuwaka, 2022)
[49] (Te Ihuwaka, 2022)
[50] (Ministry of Education, 2019)
[51] (Office for Disability Issues, 2016)
[52] (Office for Disability Issues, 2016)



The biggest barrier whaikaha learners face is limited access to the full range of opportunities that come with school life. Learners and their whānau report that they have been discouraged from enrolling at their local school or are not included in school activities like camps and events.[48] For staff this could be considered a resource issue, with the learners' extra needs requiring greater attention. However, this attitude results in learners feeling like school is not for them. This is evidenced in more than a quarter of whaikaha students stating they do not feel accepted for who they are, with a third feeling they do not belong at school.[49]

The 2013 Disability Survey found that 14% of disabled students required additional support in their learning, while this figure rose to 38% for students with higher needs.[50] These needs are complex and often the catch-all term 'disability' does not convey the full range of physical, intellectual and health-related challenges students may face in their day-to-day lives.

Not all tāngata whaikaha require additional resources or adjustments to the environment. A better understanding of the needs of whaikaha students and the development of supports for inclusion is needed by education providers, which can enable greater flexibility and access within lesson delivery.[51] This is especially so with learning difficulties being the most common impairment for children in Aotearoa.[52] A more inclusive approach during primary and secondary education could help more students of all abilities to gain the skills needed to enter work or tertiary education.

Photo by Cottonbro Studio from Pexels

Early school leaving and lack of exposure to tech careers limits Māori, Pacific and whaikaha learners' desire to enter the sector

The Tertiary Education Commission reports that 60,000 school leavers transition from secondary education each year.[53] Of this group, Māori and Pacific learners are half as likely to meet university entrance requirements upon leaving secondary education. In 2020, rates of early leaving were higher for Māori students across all deciles.[54] Reasons for early leaving can vary widely but may result from learners feeling that the education system is not serving them, that they lack the ability or confidence to progress to tertiary education, or that earning an income is a higher priority than continuing education. Pacific learners, for example, are more likely to prioritise supporting family over enjoyment-based career decisions, which can result in leaving education early to pursue lower skilled employment.[55]

Early leavers may experience lower median incomes after schooling than those who reach NCEA level 2, contributing in part to the kinds of income disparities outlined in the section above. While early school leaving by no means closes the door to meaningful or well-paid employment, early leavers can find it more difficult to enter the tech sector unless they have prior interest and skills in digital technologies or have a network of contacts to introduce them to the sector.

[53] (Jackson, Burmester, Clayton, Hennity, & Barton-Howes, 2022)
[54] (Ministry of Education, 2020b)
[55] (Jackson, Burmester, Clayton, Hennity, & Barton-Howes, 2022)

Photo by Katerina Holmes from Pexels

Photo by Charlotte May from Pexels

03

Tertiary education

University, vocational and PTE programmes

Entering tertiary education can be a major life step, particularly for individuals from groups identified in this report. Te Rito reports from Te Pūkenga feature in depth qualitative research into its priority learner groups, stating that Māori, Pacific peoples and disabled people are often underserved by tertiary education in Aotearoa.[56] The research reveals numerous challenges faced by these groups when transitioning to, or taking part in, tertiary education. While issues raised by the research are not applied to tech pathways specifically, they underline the theme of certain groups remaining excluded from effective education delivery.

The implications of unequal educational outcomes for tech become clearer when we observe that 80% of the tech workforce has a post-school certificate/diploma and 66% have a Bachelor's degree or higher.[57] With formal education remaining the most direct pathway into tech careers, and considering the current Reform of Vocational Education (RoVE) programme, tertiary education can play a central role in improving inclusivity and creating a strong and diverse talent pool in tech.

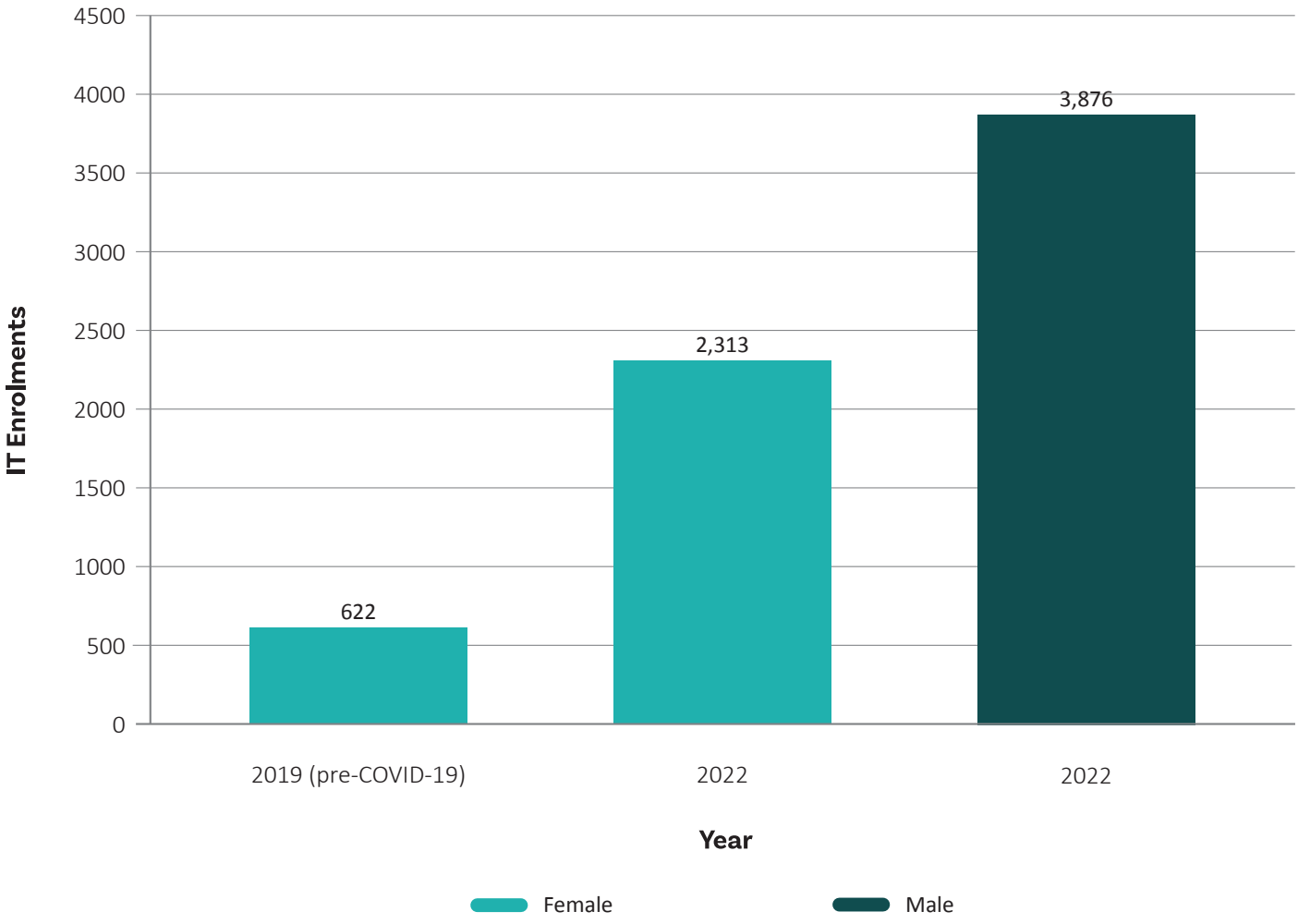
80%

post-school certificate/diploma

66%

Bachelor's degree or higher

Many of the insights above relate to tertiary education broadly; however, tech courses in particular are not currently attracting large numbers of women, Māori or Pacific peoples.[58] Data from vocational education suggests this is improving for women, with an increase from 622 IT enrolments in 2019 (pre-COVID-19) to 2,313 in 2022.[59] Still, this number is 40% lower than male enrolments for 2022 (3,876 enrolments).



[56] This research was carried out among the 16 polytechnics before their amalgamation into Te Pūkenga.
[57] (Toi Mai, 2022a)
[58] (NZ Tech, and New Zealand Digital Skills Forum, 2021)
[59] (Tertiary Education Commission, 2022b)

Barriers at **tertiary level** include:

- financial and time pressures making it difficult to prioritise study. Cost of study is a clear barrier for many school leavers, with high university fees often considered an insurmountable barrier [60]
- learners entering tertiary education – either in polytechnics, wānanga, private institutions or universities – having to juggle household pressures such as dependents, high living costs and limited income sources
- currently limited opportunities to 'earn while you learn' for tech courses, which can exclude learners with financial constraints
- Pacific students' strong commitment to family sometimes clashing with study obligations
- many whaikaha students facing difficult school environments and needing to overcome self-stigma, such as feelings of being less capable than their peers when in tertiary education.[61]

For many, being a full-time student can be challenging or even impractical, especially where no financial support from family exists.[62] Women, Māori, Pacific peoples and tāngata whaikaha are most affected by the lack of flexible or combined work and study options.[63]

Only 25% of Pacific students and 30% of Māori are supported by family while studying, further demonstrating that finances are a decisive barrier or enabler of entry into tertiary study. Outcomes from trialled low fees or fees free schemes like the Targeted Training and Apprenticeship Fund (TTAF) demonstrate that, with reduced financial barriers, participation of underrepresented groups can increase. Preliminary outcomes from TTAF show that the scheme had a positive impact on groups underrepresented in tech sub-degree courses between 2019 and 2021, with a particularly large impact on female participation – an average increase of 137%.[64] With TTAF ending, it is important these financial barriers are thoroughly analysed and addressed to support greater diversity in tech courses and jobs.

