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Assisting the formation of inclusive engineering cohorts

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1 Executive summary

This study discusses how diversity and inclusivity can be promoted in cohort programmes. We examined the student experiences in select Engineering cohorts at the University of Canterbury. Results from student surveys and focus groups showed three themes: inclusive and non-inclusive behaviours; individual and group identity; and opportunities to form community. We showcase the way that Engineering at UC has restructured its orientation programmes to help address these issues as part of a larger strategic move to promote inclusivity and diversity within the College. We finish with more general recommendations for inclusive cohort formation that are not tied to our specific situation, with a focus on what teaching and programme staff can do to promote an inclusive cohort. As part of this study, we also provide resource guides for teaching staff and programme leaders to facilitate healthy cohort formation.

2 Introduction

Learning as part of a cohort can be a powerful and engaging experience. The sense of belonging, the "we are all in this together" mentality and the shared experiences can foster strong bonds among students that, in turn, may serve as an asset for student retention and achievement (Thomas, 2012). However, the success of cohort learning is predicated on the cohort being inclusive to all its members. If this is not the case, the learning experience can be very negative indeed. In this work, we look at how programme leaders, teaching staff and support staff can assist the formation of inclusive cohort-based learning communities in an undergraduate engineering programme. Many of the processes and findings from this study are applicable to other cohort-based programmes.

Learning can be viewed as an active process of *becoming* and involves co-constructing not only knowledge, but also the individual and collective identities of the members of a learning community (Colley, James, Diment, & Tedder, 2003). In the case of engineering, the culture of a learning community will be influenced, at least in part, by the vocational / engineering culture, perceived or real (Colley, James, Diment, & Tedder, 2003). Researchers have suggested that engineering has a distinct culture based on "particular notions of masculinity" (Colley, James, Diment, & Tedder, 2003) (Seron, Silbey, Cech, & Rubineau, 2018). Over several decades, engineering has been seen to prioritise logical thinking, judgement and technical innovation independent of the people side of problems. The persistent engineering culture has been explained in terms of the engineering values of meritocracy and individualism being adopted by marginalised members, hence leading to cultural reproduction (Seron, Silbey, Cech, & Rubineau, 2018). The learning community and its culture are impacted by forces outside the control of programme leaders, such as perceptions of what it means to be an engineer as well as engineering culture in industry, the vocational habitus[1] of the field. Given that the learning community has the potential to transform students, programme leaders need to be mindful of these influences (Colley, James, Diment, & Tedder, 2003). In addition, programme leaders and teaching staff need to be forward thinking with a vision for the discipline such as that laid out in the Aotearoa New Zealand National Education and Learning Profiles (NELP) and Tertiary Education Strategy (TES), one that places learners at the centre; provides barrier-free access; ensures quality teaching and leadership, reflects the future of learning and work; and represents a world class, inclusive public education (New Zealand Ministry of Education Te Tāhuhu o te Mātauranga, 2021).

Engineering teaching and learning goes beyond individuals and technical activities, and has important social, cultural and emotional aspects (Colley, James, Diment, & Tedder, 2003). Staff have a role to take in the process of orientation towards and subscription to a particular culture of the discipline. To that end, initiatives that emerge from the findings will be based on beliefs that safe, inclusive learning cultures can not only be actively encouraged, but should be expected by programme leaders and the students

[1] If we consider Bordieu's concept of habitus, it includes not only personal skills, habits, perceptions, dispositions and individual aspects of identity, but also includes collective pre-dispositions or habits shaped by race, gender and class. Vocational habitus in turn gets learners to aspire to the predispositions expected by the vocational culture, dictating things such as appearance, behaviour, how one should feel, values, attitudes and beliefs (Colley, James, Diment, & Tedder, 2003). It can be derived from both real and idealised identities. As such, vocational habitus has the potential to reproduce social inequities (Colley, James, Diment, & Tedder, 2003).

and staff that make up the Engineering community. This being part of providing barrier-free access and inclusive public engineering education in New Zealand.

This project focuses primarily on the initial formation stages of the cohort learning community and the development within it of a sense of belonging, where all students can feel safe, valued and accepted (Browne-Ferrigno & Maughan, 2014). Students feel valued when "everyone gets a say, everyone gets listened to" (Greenhalgh, Walker, Tipa-Rogers, & Hunter, 2011). The process of whanaungatanga, building relationships, is central to this process (Sciascia, 2017), and has a start through common interests shared by members in their particular technical discipline of study (Macfarlane, Glynn, Cavanagh, & Bateman, 2007) and a collective purpose to become engineers (Browne-Ferrigno & Maughan, 2014). Whanaungatanga is viewed in this work as an ongoing process (i.e. extending beyond orientation week) of really getting to know each other as individuals (staff – student and within the peer group), where we come from, what matters to us, and ways in which what we learn impacts on ourselves and others. When relationships involve a deep sense of belonging and members (peers and teachers) feel a responsibility to their learning community, then these relationships can begin to resemble whānau connections, see (Sciascia, 2017) and the references therein. In essence, our hope is to draw from what we have learned in this study to develop pedagogical strategies and programming to support learning communities to develop positive, inclusive relationships that are based on mutual trust and respect, and have the added academic benefit of contributing to effective and enjoyable cooperative learning experiences. The importance of developing relationships for Māori and Pacific student success is outlined in Tomoana, 2012.

This research was conducted in the College of Engineering at the University of Canterbury (UC). Three key themes have come up during the research, namely involvement, inclusion and identity. We will now introduce each of these overlapping themes in turn.

2.1 Involvement: Building a Learning Community

Engineering education (and the engineering profession) involves people working together to reach a common goal. In the engineering programme, this is typically done through collaborative writing, laboratory work, design projects and research projects. These hands-on, team-based, collaborative learning experiences give students the opportunity to develop technical skills, see other perspectives, make social connections, engage in discussions, take responsibility for their learning and develop critical thinking skills (Doolen & Biddlecombe, 2014). Engineering education is about more than technical engineering and science knowledge; it also involves professional skills such as teamwork, business skills, ethical decision making, management and leadership skills, cross-cultural communication, inclusion practices and innovation (Simmons & Lord, 2019).

Engineering cohorts spend a large amount of time together over their degree programme, attending the same lectures for several years, working together in small groups in laboratories, going on field trips together and doing a lot of group project work (both in and out of usual class hours). A lot of learning comes from within the cohort as well as from University staff and Industry mentors. Closed cohort programmes, like the one in this study, do not simply comprise of a programme of courses, but have an emphasis on community building (Browne-Ferrigno & Maughan, 2014) and more specifically building a sense of community among students (Zhao & Kuh, 2004). A closed cohort is defined as a group of students who start and end their study of a common set of courses together over a number of years (usually 1-3) (Browne-Ferrigno & Maughan, 2014). Usually, students do not join the cohort later and only leave

through attrition (Browne-Ferrigno & Maughan, 2014). Therefore, students are part of the same learning community for the duration of their degree (Lenning & Ebbers, 1999). Typically closed cohorts involve 10-25 students, but the cohorts studied here can be much larger. One approach to handle larger cohorts is to have smaller groups run by more senior students (Tinto, 2003), akin to a tuakana-teina model[2]. For example, we use peer mentoring groups of up to 30 students for first year students, before they reach the departments and their chosen discipline.

With the careful design of activities and continued efforts, closed cohorts can become communities of practice (COP), which are defined by a domain of knowledge, a community of people engaged in the domain and shared practice used to develop competency in the domain (Browne-Ferrigno & Maughan, 2014). A successful COP will have curriculum integration, programme coherence and shared responsibility (Browne-Ferrigno & Maughan, 2014). This requires mindful programme design and coordination across courses and years as well as oversight from an academic as the appointed cohort leader (or year coordinator) (Browne-Ferrigno & Maughan, 2014). Beyond curriculum, the cohort leader also monitors student progress through the programme and oversees logistics like timetabling and assessment schedule coordination. In addition, there are regular cohort-academic / staff-student liaison meetings (Browne-Ferrigno & Maughan, 2014). In engineering, the curriculum planning and programme overview is done at programme, departmental, College / Faculty and University levels as well as by an external accrediting body (such as Engineering New Zealand). Engineering degrees in New Zealand require 800 hours of relevant work experience (internships). Coordinating and monitoring internships experiences of the cohort has been shown to be important and may include site visits to check on students (Browne-Ferrigno & Maughan, 2014). Community service is another way to link people in learning communities, through so-called service learning (Tinto, 2003).

