

# Journeys of Māori Women in Engineering and Engineering Trades: Navigating Challenges and Embracing Identity

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## ABSTRACT

### CONTEXT

To address the underrepresentation of Māori women in engineering and engineering trades, it is crucial to understand the experiences of those currently working in these fields. This study explores the lived experiences of five Māori women in New Zealand, with the aim of inspiring more Māori women to pursue careers in these professions. The study explored three pivotal phases of women's lives through in-depth interviews: background and upbringing, experiences during education, and encounters in the profession.

### PURPOSE OR GOAL

The research aims to identify barriers encountered by these women and the strategies they employed to navigate their journeys.

### APPROACH OR METHODOLOGY/METHODS

Data collection involved an initial short questionnaire and two semi-structured interviews. Qualitative inductive analysis was used. Early thematic coding occurred during the analysis of initial questionnaires to identify key themes for the interviews. Interview data were coded inductively by research assistant and cross-checked by the main researchers to find common themes.

### ACTUAL OR ANTICIPATED OUTCOMES

The lives and experiences the five Māori women in this study illuminate the unique experiences and challenges faced by indigenous women pursuing careers in engineering and engineering trades. Common themes such as identity development, others' beliefs and attitudes, cultural identity, determination, and support and encouragement frame the discussion, assisting in demystifying societal realities and gaining insight into their social realities.

### CONCLUSIONS/RECOMMENDATIONS/SUMMARY

Collaborative efforts from educators, researchers, and policymakers are needed to address systemic barriers and create inclusive pathways for indigenous women and other underrepresented groups into engineering. Flexible support services tailored to the diverse needs are essential for facilitating success in these fields. The researchers suggest further research should focus on longitudinal studies tracking the career trajectories of minority groups, exploring how cultural and gender identities influence educational experiences, evaluating the effectiveness of existing support programmes, and examining the role of mentorship and support networks in empowering minority students to succeed in engineering and trades careers.

### KEYWORDS

Māori, engineering, trades, indigenous women

## Introduction

Despite efforts to promote diversity in gender and ethnicity, disparities persist in engineering and engineering trades in New Zealand (NZ), with Māori women significantly underrepresented. This study amplifies the voices of Māori women who pursued careers in engineering and engineering trades. Engineering trades involve skilled work in areas like electrician and construction, while engineering qualifications encompass higher education degrees providing deeper theoretical knowledge (level 6 and above).

Recent initiatives emphasize the importance of diversity for innovation and effective problem-solving (Arriagada, 2021; Chopra, 2022). However, Māori women remain underrepresented and missing opportunities for economic stability and reduced gender pay gaps. For instance, Māori women earn significantly less per hour than their NZ European male counterparts, reflecting broader trends of occupational segregation and gender pay disparities (MBIE, 2023; Stats NZ, 2018).

In response to the shortage of skilled workers in trades, the NZ government announced a \$230 million NZD investment in trades training programmes in 2022, building on an initial \$1.6 billion NZD investment made in 2020 (Weekes & Neilson, 2022). Government investments in trades training highlight the potential for increased participation, yet the majority of apprentices remain European males (Education Counts, 2022).

NZ construction industry employs 10% of the national workforce, and contributes 6.2% to the GDP (MBIE, 2020). Despite its significance, only 13% of the workforce in construction are women, and a mere 2.5% of those in engineering trades are women. This, underscoring the need for targeted efforts to recruit more women, particularly Māori women, into these roles.

This study focuses on the experiences of five Māori women in engineering and engineering trades across different phases of their lives. The aim of this research was to identify the barriers and challenges the women experienced and the factors, opportunities, and strategies that they employed which assisted them through their journey. The insights gained aim to inform policymakers, educators, and employers on fostering inclusive and supportive environments. By sharing their stories, we aim to inspire more Māori women and girls to follow their footsteps. The study provides insights into the experiences of Māori women in engineering and engineering trades using a narrative approach.

## Literature Review

Diversity remains a persistent concern within traditionally male-dominated fields such as engineering and trades, as demonstrated by numerous studies (Fletcher et al., 2021; Ibáñez, 2017; Manesh et al., 2020; Simon & Clarke, 2016). The literature underscores the invaluable contributions of a diverse workforce, including fresh perspectives, insights, and innovative problem-solving approaches (Benavent et al., 2020; Hutton, 2019).