[60] (Jackson, Burmester, Clayton, Hennity, & Barton-Howes, 2022)
[61] (Jackson, Burmester, Clayton, Hennity, & Barton-Howes, 2022)
[62] (People's Inquiry into Sudent Wellbeing, 2022)
[63] Only 25% of Pacific students and 30% of Māori are supported by family while studying. (IT Professionals New Zealand, 2022)
[64] (Toi Mai, 2022b)

Whaikaha learners contend with limited accessibility and understanding of their needs

According to Te Pūkenga, some key barriers commonly faced by whaikaha learners include:

- a lack of resources for supported learning and limited understanding of learners' diverse needs
- inaccessible physical environments for people with different impairments
- a lack of consideration for feelings of shame or stigma they may face. Tāngata whaikaha may require additional flexibility and empathy for their situation due to the range of constraints or disruptions to their study routine. In many cases, providing regular communication and adjusting assessments to meet learners' specific needs can go a long way.[65]

The challenges faced by neurodivergent learners (who make up 9% of school leavers) are not yet well understood.[66] However, common activities like finding course information, reading texts, completing assessments in given timeframes and socialising with peers can all present barriers to attaining their learning goals in general, let alone their goals in tech.

[65] (Te Pūkenga, 2021a)
[66] (Jackson, Burmester, Clayton, Hennity, & Barton-Howes, 2022)

Māori and Pacific students and NEETs require enhanced learner support, visible representation and cultural safety to flourish

For many Māori and Pacific learners, entering tertiary education can be a major step for them and their families. Te Pūkenga report that

10% of Māori and Pacific learners are the first in their family to take up tertiary level education.[67]

Photo by George Pak from Pexels

Extensive wrap-around support ranging from mentoring to regular communication from staff on deadlines and course delivery may be required to guide learners for whom tertiary education is uncharted territory.

Pacific learners in focus groups report a lack of support during enrolment and during their studies.[68] Moreover, they report benefitting from peer-to-peer mentoring while carrying out their studies. While Pacific identities and experiences are diverse, having peers and role models at hand can help Pacific learners to feel they fit into their new learning environment.

Focus groups with Māori learners entering vocational education have revealed that learners bring the impacts of colonisation with them on their educational journey.[69] Learners may experience feelings of inadequacy or isolation when entering a Western tertiary education system. These feelings can be especially acute if learners are studying far from their family, community, hau kāinga or whenua. Māori students stated that they required "more holistic environments that were physically, culturally, emotionally and spiritually safe and included the wellbeing of whānau."[70]

These cultural needs may not always be catered for in predominantly Western learning contexts. Te Rito also reports that Māori and Pacific cultural identities are growing and that a strongly Western learning experience may limit feelings of success in courses.[71] Increasing numbers of influential Māori and Pacific staff can help to create more authentic cultural understanding and practices within a learning context, including through the incorporation of indigenous worldviews in learner support and content delivery.

Mentorship and wrap-around support are also critical for attracting and keeping NEETs (people Not in Education, Employment or Training) in their chosen courses. NEETs' education aspirations may be negatively influenced by a prior low achievement, difficulties in the home environment, low expectations, or even discrimination based on socioeconomic position, ethnicity, ability or otherwise.[72]

[67] (Preston & Grbic, 2022)
[68] (Te Pūkenga, 2021b)
[69] (Te Pūkenga, 2021c)
[70] (Te Pūkenga, 2021c)
[71] (Te Pūkenga, 2021c)
[72] The Education (Pastoral Care of Tertiary and International Learners) Code of Practice 2021 will go some way to ensuring all institutions have these needs in mind.

Photo by Raeng from Pexels

04

Workforce

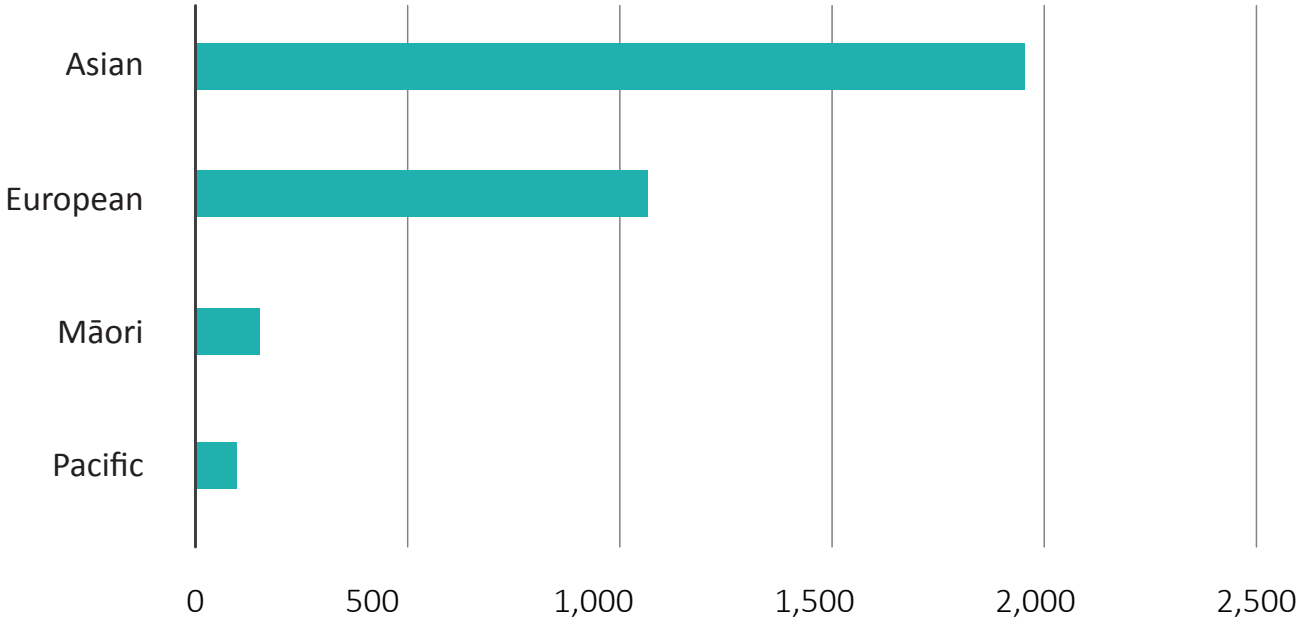
Employment in a tech role or within the tech sector

Not surprisingly, given the significant barriers for women, Māori, Pacific and tāngata whaikaha in the spaces discussed so far, those that end up working in the tech sector are predominantly Pākehā or Asian, middle-class, and male.[73] This in turn presents a further barrier to a more diverse workforce, as people of diverse ethnicities, genders and abilities struggle to envision themselves in tech roles – "you can't be what you can't see".

Asian peoples have an important place in the Aotearoa tech sector. Where Pacific peoples and Māori have low participations, students and workers of Asian descent contribute much to the sector's ethnic diversity. This includes a significant number of migrant workers and international students.

Photo by Annie Spratt from Unsplash

In 2019, 1,955 of IT graduates in Aotearoa were Asian, compared to 1,070 European, 150 Māori and 95 Pacific.[74]



Furthermore, Asian students were the largest ethnic group enrolled in degree level IT qualifications at 50.4% (European were the second largest at 41.6%). It should be noted that 'Asian' is a vague ethnic grouping and may further exclude minority groups within Asian nationalities.