This level of curriculum integration and teaching team collaboration is the cornerstone of so-called curriculum learning communities (Smith & MacGregor, 2009). The approach at UC aligns with the concept of a learning community with coordinated studies (Tinto, 2003). This leads to sharing teaching strategies, collective responsibility and accountability; in this model, staff alert each other when students are having difficulty. Aims of curriculum learning communities include bringing coherence to the curriculum (through shared curriculum planning and connected courses), building both academic and social community (in the common cohort of students), and increasing student engagement (Smith & MacGregor, 2009). Hence, it is critical that staff teaching into learning communities can work together effectively and collaboratively, sharing pedagogy and goals for the overarching theme of the learning community (Tinto, 2003). The core principles in effective learning community teaching and learning include community, diversity, integration, active and collaborative learning and reflection (Smith & MacGregor, 2009).

A key aspect of a successful learning community / closed cohort is having all members "actively and purposefully" engaged in learning activities (Browne-Ferrigno & Maughan, 2014). To this end, students need to see the value in interaction and value interdependence (Browne-Ferrigno & Maughan, 2014). There is more frequent interaction between staff and students in learning communities (Zhao & Kuh, 2004). Learning communities get students to work in collaborative groups and expect them to be active and responsible for learning within the group (Tinto, 2003). Three common aspects of learning communities are (Tinto, 2003):

[2] In an education setting, the tuakana-teina model captures more experienced and less experienced students learning from each other much like siblings (Sciascia, 2017).

- Shared knowledge: A shared coordinated and coherent curriculum is used so that students take courses together on a given theme.
- Shared knowing: Students get to know each other through shared classes as they construct knowledge together. Learning communities encourage social and intellectual involvement.
- Shared responsibility: Collaborative groups create an atmosphere where students are mutually dependent on each other, in turn becoming responsible to each other.

In addition to using active and collaborative learning, learning communities commonly promote involvement in both academic and social activities and hence extend their impact beyond class (Zhao & Kuh, 2004). The shared knowing and social aspect can be seen through students forming their own self-supporting groups outside class, spending more time together in and out of class and by making friends in the learning community (Tinto, 2003). This is part of the increased academic effort, bigger emphasis on higher order thinking and diversity-related activities seen in learning communities. These social and academic activities need to be meaningfully woven together to achieve authentic learning (Zhao & Kuh, 2004).

An important consequence of these learning communities was found to be fostering "norms of educational citizenship", where students recognise that their educational welfare is linked to that of others in the community and accordingly feel an increased sense of responsibility (Tinto, 2003). This leads to increased academic effort as well as promoting social tolerance, openness to diversity, personal development and interpersonal skill development (Zhao & Kuh, 2004). In fact, part of the opportunity for students to grow comes from the disequilibrium caused by working closely with peers from different backgrounds, disciplines or cultures as it gives them a chance to hear different perspectives, think differently and to think in more complex ways about their experiences (Zhao & Kuh, 2004).

In the research literature, learning communities have been linked to better persistence, learning (Tinto, 2003) and more satisfaction with the University experience (Zhao & Kuh, 2004). Although, it has also been argued that it is the environment created by the learning community rather than the learning community itself that provides benefits from increased peer and faculty interaction leading to learning and growth (Zhao & Kuh, 2004).

2.2 Inclusion: Do I fit in here? Are there others like me?

Key to involvement is a sense of inclusion. Although there has been an improvement over recent years, there are still several under-represented groups within engineering in New Zealand, including Māori, Pasifika and women (Tokalau, 2020) (WSP, 2019). The need for diversity is not just about fairness, equity or the size of the pool of potential engineers, it has impacts on the quality of engineering as a whole (Wulf, 2002). Groups with diversity in race, gender and other dimensions bring unique information and different experiences, which can be drawn on during problem solving (Philips, 2014).

To this end, Universities need to recruit and retain a diverse student body. Care must be taken to create more strongly inclusive learning cultures, without excluding those who do not fit; being part of the group can be at the expense of those out of the group (Pierrakos, Beam, Constantz, & Johri, 2009) (Colley, James, Diment, & Tedder, 2003). If engineering students feel that they need to take on an "engineering" persona in order to become an engineer, be successful as an engineer or to fit in, then industry will be limited to only those willing to do so (Meyers, Ohland, Pawley, Silliman, & Smith, 2012). As students integrate into their cohort and engineering education culture, we need to encourage a "robust critical standpoint toward it", to avoid adoption of the

characteristics and perpetuating the existing culture of meritocracy and individualism (Seron, Silbey, Cech, & Rubineau, 2018). This highlights the need to consider identity when looking at inclusion. Identity will be considered in more detail in the next section.

A core focus of this research is on fostering engineering cohorts that are inclusive and culturally safe places to be, with safety meaning being free to be who (individual) and what (collective) we are (Macfarlane, Glynn, Cavanagh, & Bateman, 2007). Relationships are a core element of achieving this. We want to provide opportunities to build mutual trust and respect, and encourage cooperative learning. This can be a bit of a challenge given the traditionally competitive atmosphere of a University setting. This report will provide recommendations to teaching staff on inclusive practices as part of the journey to rangatiratanga (self-determination) and becoming an effective and competent teacher (Macfarlane, Glynn, Cavanagh, & Bateman, 2007). In addition, we are looking at the start of the students' journey with their cohort to rangatiratanga in their discipline. In order to gain the respect of students we also need to recognise everyone's mana, integrity and respect, which will help foster kotahitanga, a sense of unity and inclusiveness (Macfarlane, Glynn, Cavanagh, & Bateman, 2007). This is linked to a genuine manaakitanga, ethos of care, based on respect and kindness (Macfarlane, Glynn, Cavanagh, & Bateman, 2007) (Sciascia, 2017). This will only come to life, pumanawatanga, through staff consistently using and role modelling these concepts and through having an infrastructure that supports this for the whole community (staff and students).

There needs to be a focus on "inclusive excellence", where the needs of the diverse cohort are woven into what is done (Araújo, et al., 2014). Research has shown Māori pedagogical approaches contribute to Māori student success (Sciascia, 2017). In particular, strategies such as the tuakana-teina methods, whanaungatanga methods, Mātauranga Māori in courses, positive Māori curriculum content, and culturally responsive methods in teaching (Sciascia, 2017) (Greenhalgh, Walker, Tipa-Rogers, & Hunter, 2011) (Curtis, et al., 2012). This also involves weaving Te Ao Māori (language, customs, values and culture) into the everyday learning environment (Hall & Jerram) (New Zealand Ministry of Education Te Tāhuhu o te Mātauranga, 2021) (Tomoana, 2012). Fundamentally, this exposes all learners to different perspectives, approaches to doing things, ways of seeing the world, ways of thinking and ways of being (Sciascia, 2017).

One way to make engineering education attractive to a more diverse group of people is to reduce stereotypical examples within the curriculum (ASEE) (Mills, Ayre, & Gill, 2010), or to work to interrogate them as part of the learning experience. For example, engineering curricula tends to over-use masculine stereotypes and examples, e.g., vehicles and rockets (Mills, Ayre, & Gill, 2010). Curriculum design involves more than just the technical content (knowledge and theories), it is also about the language, examples, problems, design of teaching and learning activities, learning environment, mode of delivery and assessment (Mills, Ayre, & Gill, 2010). Choices made in curriculum design will be based in part on assumptions about how students learn, their interests and what they will find relevant (Mills, Ayre, & Gill, 2010) (ASEE). As a result, the accessibility of the information will depend on the student's prior knowledge and experiences.

An inclusive curriculum needs to respect that every student is an individual, hence recognising, acknowledging and respecting the diversity of the student in terms of interests, values, perspectives, prior experience, ambitions, home circumstances and learning skills / experience (Mills, Ayre, & Gill, 2010). Curriculum change must be done while paying attention to the people involved in the change and creating a community around the change (Goldberg, Somerville, & Whitney, 2014, p. 217). We direct interested readers to (Goldberg, Somerville, & Whitney, 2014) for detailed information and suggestions for cultural and curriculum change within engineering. They include

examples of framing engineering education as a student-centred process. To quote them, “We respect your aspirations, we respect your choices, and we are here to witness and support the formation of your identity as a person and as an engineer,” (Goldberg, Somerville, & Whitney, 2014, p. 54).