Efforts to enhance diversity in engineering must address systemic barriers across all levels of education. Women and racial minorities are disproportionately affected by these barriers, often referred to as the "leaky pipeline" (Clewell, 1992). For instance, in the US, women comprised only 9.9% of the construction workforce in 2018 (Bureau of Labor Statistics, 2018), highlighting the significant underrepresentation in this sector.

Addressing the underrepresentation of women of colour is not solely an economic concern but also a matter of social justice (Cantor et al., 2014). Barriers persist for students intersecting race, gender, ethnicity, and socioeconomic status, impacting their academic and professional journeys (Morris, 2016). Indigenous Canadians, for example, face systemic barriers to post-secondary education due to colonization's legacy, including culturally irrelevant curricula, relocation, lack of guidance, and intergenerational trauma (Arriagada, 2021; Truth & Canada, 2015). Similar challenges are observed among other indigenous communities globally (Arriagada, 2021; Behrendt et al., 2012) including NZ Māori.

In NZ, Māori, comprise 17.3% of the population (Stats NZ, 2023). The Treaty of Waitangi, signed in 1840, promised protections for Māori culture and sovereignty, but subsequent policies largely stripped these protections, relegating Māori to manual labour roles (Theodore et al., 2016). Māori educational experiences bear similarities to those of other indigenous peoples in developed nations, with a focus on practical skills over academic achievement (Smith, 2009). Despite historical obstacles, Māori participation in higher education has increased. However, significant disparities remain, necessitating continued efforts to address these inequities (Ministry of Education, 2013).

NZ faces a notable shortage of skilled workers in sectors such as construction and engineering. Despite making up half of the working-age population, women are significantly underrepresented in these industries, with only 2.5% of construction tradespeople being women (Ministry for women, 2021). Attracting more women and Māori women to these fields is crucial to addressing the skills shortage. One primary barrier for women in construction is the lack of proper facilities and resources, such as inadequate sanitary facilities and ill-fitting personal protective equipment (Greene & Stitt-Gohdes, 1997). Additionally, industry culture often perpetuates gender stereotypes, hindering career progression and work-life balance (Menches & Abraham, 2007). Government investments in trades training highlight the potential for increased participation. However, significant gender and ethnic disparities persist, with a majority of apprentices being European males (Education Counts, 2022). The Māori and Pacific Trades Training (MPTT) initiative aims to increase Māori and Pasifika participation in trades, though challenges remain in completion rates (Bellett, 2017).

In engineering, women and Māori are also underrepresented. Women comprise less than 25% of engineering students, and research highlights various barriers including outdated facilities, inadequate career guidance, societal stereotypes, and teacher reinforcement of these stereotypes (Fox-Turnbull et al., 2023; Moridnejad et al., 2020). Women in engineering also leave the field at higher rates due to dissatisfaction with pay, promotion opportunities, and the need to work harder for recognition (Fernando, 2011; Hunt, 2016).

To assist our understanding into the low representation of Māori women in engineering and engineering trades, this study explores the experiences of five Māori women in education and employment. By examining the experiences, barriers, challenges, opportunities, and strategies these women employ, this research aims to inform policymakers, educators, and employers on creating inclusive and supportive environments. Sharing the stories of Māori women in these professions seeks to inspire more Māori women and girls to pursue these careers, contributing to increased diversity and equity in NZ.

## Methodology

A critical aspect of engineering education research is how the researchers' positioning influences the study. Understanding the positionality of the researchers is crucial in shaping the epistemological, ontological, and methodological perspectives of this study (Secules et al., 2021). Both key researchers in this study are women; one is a third generation Pākehā (New Zealander of European descent), and the other is an Iranian immigrant. One researcher is an engineering educator and former engineer, while the other is a teacher educator and former teacher, experienced in qualitative educational research dealing with complex social interactions.

The study is underpinned by a feminist poststructuralist conceptual framework, emphasizing that knowledge is constructed rather than discovered, and power relations are shaped within cultural and societal contexts. This framework aligns with the researchers' constructivist stance, common in contemporary educational theory, and aims to demystify societal realities (MacNaughton et al., 2010). Feminist theory assists in understanding the experiences of groups outside the dominant discourse—here, gender and ethnicity—with the goal of creating change (MacNaughton et al., 2010). A feminist perspective focuses on making women's experiences visible, raising their consciousness, and empowering them (Holloway & Wheeler, 2010). It also aims to disrupt systems of oppression or societal barriers to create change (Arinder, 2020) and reframe the relationship between gender, environmental, cultural, and social fields (McLeod, 2005).