[73] (Calhoun, Jayaram, & Madorsky, 2022)
[74] (NZ Tech, and New Zealand Digital Skills Forum, 2021)

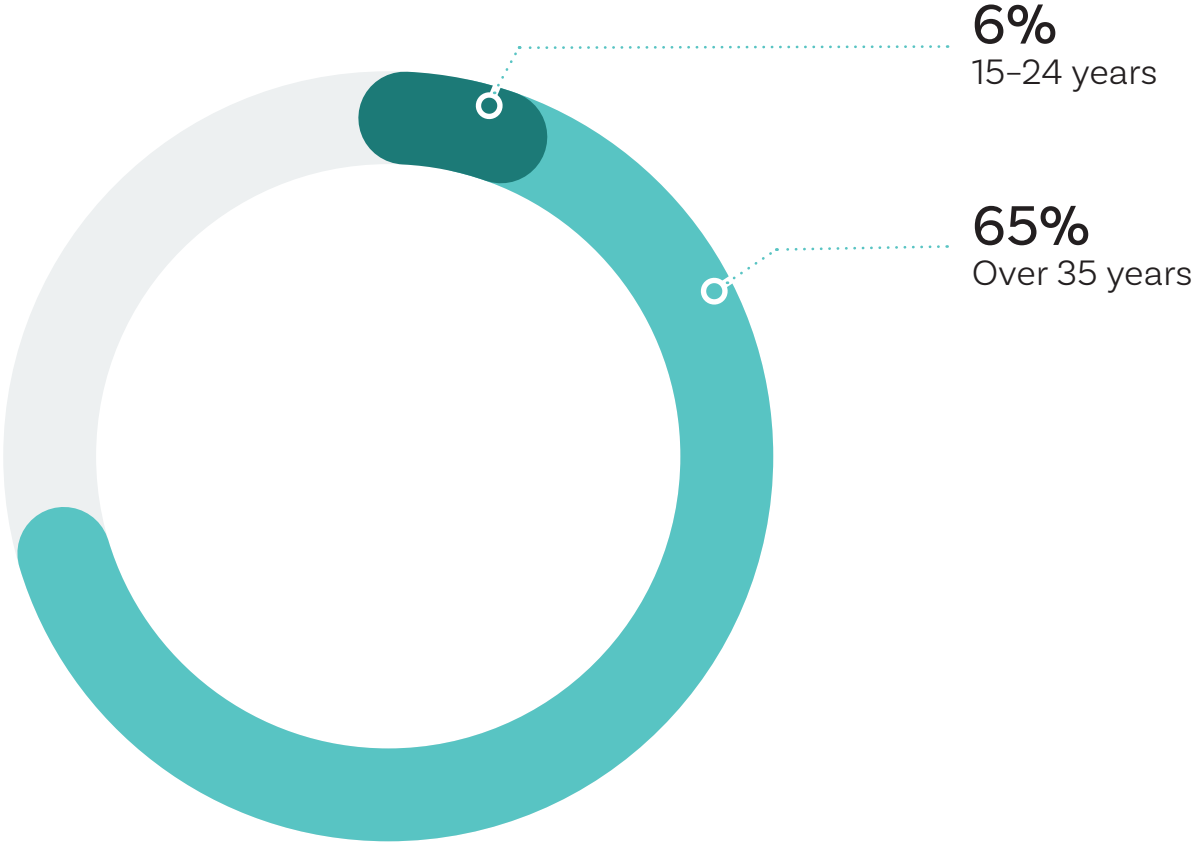
Barriers in the **workforce** include:

- a previous focus on hiring professionals from abroad, which further reduced representation in the tech sector. A knock-on effect of this approach is a dearth of local talent
- underrepresentation becoming self-perpetuating when groups do not see people like themselves taking part in a discipline, workplace or sector
- disparities between what employers expect from applicants and what applicants feel they can bring to roles (commonly misunderstood as "attitude")
- the workforce often not understanding values and skills brought by Māori and Pacific peoples, while previous experiences of discrimination can discourage LGBTQIA+, tāngata whaikaha and NEETs from applying for roles. Unfamiliarity with professional work environments, distance from home and family commitments can all impact the transition into work
- a lack of organisational awareness of tāngata whaikaha needs and ways to support these needs. This ranges from the recruitment stages to onboarding and retaining workers who are disabled by their work environment
- a lack of local and culturally specific approaches needed to make more inclusive workplaces, including uplifting Māori and Pacific values, knowledge and customs
- low of visibility of women in tech – greater visibility is needed to shift perceptions of tech being a men's industry
- organisations not sharing the responsibility of inclusivity and representation. They must anticipate workplace challenges to provide accessible and safe work for current and future team members of all backgrounds and abilities.

Tech employers are hesitant to hire and develop people with less experience in the sector

A large proportion of new tech workers are people transitioning from other careers or roles.[75]

In general, the sector has an older workforce with 65% of workers over 35 years of age and only 6% between 15 and 24.



[75] (Toi Mai, 2022a)

In recent years, hiring international talent has been preferable to developing employees from within organisations or hiring inexperienced people, including interns. This approach put significant strain on the sector when borders closed due to COVID-19. The preference for international experienced workers has had a detrimental effect on local young people and underrepresented groups breaking into the sector.

With the current shortage of senior developers in areas like game development, hiring younger or inexperienced staff has proven difficult due to the additional on-the-job training they require.[76] This issue is compounded when considering the accessibility support or guidance required by tāngata whaikaha and for some Māori and Pacific peoples. Earn-as-you-learn options created through partnerships with employers could help to alleviate the financial and time constraints faced by women, Māori, Pacific peoples and tāngata whaikaha.

Photo by Djordje Petrovic from Pexels

Māori, Pacific peoples and women do not see themselves reflected in tech, thereby reinforcing negative perceptions of the sector

The current diversity gap is potentially the largest barrier to greater representation of the groups identified in this report. Despite a growing sense that sector demographics are shifting, a perception remains that the tech sector is dominated by men. This perception may contribute to fewer young women participating in NCEA standards (39% of all participants in NCEA standards) and the current disparity between women and men in the digital workforce (only 29% women).[77] In game development, women make up less than 20% of workers, despite nearly half of game players being women.[78] Women may be hesitant to enter an industry they perceive as unsafe based on online interactions, with gaming communities being one common source of negative interactions. LGBTQIA+ representation in tech is less clear, but a 2021 survey by New Zealand Game Developers Association found that 19% of employees in the games industry identified as LGBTQIA+,[79] compared to 4.2% of the general population.[80] In 2022 this number fell to 9%.[81]

Exclusion of ethnic or racial minorities in tech is well-reported globally, and therefore underrepresentation is not unique to groups like Māori and Pacific peoples.[82] For Māori, Pacific peoples and tāngata whaikaha, a small number of tech 'champions' exist who are active at conferences, on boards and advisory panels, and on social media.[83] This role can be taxing, often involving additional work to promote participation in the sector while still fulfilling their regular work obligations. Female, Māori and Pacific champions can risk being targeted for speaking out on current issues in tech. Burn-out is a genuine risk. Considering the emotional and mental effort taken to promote pathways for underrepresented groups, these champions must be acknowledged and fairly remunerated. This work is currently supported by a handful of large corporates, NGOs and government initiatives, but greater industry buy-in and collaboration is required to shift perceptions.

[76] (Toi Mai, 2022c)
[77] (Ministry of Education, 2018a)
[78] (Toi Mai, 2022c)
[79] (New Zealand Game Developers Association, 2021)
[80] (Stats NZ, 2021)
[81] (New Zealand Game Developers Association, 2022)
[82] (NZ Tech, and New Zealand Digital Skills Forum, 2021)
[83] (Ministry of Business, Innovation and Employment, 2022a)

Navigating the recruitment process presents significant challenges for underrepresented groups

Barriers in recruitment exist for tāngata whaikaha, LGBTQIA+, Māori and Pacific peoples. Tech sector insiders often refer to unconventional pathways into the sector and open-minded work cultures within tech organisations. However,

> entering any workforce can involve taking on norms and behaviours that appear natural to those already in the sector (insiders), but unfamiliar to those wanting to break in.

This disparity has been characterised as "the attitude gap", where employers seek candidates with the "right attitude" on the one hand, while on the other hand candidates have yet to gain a sense of preparedness and self-assurance.[84] The result is a mismatch between expectations and ability to meet those expectations.

For groups often underserved in education and underrepresented in high-paying and technical roles, applying for a role can be a challenge when barriers have been the norm throughout their life journey so far. This is often the case for tāngata whaikaha. For groups well represented in the primary industries, manufacturing and construction, such as Māori and Pacific peoples, remaining within these familiar industries may feel like a safer option.[85] Engaging in relationships with non-traditional sources such as marae, kura and Pacific communities could help de-mystify entry requirements for tech roles, thereby developing new pathways.

Showing a confident or proactive attitude can clash with some cultural norms for groups like Māori and Pacific peoples. These groups may present qualities that are valuable in their whānau or community context but are less recognised in the workplace. This lack of cultural awareness is evident in situations like interviews, where panel members may be unaware of cultural norms for Pacific peoples. For applicants who overcome confidence, cultural or identity barriers and can present their experience and qualifications in a CV, employers may be looking for qualities like strong interpersonal and communication skills, maturity in the workplace context, or technical skills that applicants either do not expect or have not yet gained in life.[86 87] This issue signals a need for greater focus on transferable and professional skills by education providers on the one hand, and improved guidance and patience on the part of employers to develop employees on the other.

Additional guidance and support help Māori, Pacific and tāngata whaikaha succeed in their roles

Tāngata whaikaha have reported feeling that there is no place for them in the workforce or that their impairment will disrupt their employment.[88] This expectation can be internalised throughout different life stages. Some employers may be unwilling to take the risk of a disabled person's employment not working out.[89] Challenges can be compounded for high needs individuals who require assistance to prepare for their day and get to and from work. For neurodivergent people, "invisible" challenges may exist that are not noticed by employers but make adapting to the work environment or certain tasks difficult. While internship programmes exist to facilitate entry into the workforce, regular support is required to guide them and the employer at the outset of their employment journey.