2.3 Identity: How do I see myself? How do others see me?

A student’s sense of belonging to the engineering community is critical to the path towards engineering identity and persistence. Encouraging a sense of belonging and identity formation during the transition into the cohort / department / school is part of creating an inclusive learning environment with engaged learners (Araújo, et al., 2014). Restorative practices, relationship-based classroom pedagogy and having a culture of care (including rituals, relationships and community) have been found to be important in achieving this (Macfarlane, Glynn, Cavanagh, & Bateman, 2007). Each progressive year there is increased sense of the difference between engineers and non-engineers (Meyers, Ohland, Pawley, Silliman, & Smith, 2012). Identity and identifying with a group, as well as perceived fit with the environment are key in the pursuit, persistence and perseverance in engineering (Han, Cook, Shuman, Mason, & Turns, 2018). Identity is developed through a social process, where thoughts and behaviour are influenced through relationships, affiliations and identification with a group and community-based interactions (Han, Cook, Shuman, Mason, & Turns, 2018). Identity can impact a student’s sense of belonging, aspirations and beliefs of what they can achieve (Han, Cook, Shuman, Mason, & Turns, 2018). People can have multiple identities, both personal and social, coming from different parts of their lives, and perceptions of self and others will be impacted by which of these identities dominates (Pierrakos, Beam, Constantz, & Johri, 2009), and some may play more salient or prominent roles than others (Secules, Sochacka, & Walther, 2018).

Identities of privilege have been suggested as being less salient, even taken for granted, compared to minority identities, e.g., a white woman identifying as a woman and a black woman identifying as a black woman. Self-identification can also be impacted by experiences of structural oppression (Secules, Sochacka, & Walther, 2018). Identity conflict can emerge when expected societal roles and engineering habitus don’t align (Han, Cook, Shuman, Mason, & Turns, 2018), eg. for women and the perceived masculinity of engineering. Having female role models can help undergraduate women develop their professional identities (Meyers, Ohland, Pawley, Silliman, & Smith, 2012) and implicit attitudes towards STEM (Herrmann, Adelman, Bodford, Okun, & Kwan, 2016). It has been found that women, especially minority women, can have quite different perceptions of engineering school. One research study found undergraduate women in engineering were less likely to consider themselves to be an engineer by around 10% compared to men in upper years, and 20% in the first year (Meyers, Ohland, Pawley, Silliman, & Smith, 2012). Having professional or educational plans for the future correlated with a higher chance of identifying as an engineer (Meyers, Ohland, Pawley, Silliman, & Smith, 2012).

While self-categorisation is an important factor in how one identifies, there are organisational, institutional and situational factors shaping identity as well (Pierrakos, Beam, Constantz, & Johri, 2009). People look for similarities with those around them to feel belonging, but also seek differences to keep their sense of uniqueness and identity (Pierrakos, Beam, Constantz, & Johri, 2009). Similarly, although a student may identify as belonging to a given group, they may not want to be exclusively associated with it, and instead convey some uniqueness by highlighting additional identities (Ellemers, Spears, & Doosje, 2002). Social identities come with associated behaviour norms and information about the social group, and adherence to those will depend on how committed one is to the group (Pierrakos, Beam, Constantz, & Johri, 2009) (Ellemers, Spears, & Doosje, 2002). How aspects of one’s self feel secure or threatened in the

group and the social context will impact the perceptual, affective and behavioural responses of the social identity. For example, if they are committed to a group, then there is a threat in lack of acceptance or exclusion from the group, but not from being categorised to the group (Ellemers, Spears, & Doosje, 2002).

The connection between learning engineering and becoming an engineer, is very connected to identity as an individual, cohort and profession (Colley, James, Diment, & Tedder, 2003). A complication here is that students entering University do not necessarily have a good understanding of what engineering is, its many different disciplines, and the variety of paths one can take with an engineering degree (Pierrakos, Beam, Constantz, & Johri, 2009). Professional engineering related experiences throughout undergraduate studies, such as internships, are an important part of developing engineering identity (Meyers, Ohland, Pawley, Silliman, & Smith, 2012). Therefore, it is critical that first year students can gain a sense of the "community of practice", understand the breadth of the profession and what it means to be an engineer, in order to start to identify with the profession (Pierrakos, Beam, Constantz, & Johri, 2009). At Seattle University, engineering students have a strong link and ongoing relationship with practicing engineers, they solve problems together, present work and receive feedback (Han, Cook, Shuman, Mason, & Turns, 2018). This highlights the importance of the engineering culture not only in engineering school, but also in the workplace as impacted by required industry placements or internships to enhance learning (Colley, James, Diment, & Tedder, 2003). How Universities, degrees and staff label students as engineers will impact how students see themselves and how committed they are to engineering (Meyers, Ohland, Pawley, Silliman, & Smith, 2012).

2.4 Report structure

The research showed many themes, but the three most prominent were inclusivity, identity and involvement, and we have structured the report accordingly. In Section 3, we discuss methodology. Research results are presented in Section 4 along the themes of inclusivity, identity and involvement. Section 5 outlines activities developed during the study and Section 6 provides interventions and recommendations based on the research findings.

3 Methodology

3.1 Cohorts studied

This research has focused on the Electrical and Electronic Engineering (EEE) and Computer Engineering (CE) second and third year cohorts, although a small number of fourth year students also participated in the focus groups. Each EEE cohort had 47–72 students during the study, while each CE cohort had 11–27 students. The cohorts' demographics are overwhelmingly New Zealand European male. At UC, students have a general engineering first year and only enter their discipline and home department(s) at their second year. The years following the general first year are called the professional years. Until 2021, second year was called 1st Pro., third year was called 2nd Pro. and fourth year was called 3rd Pro. Engineering at UC is a "lockstep" programme: all first-year requirements must be completed before being allowed to progress to second year and the whole cohort starts in the discipline together (Lenning & Ebbers, 1999). The Bachelor of Engineering with honours degree (BE (Hons)) takes 4 years and full-time study[3] is expected due to a cohort learning approach. The Electrical and Computer Engineering (ECE) department runs the EEE programme, while the CE programme is co-run by the ECE and Computer Science and Software Engineering (CSSE) departments. These programmes have high levels of curriculum integration and teaching team collaboration indicating a curriculum learning community (Smith & MacGregor, 2009). Particular attention is paid in this research to the orientation of a new cohort into the ECE department and how the ECE department can assist cohort formation to result in an inclusive learning community.

3.2 Research methods

The study used a combination of student surveys and focus groups. Ethics approval was sought and obtained (reference number HEC 2018/04) for surveys and focus groups. The research involved a survey in March 2019 to see how things were working pre-intervention (as baseline data). The survey was for second and third year students studying EEE or CE and used the questions shown in Appendix 8. While analysing results, key areas for further investigation were found and focus groups were run. Focus groups ran for class representatives, women and the CE cohort in August 2019 to explore themes.

The interventions run included orientation at the start of semester 1 of second year and reorientation at the start of semester 2 of second year. These were designed and refined based on the surveys, focus groups and student feedback each year. These were for all second year EEE and CE students to provide opportunities for students to get to know each other, perform some team building, highlight the power of diversity in problem solving and induct them into the culture of the department. These will be described in detail in Section 5.

Finally, an extensive literature search was conducted to draw together knowledge from around the world (including New Zealand) and apply it to a New Zealand engineering education environment.

[3] Students are given two years to complete the first year engineering papers, which acknowledges that students can find it challenging to adjust to University life and that they arrive with different levels of preparation. This is also addressed by having multiple entry pathways (such as using introductory and preparation courses).

3.3 Limitations

There are some limitations in the present research, for example, race/ethnicity, language proficiency and accent did not come up in the surveys or focus groups. In (Camacho & Lord, 2011), they found the narrative around micro-aggressions differed according to cultural group, highlighting the difference of "model minority" (e.g., Asian women) and "affirmative-action baby" (in their case Latina students). These different groups of minority students were up against quite different stereotypes about their abilities, aptitudes and likelihood to succeed. The different ethnicities also had quite different strategies to handle the harsh climate of micro-aggressions, for example, white women modifying their gendered persona to fit in, Latina women learning how to fail and Asian women learning to handle their internal pressure to excel (Camacho & Lord, 2011). The use of student societies and socialising within the cohort were also different. White women mixed academic and social aspects, with friends in the cohort (their major giving a sense of social identity). Latina women were more likely to shape identity based on culture first, while Asian women were more likely to be shaped by racialisation experiences (Camacho & Lord, 2011). In a New Zealand context, for example, affirmative action may be used to assist Māori and Pasifika students to achieve equality (NZ Human Rights Commission, 2020). As ethnicity was not collected at focus groups and focus groups were not formed based on ethnic group in our study, we cannot comment further on this trend. We highlight it as an interesting area for future research. One theme that did not come up, but which has come up in previous studies was inclusion issues based on language proficiency, accent and ethnicity. We note this as a limitation of the current study.