This study employs a qualitative case study approach to investigate the lived experiences of Māori women in engineering and engineering trades. Case studies are chosen for their ability to recognize the complexity and embeddedness of social truth (Cohen et al., 2011; Cohen et al., 2018). Purposeful sampling was used to identify participants through their former lecturers. Given the small cohort size, identifying participants was challenging. Participants consented to be part of the research and to participate in the production of promotional resources, including posters and videos. Pseudonyms are used to protect participants' identities: Kylie (junior civil engineer), Suzzie (intermediate mechanical engineer), Rawehe (apprentice builder), Laura (qualified builder), and Peta (apprentice electrician).

Data collection involved an initial short questionnaire and two semi-structured interviews with at least two researchers present. The questionnaire and interviews explored participants' career choices, childhood, schooling, tertiary education, and workplace experiences. The first interview was video-recorded, and subsequent interviews were informed by the initial interview's findings. The second interview was professionally videoed for wider dissemination, asking participants to speak to young Māori girls considering their future careers. Interviews lasted between 45 minutes to 1.25 hours, were transcribed using Otter software, and cross-checked by the research team.

Qualitative analysis in this study is inductive, identifying patterns during data gathering (Neuman, 2011). Early thematic coding occurred during the analysis of initial questionnaires to identify key themes for the interviews. Interview data were coded inductively by research assistants and cross-checked by the main researchers to find common themes. In a further analysis phase, interview transcripts were loaded into ChatGPT to identify key commonalities, which were compared with researchers' codes to finalize the themes. These themes framed the discussion and provided a basis for understanding the lived experiences of Māori women in engineering and engineering trades.

## **Findings and Discussion**

The lives and experiences the five Māori women in this study illuminate the unique experiences and challenges faced by indigenous women pursuing careers in engineering and engineering trades. By amplifying their voices, this research highlights their perspectives, celebrates their agency and resilience, and showcases how they assert themselves, overcome challenges, and advocate for gender equality in their professions. Common themes such as identity development, others' beliefs and attitudes, cultural identity, determination, and support and encouragement frame this discussion, assisting in demystifying societal realities and gaining insight into their social realities. This research aims to empower and make these women visible.

### **Identity Development**

The participants' backgrounds reveal a strong influence of their upbringing on their career choices. Kylie and Suzzie, both engineers, had farming backgrounds, fostering a "can do" attitude and a love for machinery. Peta's father, skilled in various trades, inspired her belief that she could do anything. Rawehe's father was also a tradesperson, and Laura's family was similarly involved in trades, with a creative mother who renovated their home.

None of the women received negative messages about their ability to work in any profession. Although not explicitly encouraged into their selected professions, their career choices did not surprise their families, who saw them as "outdoorsy" types. This supports feminist theory's assertion that early socialization and family dynamics shape gender identities and career choices (Cuomo & Massaro, 2016; Seron et al., 2018).

### **Others' Beliefs and Attitudes**

The participants faced gendered comments and stereotypes, a significant barrier in male-dominated fields like engineering and trades (Agapiou, 2002; Denissen, 2010). Tradeswomen reported derogatory remarks from colleagues and clients, such as doubts about their abilities or inappropriate comments. Peta, for instance, laughed off such comments, attributing them more to ethnicity than gender. The participants emphasized that negative comments were not regular

occurrences and reported generally positive workplace experiences. Support from colleagues and supervisors, who often changed their behavior in the presence of women, was crucial. Rawehe, for example, noted that her colleagues' language changed over time, and they recognized her as a hardworking and committed professional. This aligns with findings that women in trades often prove themselves by excelling in their jobs, earning respect and acceptance (Agapiou, 2002).

### **Cultural Identity**

Cultural identity played a significant role in the participants' experiences. Three participants attended Kura Kaupapa Māori for their primary education, but two felt disconnected from their culture in later schooling. Suzzie, for example, lost her language and cultural connection after moving to a different community. Kylie, feeling isolated at her first engineering job, sought a workplace where she could connect with other Māori individuals. Peta felt lost when she went to 'pakeha' school for her secondary education. One of her long-term goals was to be part of an engineering firm that was underpinned by, and practiced engineering based on tikanga Māori.