Because many tech roles are based in cities, new employees or trainees may also be leaving home for the first time. Managing finances, housing, personal wellness and transport, all while navigating an unfamiliar workplace and community, can present challenges. Extensive wrap around support can be a key factor in bridging the transition to work for Māori, Pacific peoples and tāngata whaikaha. For those from disadvantaged backgrounds, employment brokers and mentoring figures help to smooth the transition between education and employment.

People in the youth NEET group (aged 15–24, Not in Employment, Education or Training) experience additional obstacles to gaining employment. They may start off with lower qualifications having left school early or are absent from educational or employment spaces where targeted programmes are promoted. Childcare and care for older family members are other common impediments to beginning work or study. Māori and Pacific peoples rate highest in youth NEET figures by ethnic group at 17.6% and 16.6% of their population, respectively,[90] compared to 12.8% for the overall population.[91] Disabled and neurodivergent people are highly likely to fall within the youth NEET group (up to 48.2% in 2020), again reflecting the significant barriers they face in the transition from school to work or tertiary.[92]

[84] (The Auckland Co Design Lab, 2016)
[85] (Schulze & Hurren, 2020)
[86] (The Auckland Co Design Lab, 2016)
[87] (Toi Mai, 2022a)
[88] (Te Pūkenga, 2021a)
[89] (Workbridge, 2020)
[90] (Ministry of Business, Innovation & Employment, 2021c)
[91] (Ministry of Business, Innovation & Employment, 2022b)
[92] (Stats NZ, 2020c)

Greater cultural competency and preparation for diverse needs is required from industry

In order to better accommodate diverse people and ideas in tech roles, continuous effort is required to make workplaces safer and more inclusive. Centring biculturalism, improving cultural competency and broadening understandings of ability and gender are gaining momentum in Aotearoa today, but many organisations still lack practical ways to embed diversity and inclusion within their operations.[93]

Creating a safe environment for women, gender diverse and tāngata whaikaha requires concerted effort by organisations to transform workplace culture and policy.[94]

Photo by Mikhail Nilov from Pexels

Often a lack of resources and prioritising 'business as usual' prevent improvements in this area. In some cases, ignorance and bias can remain under the surface of a workplace culture. Normalising diverse ways of being and knowing in tech is a sector-wide responsibility.

Encountering "invisible practices, language and rules" in the workplace is common for underrepresented groups.[95] This is particularly true when entering large international organisations or those not owned by minority groups (most tech organisations). These norms can reinforce internalised feelings of not belonging. Incorporating tikanga and te reo Māori into everyday workplace culture can benefit Māori entering the sector as well as promoting biculturalism for the benefit of all staff. Similarly, celebrating the diversity of Pacific peoples – their values, knowledge and customs[96] – helps to situate New Zealanders within the wider Pacific community of nations and cultures. Growing partnerships with tāngata whenua and Pacific stakeholders is key to ensuring authentic integration of culture in the workplace and achieving better outcomes for their communities. Making this an organisation-wide priority, with the buy-in and participation of senior management, also helps to lessen the burden of representation for the minority of Māori and Pacific professionals.

Inclusive work environments for tāngata whaikaha begins with useability and accessibility. Many devices and digital platforms have been designed by developers who are not disabled by their environments. This exacerbates digital exclusion and lower rates of digital literacy for tāngata whaikaha at the grass roots level. Thus, there is a need for greater representation at the design and development phases of tech products. A quarter of individuals in one study with disabled people indicated that their difficulty (for example, in mobility, sight, hearing, remembering or concentrating, among many others) limited their use of the internet.[97] Workbridge highlights cases where vision or hearing impairments impact a person's ability to perform work tasks on standard format (more affordable) smartphones and laptops because they lack assistive functions like screen reading software or hearing aid compatibility.[98] Tāngata whaikaha may anticipate these workplace challenges before even applying for a role. Therefore, ensuring workplaces and tasks are accessible for all staff, and devising roles that leverage different strengths, can empower people to realise their skills and potential.

[93] (NZ Tech, and New Zealand Digital Skills Forum, 2021)
[94] (IT Professionals New Zealand, and NZ Tech, 2021)
[95] (The Auckland Co Design Lab, 2016)
[96] (Tech Talanoa: Pasifika in Technical Tech, 2022)
[97] (Díaz Andrade, Hedges, Pacheco, & Turcu, 2021)
[98] (Workbridge, 2020)

Summary of the barriers discussed in this report

The following is a summary of the key barriers faced by groups currently underrepresented in the tech sector according to the environments detailed below. The barriers are also summarised in Table 1 below.

Key barriers in the domestic environment

At the domestic level, we see a strong correlation between socioeconomic barriers and digital literacy and access. Groups like Māori, Pacific peoples and tāngata whaikaha are more likely to face these socioeconomic barriers, including employment, educational and housing challenges that restrict access to digital technologies (devices and internet). Tāngata whaikaha require additional accessibility support to bridge the digital divide. Meanwhile, due to current and historical labour trends, Māori and Pacific peoples are less likely to gain exposure to the tech sector through their whānau and community networks. The result is less awareness of the opportunities available to them in the sector, and low representation means they are less likely to envision a tech career for themselves.

Key barriers in primary and secondary education

The digital curriculum for primary and secondary school in Aotearoa is still maturing. Teachers require further experience and professional development to better teach digital skills, including adapting non-tech specific subjects to incorporate those skills. Māori, Pacific peoples and tāngata whaikaha currently benefit least from educational pathways in Aotearoa, including lower achievement of university entrance. Streaming and related issues like unconscious bias and low expectations for some groups have resulted in a wider imbalance in our education system and the legacy of a one-size-fits-all model. In this regard, young women and girls also require extra encouragement to take tech subjects and to see pathways into tech tertiary courses and work. In general, greater awareness of tech opportunities and the transferable skills desired in today's tech workforce are needed to encourage all young learners to pursue tech pathways.

Key barriers in tertiary education

Financial and time pressures can present major obstacles for the groups identified in this report. Māori and Pacific peoples (and particularly women within these groups) are less likely to be able to prioritise full-time study over earning an income or caring for dependents. Pacific and Māori learners state that they would benefit from stronger social networks and mentorship to support their learning. This includes having role models from similar backgrounds sharing their experience in tertiary learning and offering guidance through challenges. Extended pastoral care systems are needed to encourage NEETs to take up education and to retain them. Whaikaha students also require extended outreach and support. Physical obstacles in the learning environment, a lack of assistive technologies, and a lack of understanding of day-to-day challenges or stigma can contribute to whaikaha students being underserved by tertiary education. Greater representation and promotion of the opportunities available could encourage participation of Māori, Pacific peoples, women and tāngata whaikaha in tech courses.

Key barriers in the workforce

The recruitment process presents barriers for those entering the workforce for the first time. A disparity exists between what employers expect from applicants and what applicants feel they can bring to roles. Māori and Pacific peoples also bring values and skills that are not always understood in the workforce, while LGBTQIA+, tāngata whaikaha and NEETs may lack the confidence to apply for roles due to previous experiences of discrimination in work and education. The tech sector has tended to hire skilled workers from abroad rather than train local talent, further reducing the scope for underrepresented groups to enter the sector. Diversity issues are not unique to the tech sector in Aotearoa. Nonetheless, local and culturally specific approaches are needed to make more inclusive workplaces, including uplifting Māori and Pacific values, knowledges and customs. Women in tech also need greater visibility to shift perceptions of tech being a men's industry and – worse – a sector that is unwelcoming to women. Too often the responsibility has fallen on a few people to champion their identity and attract talent. For tāngata whaikaha, organisations should anticipate workplace challenges and provide accessible and safe work environments.

	ENVIRONMENT: HOUSEHOLD, WIDER FAMILY AND COMMUNITY ENVIRONMENT	PRIMARY TO SECONDARY: PRIMARY, INTERMEDIATE AND HIGH SCHOOL	TERTIARY: UNIVERSITY, VOCATIONAL AND PTE PROGRAMMES	WORKFORCE: EMPLOYMENT IN A TECH ROLE OR WITHIN THE TECH SECTOR
BARRIERS	Household income impacts digital skills and access to devices and connections	Success at school is linked to effective delivery of the digital curriculum and positive engagement with learners	Financial, time and household pressures make it difficult to prioritise study	Tech employers are hesitant to hire and develop people with less experience in the sector
	A lack of exposure to tech careers limits involvement of underrepresented groups	Whaikaha learners can feel discouraged from pursuing educational pathways	Tāngata whaikaha contend with limited accessibility and understanding of their needs	Māori, Pacific peoples and women do not see themselves reflected in tech, which reinforces negative perceptions of the sector
	Tāngata whaikaha are more likely to face digital exclusion leading to wider inequities	Early school leaving and lack of exposure to tech careers limits Māori, Pacific and whaikaha learners' desire to enter the sector	Māori and Pacific students and NEETs require enhanced learner support, visible representation and cultural safety to flourish	Navigating the recruitment process presents significant challenges for underrepresented groups
				Additional guidance and support help Māori, Pacific and tāngata whaikaha to succeed in their roles
				Greater cultural competency and preparation for diverse needs is required from industry

Table 1: Summary of the barriers to inclusion in the tech sector of Aotearoa

Photo by Mikael Blomkvist from Pexels

Initiatives and recommendations to address the barriers

In this next section we provide examples of initiatives taking place across Aotearoa to tackle the barriers discussed so far. By demonstrating action on the part of communities, government, industry and NGOs, these initiatives point to a way forward for our digital future.