4 Research findings and discussion

As previously mentioned, the research highlighted three overlapping themes, namely inclusion, identity and involvement. We will now highlight some of the key messages from students, particularly those from the focus groups.

4.1 Inclusion

When we looked at the EEE and CE cohorts within the ECE department we found that they weren't exclusive, just not inclusive.

> "You see in lectures; you know which one is in this group or in that group. But if you want to go in to that group, you have to be the one that goes there, they're not going to come to you. You have to be the one that goes to them. You have to get that courage and some people don't have that courage."

> "It's not inclusive in the sense that everyone knows each other, but it is inclusive in that if you go up to talk to someone they're going to be friendly to you. Like I float around quite a bit, and I've never had anyone dismiss me, but I know for a fact that there are cliques in EEE. "

In particular, students in the small CE cohort didn't see inclusivity, due to not having shared courses or a shared space, which is just for their cohort. This highlights the need for cohorts to have chances to connect and work together during their studies. This is something to be mindful of when courses are used by multiple cohorts.

> "I don't think it's inclusive at all, at least in my cohort (CE). I've been here for four years, and we have 20 people in my cohort at least and I only know like four or five. No there's no inclusiveness in my cohort. We don't really connect; we don't have a chance to connect. There isn't a single only CE course or anything outside of that. We're always bundled with EEE or Computer Science like there isn't just CE."

4.1.1 Stereotype threat and Micro-aggressions

Stereotype threat is the anxiety that comes from the fear that they will confirm the negative stereotypes of their group or be judged or treated negatively based on the stereotype (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014) (Spencer, Logel, & Davies, 2016). Stereotype threat can result in higher stress levels, long-term well-being consequences, reduced performance, reduced aspirations, reduced sense of belonging, less trust, impaired ability to learn and recall information (memory), less likelihood of using feedback to improve work, reduced motivation and disengagement (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014) (Spencer, Logel, & Davies, 2016). The specifics of the threat are less important than the perception that there is a threat (Spencer, Logel, & Davies, 2016).

Stereotype threat can impact students who are under-represented minority, women, non-traditional, disabled, neuro-diverse, from rural areas, first in family/first generation, from low socio-economic backgrounds or LGBTQIA+/rainbow community. In fact, anyone can suffer from it as every person has at least one social identity associated with a negative stereotype (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014) (Spencer, Logel, & Davies, 2016) (Simmons & Lord, 2019). Students can also identify from multiple groups, intersectionality. Stereotype threats are most likely to make an impact when the person is working on tasks near their limits, as on easier tasks it can be motivating to disprove the negative stereotype (Spencer, Logel, & Davies, 2016). People are only vulnerable to a given stereotype threat if the stereotype is associated with

their social identity, if not associated with their social identity there can even be a "stereotype lift" or boost in performance (Spencer, Logel, & Davies, 2016). The stereotype threat will have greater impact if their social identity is more strongly matched to the stereotype domain (Spencer, Logel, & Davies, 2016). For those with multiple identities, priming them according to the identity most positively associated with a stereotype in the relevant domain can improve performance (Spencer, Logel, & Davies, 2016).

Women are vastly outnumbered by men in EEE and CE cohorts, making them an under-represented minority group in this context. In (Camacho & Lord, 2011), women in engineering were found to experience micro-aggressions at an institutional level, inter-personal level and in the form of derisive humour or jokes. This contributes to what has been called a "chilly climate" for under-represented minority groups (Simmons & Lord, 2019). Micro-aggressions can also be linked to increased scrutiny (watched and judged) due to perceived difference, called hypervisibility (Ryland, 2013). It isn't positive visibility, it actually stops people from being seen and recognised. This scrutiny can lead to feeling hesitant to speak due to likelihood of dismissive or harsh comments, being ridiculed or threatened. It can also be seen in people being asked to explain, justify or erase their difference. These same groups of people can be subjected to invisibility, which can lead to silence, being ignored and having interests ignored / invisible (Ryland, 2013).

Students spoke of feeling like they were only visible when they were useful or feeling like a minority and being very visible (hypervisibility (Ryland, 2013)).

> "I think you go in lot of the time and there's the assumption that you are stupid, or you do notice people treating you differently and you notice that they're talking to you because they want something from you rather than because you're a member of the team."

> "Also being one of the few girls, you may not know them, but everyone knows you."

The quotes below highlight the issue of interpersonal and institutional micro-aggressions (Camacho & Lord, 2011) resulting in feelings of otherness, social isolation and impacting perceived sense of belonging. In the first quote a sense of otherness resulted when the male student asserted their majority status by explicitly calling out gender as a reason for dismissing offers of help. This effectively demoted the female student's social status.

> "Well, something that happened to me was in my FYP [final year project] group, a bunch of guys, and I said, "hey, let me help you with that, you're just going to end up dropping that." And he was like, "No, you just don't understand how guys do things." And then…he dropped it! And part of me was like, why did you bring in the gender fact to it? Like, I have the same qualifications as you, and I saw a problem, and… there have been a couple of times when why is my gender being raised right now, because my gender doesn't really affect my ability as an engineer. It maybe gives me a slightly different view point and you do have to change your viewpoint slightly, and it kind of leaves a weird taste because you realise that you are kind of the minority in the group."

> "I definitely say it can be an isolating experience at times."

In the following example of institutional micro-aggressions, the language used assumes majority students, which emphasises the sense of otherness. An older student commented on feeling out of place and feeling like they had different

preparation. It also highlighted the issue of intersectionality[4] (the impact of belonging to multiple under-represented minority groups) and assumed knowledge based on majority intake's assumed life and education background. This highlights the importance of addressing any hidden curriculum (Curtis, et al., 2012).

> "I feel really out of place most of the time because I'm an adult student and, uh, and a woman. And these kids are coming straight out of high school where they've done a lot of electronics so everything is natural to them, and I feel that most courses are catered to them. And when I've brought it up, I've felt the change and lecturers have adapted and they've stopped saying things like, 'Well, everyone knows this.' Because you feel terrible because you don't."

One of the things seen with institutional micro-aggressions is students taking on a different persona in working with men (Camacho & Lord, 2011). Stereotype threat also has an impact on perceptions and behaviour (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014) (Spencer, Logel, & Davies, 2016). One female student talked about learning to communicate in a different way and even take on a different persona in order to be heard. This also shows stereotype threat and the feeling of being the subject of stereotyping, but at the same time not being sure if it is real.

> "I've learned to be a lot more blunt with people. I'm chairing this committee, I've found with my personality has been quite hard, because people don't take me seriously and maybe not because I'm a girl, but because my personality is like quieter, and a few times I've had to pull the rest of the committee into line a few times over stuff they've done. I've personally hated that and I wonder if I'd just have to learn to do that. I'm not sure if I'd have to do that anyway, no matter what discipline I was in."

The perception of engineering being "men's territory" was seen to impact participation, indicating stereotype threat.

> "But in lab I've always paired up with friends and take a step back and let them do it and it's like, "It's the men's territory." But then I started pairing with women and got even better results than pairing with men. I feel like it'd be a bit better if we'd got a bit more, I don't know if representation is the word, but it's very much "men's world" and "teenage boy"."

> "Sometimes I feel like some of the TAs [teaching assistants] are more comfortable with the guys, and you have to bring them to you, you have to chase them...they won't come to you. I had this conversation with my friends. Females have to stand up to be heard. And he was like, isn't that good for you to be the one that stands up, and I'm like, no you have to do it in order to get people to pay attention."

A perception of otherness was clear when a female student talked about feeling that the teaching assistants were more comfortable with men than women and hence they aren't getting as much help in laboratories. This also indicates feelings of invisibility (Ryland, 2013). The teaching assistants (TAs) are mostly postgraduate students and so

[4] Intersectionality is not simply about the intersection of multiple identities based on gender and race, it can also include class, ethnicity, sexual orientation, ableism and other forms of oppression (Secules, Sochacka, & Walther, 2018).

also operate within the vocational habitus. Therefore, it could be difficult for them to see opportunities for change (Colley, James, Diment, & Tedder, 2003).

4.2 Identity

When we look at the focus group responses, we can split comments around identity broadly into relating to individual identity and group identity.

4.2.1 Individual identity

When listening to the women it was clear that some had felt a need to change personality to some extent or act against their personality in order to function in the cohort. The resulting change leads to feeling like not really fitting into old groups and being on the outskirts of all groups.

> "You sort of have to change your personality a bit to be sort of blunt."

> "I went to an all-girls school, and when I go back and sort of catch up with my friends. We're so different now I realise, 'Wow, we are so different now.' You're kind of on the outskirts of all groups. You can't always fit in with your old groups anymore."