Rawehe and Laura, with more Western upbringings, recently began reconnecting with their Māori heritage. However, they struggled to integrate tikanga Māori into their work, viewing their cultural journey as more personal and familial. Suzzie, on the other hand, actively engaged with Māori culture at work, contributing to discussions about cultural competency and feeling valued for her cultural knowledge. This underscores the need for a considerable cultural shift within industries to ensure Māori women can succeed as both professionals and as Māori (Bishop et al., 2009).

### **Determination and Resilience**

The narratives highlight the strength and resilience of these women. Kylie gained confidence working in a tough environment as the only woman in a roading company. Suzzie's career shift from retail to engineering involved significant sacrifices, demonstrating her dedication. Peta balanced learning a new trade with personal responsibilities, showcasing her determination. Laura and Rawehe similarly exhibited resilience, with Laura becoming a qualified builder and Rawehe continuing her apprenticeship while pregnant.

These stories reflect findings that women in trades often exhibit strong interest, determination, and confidence, leading to greater dedication compared to their younger male counterparts (Agapiou, 2002). They also emphasize the importance of self-confidence and support in overcoming challenges and excelling in their professions.

### **Support and Encouragement**

Support networks played a pivotal role in the participants' success. Positive feedback from managers and clients motivated them, and support from family, mentors, and supervisors was crucial. Suzzie, for example, was encouraged to pursue engineering by her supervisor, and Rawehe emphasized the importance of having a supportive boss.

The participants' positive experiences at polytechnic institutes, particularly in classes specifically for Māori and Pasifika students, provided a sense of belonging and cultural connection. However, Laura's experience differed as she did not feel the need for extra academic support and felt out of place in a classroom for Māori and Pasifika students. This highlights the need for flexible support services tailored to the diverse needs of indigenous learners, including academic development, job readiness training, mentoring, and cultural support (Cameron & Rexe, 2022; Kwapisz et al., 2021).

## **Conclusion**

This study addresses a significant gap in the literature concerning the experiences of Māori women in engineering and engineering trades. It underscores the importance of addressing systemic barriers across all educational levels to promote diversity in these fields. The findings reveal that while Māori women can succeed and feel a sense of belonging in engineering and trades careers, the paths they take to enter these professions are often indirect. To improve this transition, schools, higher education institutions, and relevant organizations must establish better support structures and provide more career options for women. Timely and comprehensive information about

engineering and engineering trades careers should be readily available to girls through schools and career advisors.

Historically Indigenous peoples are engineers, utilizing their cultural knowledge and skills to address local challenges. To attract more indigenous individuals to engineering and trades, opportunities must be provided, and the value of their cultural contributions acknowledged. When indigenous students pursue engineering, it reinforces their identity as engineers, as documented in existing literature (Kwapisz et al., 2021). Reframing engineering as an accessible option and integrating indigenous worldviews into these fields are crucial steps in this process.

The integration of Māori culture into the workplace is an emerging topic in NZ, signalling the need for ongoing discussions and actions. Supportive networks and mentorship programs are essential for empowering Māori women in their professional journeys and fostering diversity and inclusivity in these industries. Continued dialogue and initiatives are vital for creating workplaces that honour and integrate Māori culture, ultimately leading to more diverse and inclusive environments.

## Recommendations and Future Research

To promote diversity, equity, and inclusion in engineering and trades, educators should prioritize early exposure to diverse career options, particularly for girls and indigenous learners, and emphasize hands-on learning experiences. Integrating indigenous perspectives, knowledge, and practices into the curriculum is crucial for creating supportive learning environments that validate students' cultural identities.

Flexible support services tailored to the diverse needs of indigenous learners are essential for facilitating their success in these fields. Further research should focus on longitudinal studies tracking the career trajectories of indigenous individuals, exploring how cultural identities influence educational experiences, evaluating the effectiveness of existing support programs, and examining the role of mentorship and support networks in empowering students to succeed in engineering and trades careers.

Overall, collaborative efforts from educators, researchers, and policymakers are needed to address systemic barriers and create inclusive pathways for indigenous women and other underrepresented groups.

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