Nonetheless, as the analysis in this report has shown, there is still much to do to grow diversity and create a thriving and inclusive tech industry. Collaborations and focused investment are required across the Aotearoa tech landscape. Therefore, we also provide a set of recommendations on how to address specific areas of need – for both immediate action and long-term consideration.

Initiatives in place in the domestic environment

- **Rural Broadband Initiative (RBI2):** In 2017, 90,000 rural households and businesses were deemed to be excluded from fast broadband services.[99] RBI2 is a nationwide initiative to close this access gap by the end of 2024 (currently 84,000 delivered). Improved access for rural New Zealanders will facilitate use of digital services, remote learning and development of essential digital skills.
- **Marae Digital Capability Programme:** This programme supports marae across Aotearoa to develop their digital infrastructure through grants. To date, the programme has helped 563 marae to establish broadband connections and buy hardware. This infrastructure will also facilitate use of online health, social and education services, which can be hugely beneficial for households without digital access.[100]
- **Digital Equity Coalition (DECA):** With a mission to promote "clear, appropriate and affordable pathways to participate in digital life", DECA is a hub for digital inclusion in Aotearoa.[101] DECA works among the community to establish key issues by organising working groups (called constellations) to achieve solutions to digital exclusion.
- **The Digital Strategy for Aotearoa:** This cross-government strategy aims to create a more digitally inclusive society through three strategic themes: Trust, Inclusion and Growth.[102] Skills and education, sustainability and digital infrastructure are key components to support these themes. The strategy has been developed in recognition of the vast opportunities the digital sector provides and the high degree of digital exclusion that still exists in Aotearoa.
- **Fibre Fale:** This organisation aims to build representation of Pacific peoples "through education, advocacy and facilitation."[103] Part of this mission involves advocating for digital equity for Pacific peoples as well as providing a hub for Pacific peoples in the digital space.
- **See Tomorrow First:** This is a new initiative to raise the profile of the tech sector in Aotearoa, both for New Zealanders and international audiences. Part of the Digital Tech Industry Transformation Plan, the initiative develops the narrative of Aotearoa as an innovation hub in tech, moving beyond common conceptions of Aotearoa as a primary industries and tourism-dependent economy.
- **National and local roadshows, talanoa and hui:** Numerous tech talks are taking place around Aotearoa, aiming to showcase opportunities for underrepresented groups to pursue technology learning and careers. The key message in these talks is that tech is for everybody. Ko Māui Hangarau is a highly successful national roadshow targeting rangatahi Māori to inspire innovation using Māori ideas and values in the tech space. For Pacific peoples, centres like Porirua and Auckland have hosted talanoa where learners and families can hear a panel of Pacific tech professionals share their life experiences.

[99] (Crown Infrastructure Partners, 2022)
[100] (Te Puni Kōkiri, 2022)
[101] (Digital Equity Coalition Aotearoa, 2023)
[102] (New Zealand Government, 2022)
[103] (Fibre Fale, 2022)

Recommendations to achieve equitable access to digital tech at the domestic and community level

1. Government Chief Digital Officer to coordinate efforts across government to reduce digital exclusion by making internet connections more affordable or even free (as telephone connections once were). Efforts should align with the Digital Transformation Plan for Aotearoa. Boosting accessibility will enable more of the population to participate in digital life and benefit from digital services, especially in rural areas. Government subsidies for free connections in community housing and/or community spaces are potential avenues for making digital life immediately more accessible. DECA can be a valuable resource for informing this need.
2. Local Government New Zealand to work with councils to identify areas of digital exclusion and invest in libraries, community centres and marae in these areas to ensure they can provide reliable internet connections, up-to-date devices and basic tech skills training. Libraries in particular play an important role in assisting people to access digital services, especially for tāngata whaikaha and people who cannot afford quality connections and devices. Funding for dedicated staff and upskilling needs to match this demand.[104] Specialised community tech hubs are another way to offer essential tech skills training and low-level certifications.

DECA can be a valuable resource for informing this need. Additional strategies to boost digital inclusion and promote digital skills could include:

- continuing to provide information sessions on tech careers in community spaces to help grow understanding and interest in the sector. As the panellists of a recent tech talanoa pointed out, greater awareness of tech career prospects is needed for parents to better understand and guide an interest in tech[105]
- promoting government funding options for tāngata whaikaha to receive in-person support at home and access to assistive technologies. This will enable wider engagement with digital services and facilitate learning essential digital skills. In cases where home support is impractical or expensive, community hubs like libraries, marae and churches can enable engagement with digital skills and devices.

[104] (Digital Equity Coalition Aotearoa, 2023)
[105] (Tech Talanoa: Pasifika in Technical Tech, 2022)

Initiatives in place in primary and secondary education

- **NGOs supporting digital inclusion:** Organisations such as Manaiakalani and DigiTautua are focused on closing the digital access gap by providing devices for secondary and primary learners. Both organisations work within the Auckland region. The Manaiakalani programmes extend to providing internet connections and professional learning and development.
- **Corporate partnerships promoting digital skills for Māori and Pacific learners:** Initiatives like IBM's P-Tech and Apple's Racial Equity and Justice Initiative (REJI) aim to promote digital skills in schools with large numbers of Māori and Pacific learners. P-Tech supports the transition between secondary school and employment in digital technologies, operating in six schools in Auckland with high proportions of Pacific students. The programme runs in partnership with MIT (Te Pūkenga) and Media Design School. REJI is also supported by Te Pūkenga, where 20 kaiako and teachers from 10 schools and kura learn programming, app development and digital design skills for iOS (Apple iPhone's operating system). These educators will be able to teach those skills through a device grant by Apple.
- **Digital Natives Academy (DNA):** DNA is a non-profit tech hub in Rotorua supporting rangatahi Māori to explore digital skills and careers. DNA is interested in providing qualifications to learners to help solidify their pathways into the sector, namely in areas like coding, animation and esports. A large proportion of the rangatahi are NEETs or need wrap-around support, which DNA provides. DNA's edge is applying te ao Māori lens to tech while providing welcoming and fun digital engagement. DNA has developed a programme in schools using digital media by applying their practices to Māori unit standards.
- **Get into Games:** A 2022 initiative by DNA in partnership with Ministry of Education targeted at Years 7–9. It uses the Twitch platform to engage with students, teachers and parents to build interest in gaming and game making. Over 13,000 students from schools and kura were involved. Talks and activities covered three topics: digital wellbeing, esports industry and game development. Media Design School, DNA and several industry speakers took part. In 2023, Get into Games will consist of one major event and a collection of resources developed by Māori students who have progressed through creative/digital tech pathways into professional roles in the industry.
- **ShadowTech:** This initiative began in 2014 to provide girls and young women with workplace experience in the tech sector. Students accompany a tech sector mentor for a day to gain first-hand experience of life in a tech role. The initiative has now been extended for teachers to have the same experience. The tech professionals then provide on-going mentoring so that teachers can better guide their students to explore tech careers.

Recommendations to grow interest and improve pathways from primary and secondary education into tech

1. Ministry of Education to conduct focused research on the reasons Māori, Pacific and female learners are less inclined to take tech subjects.[106] Research outlined in the Toi Mai report Barriers for Women in Creative Technology Tertiary Training in Aotearoa begins to address this need for deeper insight.[107] Additional research on the benefits of flexible learning environments, particularly for neurodivergent learners, will contribute to the Ministry's ongoing work to eliminate streaming from schools and encourage participation in STEM subjects.
2. New Zealand Qualifications Authority (NZQA) to publish insights reports that focus on equity of opportunity for senior secondary school learners to achieve in STEM-related NCEA pathways. NZQA's equity reporting will contribute to a strong body of evidence for improved diversity in STEM.
3. The Ministry of Education to support kaiako, teachers and career advisors to demonstrate tech pathways to students and to recognise their innate qualities. Greater awareness of the opportunities on offer in tech and the wide range of skills desired by the sector is needed. The new government career planning website Tahatū will be a useful tool for promoting tech careers. Nonetheless, teachers and career advisors can actively help shift perceptions of tech for young people and whānau to emphasise the breadth of roles available and the skills in demand by tech employers, including communication, creativity, critical thinking and collaboration skills.