In talking with students, it was clear that there were some expectations on behaviour as engineers. Almost an expectation that classmates should change to fit the vocational habitus.

> "It definitely comes down to personality trait. Like I was saying before, the students that are a little more reserved are definitely at a disadvantage. I wish I could say, well, you should probably learn to do that in a way, because that's how engineers work professionally, they do work together."

4.2.2 Group identity

The focus groups found that some cohorts had split into multiple sub-groups more than meshing as a single group, given some of the cohorts were 47-72 people this is perhaps not surprising.

> "We still probably have more little groups than a big group."

> "Yeah, our group is apparently a bit strange in that there are quite a few sub groups. Other groups apparently mesh a bit better..."

There was definitely a feeling of different disciplines being quite distinct and there being some sense of identity in belonging to that discipline.

> "There's also the thing that, 'We're better than thou.' Like Civil has this whole thing like, 'Well we're the REAL engineers. You guys are all just fakes.' Everyone thinks SE [Software Engineering] has an easy ride."

> "I think the cohort system isn't bad. Like I don't think it's something that needs to get fixed per se. I don't think it does any harm, and it may actually do some good because you have that sense of identity that 'I'm a computer engineer' or 'I'm an EE'. Honestly, I don't know, I think it's fine as it is. ... If anything I'd like to see the separation of the disciplines grow slightly. The advantages being having more communication between the layers of the cohorts."

In (Meyers, Ohland, Pawley, Silliman, & Smith, 2012), they found that intangible factors such as making good design decisions, working with others and accepting responsibility

had to do with their identification as engineers. A couple of our third year students described professional engineer in exactly the same way[5] as follows:

> "To me professional in, as in 'professional engineer' is someone who holds an accredited degree, is currently working in a role in which they are solving complex and varied engineering problems, and they are accountable to ensure that their engineering decisions maintain or improve individual and environmental welfare."

4.3 Involvement

We asked how they would say non-majority students are treated and the responses indicated the case of benign neglect.

> "Broadly speaking, I'd say ignored."

> "Not badly, but not necessarily included."

4.3.1 Shared interests

One thing that gets students involved in the cohort is shared interest in the discipline.

> "There is sort of one main consistent thing is, they're all interested in CE. They're all interested in what we're doing. The people who aren't as interested in it don't get along as well with the rest of us because we're all interested in CE. I think that's the main thing that holds us together, but no, it's just who's interested in these things, who can I talk to about these things, who knows what they're about."

4.3.2 Shared space

A shared space was seen as an important element in building a sense of community (Elliott, Gamino, & Jenkins, 2016). The value of a communal space in building a learning community was highlighted in the following comment from a student.

> "If you said, when it comes to difference between Electrical vs Mechatronic, vs like Mechanical, vs like Civil we're still like, Electrical is still the best, and **we share one sort of computer lab**. Particularly because the other disciplines are quite a bit bigger, and we all **share the same computer lab**. Particularly at the start of the year when people actually went to lectures, you all go to lectures, then off to the **computer lab** to study, then back to the lecture. **We all do things as a group**. My flatmates all do engineering, but like Mechanical and Software and they don't have the same sort of coherence as we do." [emphasis added]

This quote shows the positive impact of both a shared space and shared courses on creating a learning community and "coherence". It is interesting to look at the smaller CE cohort, which uses courses from multiple degree programmes and has no dedicated computer lab, social space or project space. It is clear, that this has made it difficult for the sub-cohort to find each other and create a strong learning community.

> "One thing that's really ... hard to do is to find computer engineers, because we're all mixed up in electronics engineers and Mechatronics engineers and software engineers, so you sort of figure out that, 'so and

[5] Due to very similar wording, this may be a definition from class.

> so is in these courses so they're probably a computer engineer' so that's it, probably finding people to go and ask questions about."

Although, it is really good to have a place where a given cohort/year group can work, study and socialise together, it can also result in them not having connections with the years above and below them. Several students commented on the value of vertical integration and being able to learn from the year above them, which is in line with a tuakana-teina model (Greenhalgh, Walker, Tipa-Rogers, & Hunter, 2011) (Tomoana, 2012). It acknowledges the meaning of the Māori word Ako, namely being to "teach" and "learn" (Greenhalgh, Walker, Tipa-Rogers, & Hunter, 2011). Having a computer laboratory shared by multiple years was one way this was achieved.

> "You start utilising the resources and then you get comfortable and stuck in there. I think it would be really valuable to sort of encourage the vertical relationships more, especially with the 1st pro [second year], because you guys don't really have much to sort of…."

> "Yeah, the only people I know who do 2nd Pro [third year]. When I was in 1st pro [second year], I didn't know anyone above me, I didn't know anyone below me, just because of that location. It's the same, you really need to know someone in the year above."

4.3.3 Shared courses and course work

Teamwork, laboratory work and group projects can help foster a spirit of collaboration and help students get to know each other's names (Elliott, Gamino, & Jenkins, 2016). Longitudinal small group assignments and projects require students to practice leadership skills and manage group dynamics due to needing to share resources and responsibilities, work through conflicts, give and receive feedback and reach agreement through consensus (Browne-Ferrigno & Maughan, 2014). When doing programme design, it is important to design in feedback mechanisms to check the collaborative learning throughout the programme (Browne-Ferrigno & Maughan, 2014).

Research has shown that people are more likely to gravitate towards people with similar characteristics ("in-group" members), resulting in a potential for "out-group" discrimination and barriers to belonging and building relationship (Elliott, Gamino, & Jenkins, 2016). Identifying a superordinate goal for the cohort can help overcome in-group/out-group discrimination and also be weaved in with finding a home away from home shared space, open genuine dialogue and help students form strong ties (Elliott, Gamino, & Jenkins, 2016).

> "It is good to work in lab as part of a team sometimes, you often meet others from … within the class."

> "It is interesting working with, sharing and helping, the same people working on the same projects. Everybody wants to get an outcome hence there is a common goal, hence people wish to help each other."

> "Made some friends from group projects and enjoy the dynamic that forms."

It is important to note that team projects and group work also leads to a lot of tension due to different ways of working, procrastination, people not pulling weight, people not listening, unwillingness to work in a group, lack of communication and conflicts/ arguments. Group work must be carefully managed, especially when assessed. The design and management of group projects is a massive topic and so will only be considered briefly in this project.

Formal cooperative learning groups are a very intentional way of organising team projects involving complex tasks with the goals of developing critical thinking, teamwork skills and high-level reasoning (Smith, Sheppard, Johnson, & Johnson, 2005). Successful implementation requires "positive interdependence, face-to-face promotive interaction, individual accountability/positive responsibility, teamwork skills and group processing" (Smith, Sheppard, Johnson, & Johnson, 2005). Positive interdependence involves students believing the group succeeds only when all members succeed. Promotive interaction requires students to actually engage and interact with group members. Individual accountability/positive responsibility means that every student is responsible and accountable to do their share of the work. Teamwork skills need to be intentionally taught to help students function in teams. Finally, group processing involves group members discussing progress and working to maintain effective working relationships (Smith, Sheppard, Johnson, & Johnson, 2005).

We surveyed our second and third year students (first and second year within their discipline / cohort) on their positive experiences with team/group members and the results can broadly be split into

- **Make friends and connections.**
    - "Making new friends." "Gotten to know a few more students." Third year students.
    - "It is good to work in lab as part of a team sometimes, you often meet others from within the class". Second year student.
- **Learn from others, gain alternative perspectives and work together as a team**.
    - "Gotten to know a few more students, get to learn things that often wouldn't be taught/picked up in class, enjoyable to work alongside other similar motivated people, learn from others experiences", third year student.
    - "Being able to rely on each other to pull our weight when need be." Third year student.
    - "We all put in the effort and did the best we could. People within the team stepped up when needed. In a different group during the first year design project, it was good to have at least one other team member willing to put in the time and do the work but also share their findings with the group. It was much more productive and we learnt a lot." Third year student.
    - "My project partner has taught me a lot of what they knew about the subject area." Second year student.
    - "Alternative approach and/or alterative thinking", second year student.
    - "People willing to listen to your input and politely disagree should they not think the same. All the team members putting in their work so that the workload can be distributed." Second year students.

We surveyed our second and third year students on their negative experiences with team / group members and the results can broadly be split into

- **Poor communications skills and inter-personal skills leading to conflict**.
    - "A lot of people seem to have the tendency to disregard what anyone else is saying and talk over the top of others as if what they say it's far more important than what else". Second year student.
    - "Not communicating what they were going to do." Feeling like I had to do the whole project. Third year student.
    - "Not everyone being on the same page (people being lost with what's happening) - Arguments about how things should be done". Third year student.

    - "Conflict, not feeling opinions are heard, one person taking over." Third year students.
- **Team members not engaging, being unreliable or not contributing equally, leading to a heavy load on some group members, while everyone still received the same grade. Grading perceived as unfair by students.**
    - "First assigned partner never responded, second assigned partner only work on the project the day before it was due after I had done the vast majority of the work." Third year student.
    - "Had a group partner who myself and my other group partner felt did very little and despite talking to lecturers and staff about this during and after the project still got the same grade, with little to no reason given by staff as to why this was." Third year student.
    - "Partners not doing their share of the work and having to take it on myself." Third year students.
    - "Agreements between team/group members are made but these are often broken without letting others in the group know. Often team/group members will receive a high grade for the project, though they put little effort into it or worse, the team member doesn't do their share though indicating they are, only for me to realise the truth too late, leaving an uncompleted project and then being heavily penalised as a result. This results in high anxiety, the fear and time of trying to substantiate a case to the course supervisor/director/special consideration team and sometimes anger towards the university because they did little to help when help was asked for early on." Third year student.
    - "We formed a team under the agreement we would all work together over the holidays. One member then decided to fly home for the entire time. They contributed bugger all remotely and were never able to come up to speed for the rest of the project. Yet, they still received the same grade." Third year student.

As outlined in (Smith, Sheppard, Johnson, & Johnson, 2005), structuring cooperation between students should not be about

- Students doing individual assignments at the same table.
- One student doing all the work on a group report or assignment, while they all put their names on it.
- Students working separately and getting fast students to help the slower students.

We asked students in the surveys what behaviour they liked to see in a team member and the comments highlighted:

- **Good communication with the team**: keeping team member updated, communicating well, making sure expectations are known and properly listening to every team member.
- **Be a team player and do the mahi**: share workload, do the work, allocate time for meetings and the project, be pro-active, take part and be conscientious. Be willing to give and receive help. Stay focused on the core task and deliverable.
- **Respect your team and self (be accountable)**: be friendly, treat others well, get to know team members, be reliable, be punctual, be honest and show integrity. Admit when you don't know something or when there is a problem. Do what you say you will do, when you say you will do it.

Unsurprisingly, what students disliked was the opposite, namely being rude, getting sidetracked, unwillingness to work at all or in the group, lack of contribution, poor time

management, criticism (instead of constructive feedback), lack of commitment, procrastination, rushed jobs, slackers and distrust.

4.3.4 Social events

The students mentioned wanting more social time together, especially involving vertical integration between years or even between departments / disciplines.

> "From what I've seen, like people from mechatronics, they know everyone. Like they have social gatherings and cohort discussion type of thing. But CE and EE don't really have that. They have a professionalism rather than social based."

> "I reckon that if there were some more inter-department events, then you'd have more introductions and you could be sort of like, oh hey, can we talk about this, or this project isn't going well..."

> "Yeah, like an evening, at the beginning of the year, or end of the year to talk to people, to just communicate. It gets busy, once the year starts, and if I talk to anyone from my cohort, it would probably be due to the course rather than personal, like, trying to get to know them with like, hey, have you done this, rather."

> "Yeah, like a social event at the start of the year, would really help."

> "I reckon, it sounds terrible, but force people to come and hang out. Like no one was born with the best communication skills, no one is born with the confidence of, a, uh, Hercules, it's like especially at the very start, because if people aren't super present, even the first week of 1st pro [second year], then all the groups have already formed. That first week forming stage is key."

> "The way the university runs, it's easy to foster this anti-social thing...like you can do all your work from home, you can watch the lectures on Echo, which is really good if you want to catch up, but it's made too easy as an excuse not to go to lecture, not to ...I feel like you really should, in university, to make friends."

There were also comments on the appeal or accessibility of student run events and alcohol.

> "It would be good if the university could set things up. Like sometimes the cohorts set things up, but usually that's around drinking and if you're not really involved in that..."

> "EE people do things once a term, or once a semester, but it's just drinking."

> "It also fosters those cliques."

The perceived barrier to talking to students in other years is captured in the following comment from a male 2nd Pro. (3rd year) student:

> "I feel like I know the 3rd pro boys quite well...and I've joined ... a club group so I sort of hang around with the 3rd pro group. So that's really beneficial, since they've already taken courses that I'm just done and they can give me feedback. And some of my friends that didn't get into EE last year, and they're a year below so I feel like I'm in this middle, so I get a lot of vertical communication in this as well. I think it's really good, but unless you put in...**I don't feel like it's something that comes naturally though**? I feel like I couldn't just go around to talk to any 3rd

pro without being in the sort of situation in which you're introduced." [emphasis added]

4.3.5 Participation

Research shows that participation in class is dominated by a small group of males (Wenzel, 2003). The body language of instructors when students ask questions, the type of questions the instructors ask, the praise given to students, interruptions, disparaging remarks, facial expressions and the grading / peer review have been shown to differ according to gender and / or minority status (Wenzel, 2003).

Participation in the cohort can be daunting for some, especially when needing help as illustrated by the comment

> "In my case, there was a person that doesn't really catch up with the course, but she's so scared, and can't catch up or do anything. It made me mad because she didn't ask, but it turned out, she was too scared.... So it would be good if there was a way to help others out. Sometimes, like for me, you get caught behind, and you feel embarrassed to ask the group for help."

5 Orientation Activities

In order to create a culture of collaboration and respectful critique, initiatives need to start early before cliques are formed (Araújo, et al., 2014). However, orientation cannot solely be a first week, one off initiative (Araújo, et al., 2014). There need to be opportunities for structured events encouraging collaboration and social belonging throughout the student life cycle (Araújo, et al., 2014). Given the additional goal of forming inclusive cohorts and keeping in mind that the sexism in engineering culture can increase from first to fourth year, it is particularly important to keep up with activities that promote inclusivity and highlight the value of diversity through all years of study (Simmons & Lord, 2019). Activities supporting both peer-peer and student-staff relationships are important, both in curricular and co-curricular activities (Araújo, et al., 2014). It is important to provide opportunities for students to meet socially and develop connections in a relaxed atmosphere (Araújo, et al., 2014). Activities that are fun, collaborative and discipline-related are recommended (Araújo, et al., 2014). It is also good if they are structured to allow students to get to know a small group of people (Araújo, et al., 2014). To that end, we developed an orientation programme over the first week, which includes a team building session, academic orientation and a barbeque as detailed below. This was followed up by a mid-year re-orientation session at the start of the second semester. Further social events and inter-year events are recommended, but have not yet been implemented.

5.1 Orientation

We now outline the orientation programme developed in the ECE Department at UC for the second year students entering the EEE and CE disciplines.

The **goals** of the orientation week were:

- Introduce the culture of the department.
    - Highlight value of different perspectives to encourage inclusion.
    - Set expectations on behaviour and introduce culture.
- Foster a sense of belonging within the cohort and to the department.
    - Begin the next phase of becoming engineers and building the associated sense of identity as engineers.
    - Whanaungatanga, building relationships. Making connections to fellow students and staff.
    - Start developing teamwork skills.

Semester 1 cohort formation **activities** in the first week are

- Orientation team building and diversity awareness session.
- Academic orientation and pizza session (shared lunch for staff and students to get to know each other) (Tomoana, 2012).
- Outdoor social team event with BBQ.
- Special welcome event for the small CE cohort.

Semester 2 cohort formation activity was

- Reorientation cohort building and academic session involving vertical integration between student cohorts.

5.2 Orientation team building session

Orientation sessions are a key opportunity to set expectations and demonstrate the culture of the department. It provides a chance to build relationships, whanaungatanga, both between staff and students and between students. As such, it is important to start

with mihimihi / self-introductions (Tomoana, 2012), so that people can get to know one another and discover commonalities.

As highlighted in (Smith, Sheppard, Johnson, & Johnson, 2005) programs need to actively and intentionally teach teamwork skills. With the careful design of activities, closed cohorts can become communities of practice, which are defined by a domain of knowledge, a community of people engaged in the domain and shared practice used to develop competency in the domain (Browne-Ferrigno & Maughan, 2014). The department / school must pay special attention to group dynamics as the cohort goes through the phases of team development. As a result, the orientation team building exercises were framed around these 4 phases of team development (Tuckman, 1965), namely

1. Forming – Ball toss activity to help students learn each other's names.
2. Storming – Helium poles group exercise.
3. Norming – Traffic jam group problem solving exercise.
4. Performing – Group challenge.