[106] This recommendation has been proposed by NZ Tech in its latest Digital Skills Aotearoa report highlighting a decline in participation rates in NCEA tech subjects. (NZ Tech, 2023)
[107] (Toi Mai, 2023)

Initiatives in place in tertiary education

- **Micro-credentials:** Toi Mai is working alongside Te Pūkenga and corporate partners to develop micro-credentials. These short certifications will be stand-alone upskilling/reskilling qualifications and may be stacked into diploma programmes. The benefits of micro-credentials include providing specific skills quickly so people can more easily fill skill gaps in the tech workforce.[108] This could be particularly useful for career changers.
- **Bespoke micro-credentials for Māori and Pacific communities:** Toi Mai is working alongside Māori and Pacific community providers in both South and West Auckland to develop a bespoke digital micro-credential and qualifications. The aim is to support Māori and Pacific youth considering a career pathway in the tech sector, providing a foundation for students transitioning out of the secondary school environment and into entry level roles in tech.
- **Unified Funding System (UFS) Learner Component:** The new UFS's Learner Component is designed to enable providers to better support learners – particularly underserved learners. These include whaikaha, Māori and Pacific learners, as well as learners with low prior achievement.
- **Digital apprenticeships:** Toi Mai is also supporting Te Pūkenga to establish digital apprenticeships to better meet the current growth of demand for IT skills and capabilities in Aotearoa. This model could help to address diversity issues in the sector, especially as groups like Māori, Pacific peoples, women and tāngata whaikaha are more likely to benefit from earn-as-you-learn models.
- **Targeted Training and Apprenticeship Fund (TTAF):** 2021 and 2022 saw the trial of a fees-free initiative for certain technology-related vocational qualifications. TTAF appeared to improve the diversity of learners in tech courses, attracting more women in particular. Equivalent full-time student (EFTS) data in technology subjects shows overall EFTS have nearly doubled between 2019 and 2021.[109] This initiative ended in December 2022.
- **Disability Action Plans (DAPs):** The Tertiary Education Commission now requires all tertiary education organisations to demonstrate how they are supporting whaikaha learners. All providers were required to submit their plans from 2022. DAPs will help providers to "identify good practices and offers a blueprint for change", promoting greater inclusion and consideration of needs for disabled and neurodivergent learners.

[108] (Toi Mai, 2022b)
[109] (Toi Mai, 2022b)

Recommendations to overcome barriers to participation in tertiary-level tech courses

1. Toi Mai to explore workplace earn-as-you-learn opportunities in conjunction with providers and employers. These opportunities will benefit learners facing financial or accessibility barriers, helping them to build tech skills and gain qualifications. Such models could include digital apprenticeships with pastoral care systems in place and blended learning to help learners gain required skills quicker.
2. Ministry of Education to fund targeted subsidies to help bridge the gap for groups more likely to struggle with tuition costs. The TTAF demonstrated that Māori, Pacific, tāngata whaikaha and women can benefit from such targeted subsidies.
3. Tech programme providers to continue to develop understanding of the physical and social barriers faced by whaikaha learners. Disability Action Plans are a positive step in this regard; however, providers must continue to address accessibility challenges of their physical environments like tech spaces, labs, classrooms and lecture theatres, as well as the accessibility of digital resources. Learners who are regularly disabled by their environment require greater flexibility to support constraints or disruptions they may face in their study routine, and therefore distance learning can be an advantage.

Additional strategies to grow diversity in tertiary tech courses could include:

- providing opportunities for Pacific, Māori, whaikaha and female students to interact with peers inside and outside of the classroom. This is especially important for learners who may be minorities in tech courses and can benefit from seeing people like themselves engaged in similar content. Ensure mentors are available to guide these learners as they adjust to their new learning environment
- promoting tech as a sound career choice for people of all backgrounds and abilities, promoting role models, narratives and cultural perspectives that demonstrate an inclusive tech ecosystem. This includes NEETs, for whom tech courses can be promoted in social support or community spaces where they may engage.

Initiatives in place in workforce

- **Iwi-led tech initiatives:** Ngāi Tahu via Tokona Te Raki are partnering with industry to develop an apprenticeship model primarily for Māori learners. The pilot is funded by the Ministry of Business, Innovation and Employment (MBIE).[110] The Tokona Te Raki project began with a small apprenticeship pilot model, aiming to support the development and creation of new career pathways that will empower and support more rangatahi Māori into roles in the technology sector. The project closely aligns with and supports the Digital Tech Industry Transformation Plan – specifically its skills and te ao Māori components. The pilot will deliver analysis, an insights report, an apprenticeship prototype and a roadmap for implementation. These insights and learnings will benefit others looking to implement similar apprenticeships.
- **Summer of Tech:** An industry-led initiative that bridges the gap between learning and earning by connecting employers with top local students and graduates for paid work experience and graduate jobs. Around 600 students take part in Summer of Tech, mainly in Auckland and Wellington regions.[111]
- **ReThink Tech Talent:** Canterbury Tech and Dorenda Britten are working with Workbridge and industry partners to deliver an employer programme supporting people with dyslexia in the tech sector. The ReThink Tech Talent programme partners argue that dyslexic people are one of many talent pools currently underemployed in Aotearoa and that their strengths could be of great use to the tech sector. Running in three stages, the programme began with workshops with organisations, recruiters and dyslexic employees, followed by a series of pilots. The partners intend to create a playbook for inclusion of dyslexic employees and expansion of the programme around the country.

[110] (Toi Mai, 2022b)
[111] (Toi Mai, 2022b)

Recommendations to lift participation and progression of underrepresented groups in the tech workforce

1. Toi Mai to promote good practice on inclusive hiring processes that appeal to diverse strengths and backgrounds, supporting progressive recruitment programmes like ReThink Tech Talent. Toi Mai should emphasise providing space for inexperienced recruits to build their knowledge and skills in a supportive environment. Clear expectations in the recruitment process – and a better understanding of culturally specific qualities and diverse needs, abilities and talent sources – can help smooth the path for employers and employees.
2. Technology employers to partner with providers and Toi Mai to pilot earn-as-you-learn options. These options can help shift the focus from hiring experienced people and better aligns skills with industry needs, reducing the need for on-the-job training.[112]
3. Peak bodies such as NZ Tech and ITPNZ to partner with Toi Mai to develop and share good practice on cultural understanding and inclusivity among tech organisations. Better practices will lessen the burden of representation for minority groups within organisations and encourage individuals from underrepresented groups to enter the sector. Diverse representation can be supported through media and talks where staff share their experiences of success in the tech sector.

Additional strategies to boost diversity in the workforce could include:

- improving communication between industry and education providers to better align skills with industry needs, thereby reducing the need for on-the-job training. Toi Mai plays a key role here
- publicising the existence of roles that leverage different strengths and empower people to recognise their skills and potential.

[112] This point relates to recommendation 2 under Recommendations to grow interest and improve pathways from primary and secondary education into tech above.

Current research and priorities for Toi Mai going forward

This report supports our ongoing work to improve diversity in the tech sector of Aotearoa. Future research and engagement will be prioritised according to the most significant gaps in our current understanding, our priority learner groups (Māori, Pacific peoples and tāngata whaikaha, as stipulated by our Order in Council), and those groups with lowest representation in tech education and workforce. We hope that this report will also serve as a starting point for other government agencies and organisations investigating diversity challenges and opportunities in the tech sector.

To build on the desktop research and preliminary stakeholder engagement undertaken for this report, our Toi Whānui team is engaging with learners, professionals and advocates from the groups identified here. This work is currently underway in two separate workstreams:

- Tāngata whaikaha in Tech qualitative research
- Toi Whānui Workforce Development Plan.

The following section describes the research outlook of Toi Mai by summarising gaps in our current understanding and indicating where more attention is needed. This outlook considers work currently underway by other research groups around Aotearoa, as well as prioritisation according to our research strategy and capacity.

More insights are needed on the experiences of tāngata whaikaha in the tech sector

While there is a good degree of understanding of the challenges faced by whaikaha learners and employees, a clearer understanding of their experiences in tech education and workforce is still needed. At this stage, Toi Mai has limited awareness of initiatives in place for disabled and neurodivergent people in tech, nor what tech employers have in place to support their needs.

For this reason, qualitative research with tāngata whaikaha is considered **high priority** and currently underway. Focused face-to-face research with tāngata whaikaha engaged in tech as students or workers will help to increase understanding of the barriers they encounter and, importantly, opportunities to overcome those barriers. We also ask what future tāngata whaikaha see for themselves in the sector. Employers, educators and civil society are included in this conversation to ensure a range of perspectives are gathered. These insights will be published as a report that will be available in accessible formats. Insights will also be used in our upcoming Toi Whānui Workforce Development Plan, advice to TEC and potential earn-as-you-learn pilots with providers and industry.

There is significant activity on digital skills for Pacific peoples, but further research would be beneficial to promoting inclusion in the sector

More insights are needed on how Pacific peoples are participating in the tech sector in Aotearoa. The *Digital Skills for Our Digital Future* report, the government's Digital Inclusion User Insights – Pacific Peoples report, and anecdotal evidence gathered from early engagements with Pacific stakeholders provide a useful overview of Pacific peoples' engagement in the sector. More detailed qualitative insights on the barriers and enablers faced by Pacific peoples in the tech industry will be gained through talanoa hosted in Tāmaki Makaurau and Porirua in 2023. These insights will inform our Workforce Development Plans and advice. A better understanding of how COVID-19 Response funding and initiatives like Tupu Aotearoa and Toloa (promoting STEAM pathways for Pacific peoples) have positively impacted digital skills and tech participation would also be beneficial. Finally, *Building a Collaborative Pacific Tech, Music and Performing Arts Project and Strategy within Tāmaki Makaurau*, a project by Toi Mai, is underway. Therefore, engagement with this group is ongoing and considered **medium** to **high priority.**

[113] (Toi Mai, 2023)
[114] This research has been funded by Auckland Unlimited, Spark Foundation and Pūhoro STEMM Academy. A summary of the research findings is available at aucklandnz.com/techakl.
[115] (Making Everything Achievable, Ministry of Business Innovation & Employment, NZ Tech and Te Whare Wānanga o Awanuiārangi, 2023)
[116] (Pāua Interface Ltd, 2023)

Female participation in the tech is growing but we need to better understand barriers and motivations

The Targeted Training and Apprenticeship Fund (TTAF) showed significant improvements in numbers of underrepresented groups in tech courses during 2021–2022. This was especially so for female learners, with a 137% increase in participation. Further qualitative insights would help to clarify how assisted funding facilitates entry into tech courses and the motivations or deterrents for women interested in tech careers. While the trend is towards growth in female participation, gaining deeper insights into the intersectional experiences of women in tech remains important. Toi Mai has recently published our research *Barriers for Women in Creative Technology Tertiary Training in Aotearoa*. It compliments this report on diversity in our tech sector, helping to fill gaps in our understanding of how women are engaging with creative tech courses and the barriers they encounter. The research used qualitative and quantitative methods and is published in two reports on the Toi Mai website.[113] Further focused research in this area therefore sits at **medium** to **low priority** for Toi Mai.

There is currently strong research underway on Māori tech sector participation and pathways

Improving outcomes for Māori in tech education and the tech workforce are key objectives for Toi Mai. This is informed by current low representation by Māori in all areas of the tech sector. However, robust kaupapa Māori research on Māori participation in tech has recently been published. This includes the *Te Au Hangarau* project by Aatea Solutions (supported by Korou Digital)[114] and *Mapping the Māori Tech Sector* by Making Everything Achievable in collaboration with Te Whare Wānanga o Te Awanuiārangi and NZ Tech (supported by Ministry of Business, Innovation and Employment).[115] Additionally, Pāua Interface's *Toi Hangarau* report on Māori owned technology companies in 2023 provides in-depth insights on leading Māori tech enterprises and their successes and challenges.[116] Toi Mai can leverage and build on insights resulting from this research rather than carry out new primary research, making this research stream a **lower priority** at this stage. In future, gaining insights on how Māori learners are engaging with tech in education and how industry-led programmes in schools are fostering tech skills will help Toi Mai to understand learner pathways into the sector.

Participation and challenges of LGBTQIA+ in tech education and workforce is unclear

Data specific to LGBTQIA+ people in the technology workforce has been difficult to gather. While articles and blogs relating to LGBTQIA+ experiences are available, quality insights specifically relating to the tech sector of Aotearoa are few. For this reason, Toi Mai recommends holding focus groups with people from the rainbow community to gain a preliminary understanding of their experiences, beginning in major tech centres like Wellington, Auckland and Christchurch. This work could serve as a basis for subsequent research, however new primary research here would be deemed **lower priority** than the groups described above.

Photo by Israel Andrade from Pexels

Bibliography

Addison, A. (2022). *Redressing the Gender Imbalance in the Information Technology Sector.* Christchurch: Unpublished manuscript.

Bank of New Zealand. (2021). *BNZ Digital Skills for Life in Aotearoa*. Auckland: Bank of New Zealand.

Bay of Plenty Regional Skills Leadership Group. (2022). *Bay of Plenty Local Insights Report: February 2022*. Wellington: Ministry of Business, Innovation and Employment.

Calhoun, L., Jayaram, S., & Madorsky, N. (2022, June 1). *Leaky Pipelines or Broken Scaffolding? Supporting Women's Leadership in STEM*. Retrieved from Stanford Social Innovation Review: https://ssir.org/articles/entry/leaky_pipelines_or_broken_scaffolding_supporting_womens_leadership_in_stem#

Crown Infrastructure Partners. (2022, October 18). *What is the Rural Broadband Initiative phase two (RBI2)?* Retrieved from crowninfrastructure.govt.nz: https://www.crowninfrastructure.govt.nz/rural/what/

Department of Corrections. (2021). *Prison facts and statistis* - March 2021. Wellington: Department of Corrections.

Díaz Andrade, A., Hedges, M., Pacheco, G., & Turcu, A. (2021). *The world internet project New Zealand 2021* Auckland: New Zealand Work Research Institute.

Digital Equity Coalition Aotearoa. (2023, May 4). Spotlight on Digital Equity. Virtual, New Zealand.

Digital Equity Coalition Aotearoa. (2023, July 11). *What is DECA*. Retrieved from https://www.digitalequity.nz/

DivergenThinking. (2021). *What is neurodiversity?* Retrieved from https://divergenthinking.co.nz/what-is-neurodiversity/

Education Counts. (2022, July 1). *School Rolls*. Retrieved November 30, 2022, from Education Counts: https://www.educationcounts.govt.nz/statistics?

Employment New Zealand. (2022, August 2). *Barriers to youth employment*. Retrieved from Employment.govt.nz: https://www.employment.govt.nz/starting-employment/hiring/hiring-young-people/barriers-to-youth-employment/Fibre Fale. (2022, September 29). *fibrefale.com*. Retrieved from Fibre Fale: https://www.fibrefale.com/

Figure.nz. (2022, July 7). *Unemployment rate in New Zealand: By ethnic group, 2008–2021,% of the labour force.* Retrieved from Figure.nz: https://figure.nz/chart/YYrJRzlvHU7wkNdF-YkV9D331MrB8DeFh

Government Inquiry into Mental Health and Addiction. (2018, December 6). 3.2 Our conclusions. Retrieved from Mentalhealth.inquiry.govt.nz: https://mentalhealth.inquiry.govt.nz/inquiry-report/he-ara-oranga/chapter-3-what-we-think/3-2-our-conclusions/

Grimes, A., & White, D. (2019). *Digital Inclusion and Wellbeing in New Zealand.* Wellington: Motu Economic & Public Policy Research.

IT Professionals New Zealand. (2022). *Upskilling and Reskilling in the Digital Technology Sector - A Deep Dive.* Wellington: IT Professionals New Zealand.

IT Professionals New Zealand, and NZ Tech. (2021). *Digital Tech Industry Transformation Plan. Wellington:* IT Professionals NZ.

Jackson, A., Burmester, B., Clayton, D., Hennity, S., & Barton-Howes, Z. (2022). *Transitions from Secondary School.* Wellington: Tertiary Education Commission.

Kiro, C., Hynds, A., Irving, E., Wilson, A., Bendikson, L., Cockle, V., . . . Rangi, M. (2016). *Starpath Phase 2: Final Summative Evaluation Report.* Auckland: University of Auckland.

MacLeenan, V. (2022, July 8). *Growing the Industry: Expanding our definition of diversity.* Retrieved from techblog.nz: https://techblog.nz/2908-Growing-the-Industry-Expanding-our-definition-of-diversity

Making Everything Achievable, Ministry of Business Innovation & Employment, NZ Tech and Te Whare Wānanga o Awanuiārangi. (2023). *Mapping the Māori Tech Sector: 2023 and beyond.* Wellington: Making Everything Achievable.

Ministry for Pacific Peoples. (2020). *Pacific Aotearoa Status Report.* Wellington: Ministry for Pacific Peoples.

Ministry for Pacific Peoples. (2020).*Pacific Aotearoa Status Report.* Wellington: Ministry for Pacific Peoples.

Ministry for Women. (2017). *Decoding Diversity: How to attract and retain girls and women in tech education.* Wellington: Ministry for Women.

Ministry for Women. (2022). *Te Mahere Whai Mahi Women's Employment action Plan.* Wellington: Manatū Wāhine Ministry for Women.

Ministry of Business, Innovation & Employment. (2021a). *Overview of Māori employment outcomes in Aotearoa New Zealand.* Retrieved from mbie.govt.nz: https://www.mbie.govt.nz/business-and-employment/employment-and-skills/employment-strategy/maori-employment-action-plan/annexes/overview-of-maori-employment-outcomes-in-aotearoa-new-zealand/

Ministry of Business, Innovation & Employment. (2021b). *Pacific Peoples in the Labour Market - June 2021 Quarter (unadjusted).* Wellington: Ministry of Business, Innovation & Employment.

Ministry of Business, Innovation & Employment. (2021c). *Māori in the Labour Market - June 2021 Quarter (unadjusted).* Wellington: Ministry of Business, Innovation & Employment.