We trialled 3 different group challenges:

- In 2018, we did a diversity awareness exercise, called "lost in the bush". Individuals were asked to rank items they would salvage from a crashed plane. Then teams worked together to come up with a preferred selection. The team result tended to score significantly better than the individual results, however, there will usually be an individual who did better than their team. This provides interesting discussions around diverse perspectives adding value, but also around communication and why the best performing member of the team was not heard. This is our preferred activity, but it was adopted by a first-year compulsory course and so a new activity had to be developed for the second-year orientation.
- In 2019, our final activity was to program a human robot to dance. This involved breaking down a simple movement into clear instructions, teamwork and communications. It was particularly relevant to these cohorts due to the importance of software in their degrees. Likewise, in civil engineering a construction-based activity could be used.
- In 2020 and 2021, students needed to build land yachts out of a given set of supplies. The yachts were then raced using a large industrial fan. A supportive atmosphere was encouraged, where all teams were cheered on.

The orientation session also included a shared morning tea to give further opportunities for the class to socialize and get to know each other.

Team grouping was done carefully. We tried to make sure minority students weren't isolated, for example trying to have at least two women in a group. This did not always work as demographic information was not always available in time for planning the session and some students were still in the process of enrolling and just turned up on the day.

The CE cohort spans two departments and the 2018 survey results indicated that they found it hard to identify each other in the much larger cohorts they share courses with (EEE, Software Engineering and Computer Science). To address this, we grouped the CE students together in the orientation team building session so they would connect early. In addition, CE staff ran a separate welcome event for the CE cohort. Feedback on these changes from the Director of CE was very positive.

We would like to acknowledge Billy O'Steen who designed and ran the orientation team development exercises and Kim Rutter who designed and ran the team challenges.

5.3 Reorientation session

As noted in (Araújo, et al., 2014), it is really important that orientation is not a one-off touch point and that initiatives span the whole year. As a result, we added a reorientation session at the start of the second semester. This session was particularly crucial after the 2020 lockdown. It is a chance for students to reconnect after the mid-year break and a chance to encourage them to meet different people in the cohort.

To encourage vertical integration as requested by students in the surveys and focus groups (and recommended in (Araújo, et al., 2014)), in 2020 we asked two class representatives (students) from the previous/third year to come and give the class advice on the upcoming semester as well as having a social bingo activity (the bingo sheet is shown in Appendix 9). The idea was to "build a sense of community across multiple generations of the programme cohort" (Araújo, et al., 2014). In 2021, we invited two students again. One student was a class representative from third year who had canvased tips from their cohort of students. The other student was an upper year student who was succeeding after initially failing a course in their second year. This is in line with findings in (Herrmann, Adelman, Bodford, Okun, & Kwan, 2016) that it is important for students to have role models who have overcome challenges. Students asked lots of questions of the two upper year students and the combination of a class representative and a student who had overcome a setback in study worked really well.

In (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014), an early intervention for stereotype threat was to ask students to write about why they want to study the discipline. Solution-focused brief therapy can help students recognise their strengths, raise self-esteem, build confidence and move towards their goals (Mayhall & Burg, 2002). One technique is to ask students to write down their best hopes and then focus on one small thing they could do to move towards this.

The structure of the reorientation session is

1. Run a bingo session, where students are challenged to talk to people in the class who they've never spoken to before. They need to go around talking to classmates to learn something new about 16 classmates to fit the prompts in the 16 bingo squares.
2. Classmates from the year(s) above offer top tips on the second semester courses and answer student questions.
3. Run an academic exercise.
    a. In 2019, we ran a timetabling/scheduling exercise, where we helped students to plan out study and revision time for the semester using real assessment deadlines. Some students found this stressful as it highlighted how much work was coming up.
    b. In 2021, we ran a session to reconnect students to their purpose for studying engineering, their best hopes for the semester and to think about one small thing they could do this week to achieve their best hopes. This was based on a solution focused brief therapy modality. The worksheet can be found in Appendix 9.

6 Recommendations

In addition to the research findings discussed in section 4, which pertained specifically to the engineering situation at UC, in this section, we now explore interventions and initiatives that could be used to promote inclusiveness and foster a sense of belonging in cohort programmes more generally. The emphasis is on what we can do as teaching and programme staff to help build an inclusive cohort.

6.1 Review / Climate check

The New Zealand Tertiary Education Strategy (TES) (New Zealand Ministry of Education Te Tāhuhu o te Mātauranga, 2021) requires not only that New Zealand tertiary providers deliver world class inclusive public education, but also that they provide barrier-free access to education for all learners. This means that programs must address racism, discrimination and bullying. Ways to address racism include addressing stereotyping, stigma, prejudice, privilege and not blaming victims (Curtis, et al., 2012). They also need to look at barriers to entry such as location, price, school background and hence preparation (Greenwood & Te Aika, 2009). It is important that programme leaders are familiar with the TES and the associated expectations on tertiary providers. Note that the TES places learners with their whānau at the centre of education (New Zealand Ministry of Education Te Tāhuhu o te Mātauranga, 2021).

If you are leading an existing programme, it will be important to identify existing barriers to the formation of inclusive cohorts (Zhao & Kuh, 2004). This can be done in a variety of ways, e.g. student surveys or focus groups, staff surveys or focus groups, event participation data, observations of teaching situations and learning environments, examining roles in group dynamics, and the like (Wenzel, 2003). Tools can be found in (Mills, Ayre, & Gill, 2010), (Moore, Brantmeier, & Broscheid, 2017) and (Brantmeier, Broscheid, & Moore), but note that these are not specifically for a NZ context. It is important to look at how the programme partners with whānau and communities (New Zealand Ministry of Education Te Tāhuhu o te Mātauranga, 2021). In addition, it will be important to link to strategic documents such as your institution's academic, pastoral care, Māori, and Pasifika strategies, as well as expectations from accreditors and national guidelines. If you work at an institution that has educational developers on staff, they will typically be able to assist you with this process. If you are collecting data, then make sure to include a wide range of demographic variables, allow multiple selections (allowing for intersectionality and multiple identities) and check assumptions (Simmons & Lord, 2019), (Secules, Sochacka, & Walther, 2018) and (ASEE).

Reviews or climate checks need to be done regularly. Staff can also use teaching surveys, evaluations and feedback to perform a self-review (Tomoana, 2012). Other factors which staff can use to review their own teaching are attendance, assessment completion, participation in class and student achievement in the course (Tomoana, 2012).

Human resources may be able to assist with looking at the inclusivity of hiring processes and the diversity of staff (teaching and support) and tutors hired for the programme delivery. Research shows that appointing and developing Māori staff is an important way to support Māori student success and the bicultural goals of the institution (Greenwood & Te Aika, 2009) (Curtis, et al., 2012). However, it is important to note that bicultural efforts need to be a whole-department endeavour, and not be shifted solely onto Māori staff.

6.2 First week

Setting the tone for the culture and learning environment on the first day is crucial as the first day experience can impact a student's sense of belonging and ability to succeed (Rastovac Akbarzadeh & Ko, 2017). It is also an important chance to model expected behaviour (Rastovac Akbarzadeh & Ko, 2017). The language used matters. There are some simple things teaching staff can do at the **start of the first session** to make people feel welcome and to foster a sense of belonging. For example,

- Display on the door and on the screen the course name and code, so they know they are in the correct place (Rastovac Akbarzadeh & Ko, 2017).
- Ask students to create nametags with preferred name and pronouns (allow people not to include their pronouns) (Rastovac Akbarzadeh & Ko, 2017). Provide the supplies. Providing something more durable would allow it to be used over multiple days.
- Do a mihi at the start of class. When you introduce yourself, you could include not only your name, but a bit about yourself and your interest in the subject (Rastovac Akbarzadeh & Ko, 2017). Also tell students how to address you, e.g. by first name (Rastovac Akbarzadeh & Ko, 2017).
- Icebreakers are a good way to allow students to get to know each other (Rastovac Akbarzadeh & Ko, 2017).