Ministry of Business, Innovation & Employment. (2022b, March). *Youth not in employment, education or training in New Zealand.* Retrieved December 12, 2022, from Regional Economic Activity Web Tool: http://webrear.mbie.govt.nz/theme/neet-rate/map/timeseries/2022/new-zealand?right-transform=absolute

Ministry of Business, Innovation and Employment. (2021, September). *Overview of Māori employment outcomes in Aotearoa New Zealand*. Retrieved November 30, 2022, from mbie.govt.nz: https://www.mbie.govt.nz/business-and-employment/employment-and-skills/employment-strategy/maori-employment-action-plan/annexes/overview-of-maori-employment-outcomes-in-aotearoa-new-zealand/

Ministry of Business, Innovation and Employment. (2022a). *Digital Technologies Draft Industry Transformation 2022–2032.* Wellington: Ministry of Business, Innovation and Employment.

Ministry of Education. (2018a). *Mathematics literacy achievement: senior secondary schooling.* Wellington: Ministry of Education.

Ministry of Education. (2018b). *Reading literary achievement: senior` secondary schooling.* Wellington: Ministry of Education.

Ministry of Education. (2019, November). *Disabled people and tertiary education: An analysis of the 2013 Disability Survey.* Retrieved from Education Counts: https://www.educationcounts.govt.nz/publications/80898/disabled-people-and-tertiary-education

Ministry of Education. (2020b). *Early Leaving Exemptions 2020 Indicator.* Wellington: Ministry of Education.

Ministry of Education. (2021). *He Whakaaro: Does streaming work? A review of the evidence.* Wellington: Ministry of Education.

Ministry of Education. (2022a, July 7). Secondary Subjects Enrolment Pivot 2007–2021. *Unpublished*. Data supplied by Shaun Gear at Ministry of Education.

New Zealand Council for Educational Research. (2020). *Learning with digital technologies.* Wellington: New Zealand Council for Educational Research.

New Zealand Game Developers Association. (2021, December 9). *NZ Interactive Games 2021 Survey Results.* Retrieved from NZGDA.com: https://nzgda.com/news/survey2021/

New Zealand Game Developers Association. (2022, November 28). *NZ Interactive Media Industry Survey 2022.* Retrieved from NZGDA.com: https://nzgda.com/news/nz-interactive-media-industry-survey-2022/

New Zealand Government. (2021). *Digital inclusion user insights — Pacific peoples.* Wellington: Department of Internal Affairs.

New Zealand Government. (2022). *The Digital Strategy for Aotearoa.* Wellington: Department of Internal Affairs.

New Zealand Treasury. (2019). *Discussion Paper 19/01: An Indigenous Approach to the Living Standards Framework.* Wellington: New Zealand Treasury. Retrieved from https://www.treasury.govt.nz/publications/dp/dp-19-01

NZ Tech. (2023). *Digital Skills for Tomorrow, Today.* Auckland: NZ Tech.

NZ Tech, and New Zealand Digital Skills Forum. (2021). Digital Skills For Our Digital Future.

Office for Disability Issues. (2016, 12 1). *Key facts about disability in New Zealand.* Retrieved from odi.govt.nz: https://www.odi.govt.nz/home/about-disability/key-facts-about-disability-in-new-zealand/

Office for Disability Issues. (2016). *New Zealand Disability Strategy 2016–2026.* Wellington: Ministry of Social Development.

Pāua Interface Ltd. (2023). *Toi Hangarau: A Report on Māori-owned Technology Companies 2023.* Auckland: Pāua Interface Ltd.

People's Inquiry into Sudent Wellbeing. (2022). *People's Inquiry into Sudent Wellbeing.* Auckland: Point & Associates.

Preston, D., & Grbic, V. (2022, May 4). Learners at the centre of a transformed vocational education system. Wellington: Te Pūkenga.

Primary ITO. (2022, June 23). *Mentoring inspires trainees for learner success.* Retrieved from Primary ITO: https://www.primaryito.ac.nz/news/mentoring-inspires-learners-for-learner-success/

Scarlatti. (2022). *The COVID-19 Recovery Baseline Engagement and Data Project (BED).* Wellington: Unpublished manuscript.

Scarlatti. (2022). *Workforce Mobility in New Zealand's CCRT Sectors.* Wellington: Toi MAi.

Schulze, H., & Hurren, K. (2020). *Ka whati te tai: a generation disrupted.* Christchurch: Tokana Te Raki.

Stats NZ. (2014, June 17). *Disability survey:* 2013. Retrieved from Stats NZ: https://www.stats.govt.nz/information-releases/disability-survey-2013

Stats NZ. (2017, September 8). *Forty-two percent of disabled youth not earning or learning.* Retrieved from Stats NZ: https://www.stats.govt.nz/news/forty-two-percent-of-disabled-youth-not-earning-or-learning/

Stats NZ. (2020a, October 28). *The disability gap 2018.* Retrieved from Stats NZ: https://www.stats.govt.nz/infographics/the-disability-gap-2018

Stats NZ. (2020b, October 28). *Measuring inequality for disabled New Zealanders: 2018.* Retrieved from Stats NZ: https://www.stats.govt.nz/assets/Uploads/Reports/Measuring-inequality-for-disabled-New-Zealanders-2018/Download-data/Measuring-inequality-for-disabled-New-Zealanders-2018-Stats-NZ.pdf

Stats NZ. (2020c, August 26). *Labour market statistics (disability): June 2020 quarter.* Retrieved December 12, 2022, from Stats NZ: https://www.stats.govt.nz/information-releases/labour-market-statistics-disability-june-2020-quarter/

Stats NZ. (2020d). *National Population Projections.* Wellington: Stats NZ.

Stats NZ. (2020e). *Housing in Aotearoa 2020.* Wellington: Stats NZ.

Stats NZ. (2021, November 12). *1 in 20 adults identify as LGBT+ in major social survey.* Retrieved from Stats NZ: https://www.stats.govt.nz/news/1-in-20-adults-identify-as-lgbt-in-major-social-survey

Stats NZ. (2022, September). *Household Labour Force Survey.* Retrieved from Stats NZ: https://datainfoplus.stats.govt.nz/Item/nz.govt.stats/b7c39358-aa03-446f-a27d-91c37caac35d#:~:text=Household%20Labour%20Force%20Survey%20(HLFS)&text=The%20HLFS%20is%20a%20nationwide,it%20began%20in%20October%201985.

Taiuru, K. (2022). Honouring Te Tiriti o Waitangi in Data and Technology Projects. In A. Pendergrast, & K. Pendergrast , *More Zeros and One: Digital Technology, Maintenance and Equity in Aotearoa New Zealand* (pp. 47–63). Wellington: Bridget Williams Book Ltd.

Te Ihuwaka. (2022). *Thriving at Shool - Education for disabled learners in schools.* Wellington: Te Ihuwaka - Education Evaluation Centre.

Te Pūkenga. (2021a). *Te Rito: Insights from learners and staff - opportunties to enhance success for Te Pūkenga disabled learners*. Hamilton: Te Pūkenga.

Te Pūkenga. (2021b). *Te Rito: Insights from learners and staff - opportunities to enhance success for Te Pūkenga Pacific learners and Pacific staff.* Hamilton: Te Pūkenga.

Te Pūkenga. (2021c). *Te Rito: Insights from learners and staff - opportunities to enhance success for all Te Pūkenga learners and Māori learners.* Hamilton: Te Pūkenga.

Te Puni Kōkiri & the Treasury . (2019). *An Indigenous Approach to the Living Standards Framework*. Wellington: NZ Treasury.

Te Puni Kōkiri. (2022, September 29). *Marae Digital Connectivity.* Retrieved from Te Puni Kōkiri: Minisry of Māori Development: https://www.tpk.govt.nz/en/nga-putea-me-nga-ratonga/marae/marae-digital-connectivity

Tech Talanoa: *Pasifika in Technical Tech.* (2022, September 1). Porirua.

Tertiary Education Commission. (2022b, October 11). Ngā Kete Database. Wellington, New Zealand.

The Auckland Co Design Lab. (2016). *The Attitude Gap Challenge: A South Auckland Employment and Skills Challeng*e. Auckland: The Auckland Co Design Lab.

Toi Mai. (2022a). *The COVID-19 Recovery Baseline Engagement and Data Project.* Wellington: Toi Mai.

Toi Mai. (2022b). *Toi Mai Workforce Development Plan.* Wellington: Toi Mai.

Toi Mai. (2022c, (forthcoming). Spotlight on New Zealand's game development industry. Wellington: Toi Mai.

Toi Mai. (2023, May). *Createch reports.* Retrieved from Toi Mai: https://toimai.nz/publications/createch-reports/

Toi Mai and NZ Tech. (Forthcoming). Digital Skills Survey 2022. *Digital Skills Survey 2022.* Wellington: Toi Mai.

Valintine, F. (2019). Education Gen Z in a digital world. *New Zealand Council for Educational Research*, 1–16.

Valintine, F. (2022, July 22). Future of Education: 2022 and Beyond. Retrieved November 23, 2022, from https://www.youtube.com/watch?v=3MqAFTYJ72U&ab_channel=TheMindLab

Workbridge. (2020). *Policy that works: A fair go for disability employment post-COVID-19.* Wellington: WorkBridge.

Wylie, C., & Bonne, L. (2016). *Secondary schools in 2015: Findings from the NZCER national survey.* Wellington: New Zealand council for Educational Research.

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