During the first week, instructors hand out their **course outlines / syllabus**. These often include policies, which have evolved over time to address problems such as poor attendance, late submissions and special requests. This can result in a cold or even antagonistic tone being used (Accessible Syllabus, 2017). Create a warmer and more inclusive course outline / syllabus by doing the following

- Emphasise positive over punishing language, use invitations rather than commands (e.g., use can instead of should not) and use a more collaborative tone (Rastovac Akbarzadeh & Ko, 2017) (Womack, 2017). For example, when writing about how late work would be marked, we could say "late submissions will receive a 20% reduction" (command) or we could say "late submissions are eligible for 80% of the marks" (invitation). This change could be particularly impactful in engineering, which has a reputation of being blunt as indicated earlier in student quotes.
- Cover how to contact teaching staff and detail their office hours in order to be more accessible (Rastovac Akbarzadeh & Ko, 2017).
- Be explicit with learning outcomes and explain the approach used (Tomoana, 2012). Check that students actually understand what is required from the course and the expectations on students. Organised, clear and consistent messaging helps students understand expectations.
- Give clear messaging around how essential required texts are, what editions are acceptable and how to access them without purchase all helps to create an inclusive atmosphere as it acknowledges the sometimes prohibitive costs of buying books (Rastovac Akbarzadeh & Ko, 2017).
- Including an inclusion or diversity statement on your course outline, eg. the one found at https://docs.asee.org/public/LGBTQ/Syllabus_Inclusion_Statement.pdf, can help address stereotype threat.
- A teaching philosophy statement could also be included (Yale Center for Teaching and Learning, n.d.).
- Include information on how to speak with teaching staff.

6.3 Shared knowing and battling the case of benign neglect

If we wish to address the case of benign neglect, we need to work to assist students to achieve shared knowing. Part of creating a community and sense of belonging is being known and **names** help with this. It is important to help students get to know each other's names (Elliott, Gamino, & Jenkins, 2016). Encourage lecturers to ask students to say their names before speaking and/or make name-cards to place in front of where they sit in lectures.

One way to **encourage student-to-student interaction** is to use informal cooperative learning in class, such as asking students to discuss what they are learning or work on a problem with a partner or students nearby for a few minutes during a lecture (Smith, Sheppard, Johnson, & Johnson, 2005). Breaking up the lecture with short "cooperative processing times" also helps re-engage students (Smith, Sheppard, Johnson, & Johnson, 2005). This approach gives instructors the opportunity to walk around and hear discussions and answer questions, while encouraging students to be actively engaged in trying to understand the material (Smith, Sheppard, Johnson, & Johnson, 2005). It also gives them a chance to talk to someone and make a connection. This can be further enhanced by periodically requiring them to switch partners. The aim is to support students to develop initiative to engage with peers.

Team bonding exercises can help with shared identity. A bit of friendly competition against other cohorts can help team bonding. For example, participation in some silly activities that require cohorts to come up with some sort of name/colour/mascot.

Another important way to increase interaction is through having **shared spaces**. In modern tertiary institutions, space is at a premium, but it is worth looking at what communal spaces within the department and college are available. It may be possible to have students designate a particular zone/space/study area – even if only on a weekly basis, where all students from the discipline/cohort/multi-year group can come together in a shared space.

Look for opportunities to help smaller cohorts get to know each other, eg. CE students being part of the same lab groups and being told they are all CE students.

6.4 Respectful communication

It is important for staff to model inclusive language and use respectful communication with students, and make clear that such behaviour is expected from students as well. Try to pronounce student names correctly and use their preferred pronouns and name (don't create your own shortened versions) (Yale Center for Teaching and Learning, n.d.) (ASEE). The effort in trying to pronounce names is more important than the competence (Greenhalgh, Walker, Tipa-Rogers, & Hunter, 2011). Do not ask or indicate (e.g. looking at or away from a student) that you expect a student to be the representative for their perceived group and don't expect them to be knowledgeable on their culture unless they have made that indication (Yale Center for Teaching and Learning, n.d.).

Make your class and department a safe place to discuss ideas and speak up (Elliott, Gamino, & Jenkins, 2016). This means you must address any comments that are offensive, discriminatory or insensitive (Yale Center for Teaching and Learning, n.d.). Equitable and respectful engagement in class can be encouraged by structuring class conversations and **establish ground rules and expectations** at the start of the semester (Yale Center for Teaching and Learning, n.d.) (Rastovac Akbarzadeh & Ko, 2017). This may include giving students a minute to think of responses to a question before opening the floor or asking students to write down questions before posing them (Yale Center for Teaching and Learning, n.d.). In addition, provide a variety of ways for students to participate in class, such as classroom discussion, online discussions

and written forms (Yale Center for Teaching and Learning, n.d.). It is important to allow time for listening to students in teaching time, as this gives insights into their lives and realities (Tomoana, 2012). This also connects to the importance of seeing the student in a more holistic way, important for both Māori and Pacific students (Tomoana, 2012) (Greenwood & Te Aika, 2009). It involves actually finding out about the student's commitments and discussing how to manage them while studying (Tomoana, 2012). It also involves seeing their learning in terms of more holistic graduate attributes beyond the technical (Greenwood & Te Aika, 2009).

It is important to express high expectations and then provide support and reward efforts to achieve them (Hargraves). Acknowledging and celebrating success in class is another way for staff to build relationships with students (Tomoana, 2012). Celebration can also focus on important days for different communities, such as Samoan independence day (Tomoana, 2012).

Another aspect of respectful communications is to not expose students (problematic behaviour or lack of knowledge) in front of others, instead allowing space for one-on-one conversations with staff (Hargraves). This is particularly important for Māori students. Ridicule and shame should not occur in modern learning environments (Curtis, et al., 2012).

6.5 Social events

We were surprised by how much students wanted the department to organise social events. In particular, there was a desire to have non-alcohol related social events that are inter- and intra-year. Possible events could include "Tuesday Tea at 10", "Wednesday Wraps", "I'm Ready to Scream, but I'll Settle for Ice Cream Cram Nights", etc.

The department could also encourage co-curricular activities that are meaningful, relevant to the discipline / profession and also serve a larger goal, such as community service. There are many organisations seeking student volunteers to help with their organisation, either as a one-off or on a regular basis.

6.6 Stereotype threat

There are many approaches that can be taken to address stereotype threat and create an identity-safe environment (Spencer, Logel, & Davies, 2016). It is important to do them with a stealth approach as detailed below (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014). Teaching staff play an important role in encouraging or discouraging students (Simmons & Lord, 2019). Again, staff have a role model function; the type of behaviours and language they exhibit or tolerate become the norm for the classroom ("the standard you walk past is the standard you accept"). Here are a range of ideas which could be employed to tackle stereotype threat:

- An early intervention which allows students to write about their values or connect with why they want to study the discipline can help combat stereotype threat and recoup grades (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014). The writing of values has been described as self-affirmation and has been found to restore self-integrity (Spencer, Logel, & Davies, 2016). Students could also write about their individual qualities (Spencer, Logel, & Davies, 2016).
- Subtly encourage students to reconstrue their social identity, which is being threatened. For example, link their social identity to its stereotypical positive abilities (Spencer, Logel, & Davies, 2016). Alternatively, their social identity could be extended to include characteristics they share with the non-threatened group (Spencer, Logel, & Davies, 2016).

- Another approach is to teach students about stereotype threat and that it is illegitimate, then encourage them to attribute any anxiety to the stereotype (Spencer, Logel, & Davies, 2016).
- Teacher criticism can be perceived as being due to stereotypes. One way to address this, is through "wise feedback" built on trust to let students know of their high standards and a belief that the student has the ability to reach these high standards (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014) (Spencer, Logel, & Davies, 2016). Connected to this is providing resources to help them succeed, such as detailed rubrics for assessment.
- Reinforce a growth mindset, that successful engineers develop competency through effort not from innate ability (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014). It is important to encourage students to see their intelligence as malleable (Spencer, Logel, & Davies, 2016). The major goal of a growth mindset is to learn, by taking on challenges, working hard, and by confronting, then correcting deficiencies (Dweck, 2010). A growth mindset can be encouraged by praising a student's progress based on their effort, strategies, concentration, choices or persistence, rather than on their intelligence (Dweck, 2010). Another approach would be to ask students to write advice to the year below them and then get the year below to read the advice. This has the advantage of also helping with vertical integration. Being successful long term often involves failure or some low grades along the way, the key is to persist. This can be helped by linking poor performance to malleable factors like study skills rather than their ability or other stable factors (Herrmann, Adelman, Bodford, Okun, & Kwan, 2016).
- Reassure students that worrying about belonging is normal and reduces over time (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014) (Herrmann, Adelman, Bodford, Okun, & Kwan, 2016). This is part of helping students learn that difficulties are normal and temporary (Herrmann, Adelman, Bodford, Okun, & Kwan, 2016). Ideally have the previous intake of students communicate this to the incoming class (could be done using videos), again enhancing vertical integration. Also reassure around the anxiety of taking tests and how this is normal, but does not necessarily harm performance in the test (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014).
- Carefully design exams to be fair and to test learning not innate ability or memorisation (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014). Communicate this to students through specific learning objectives and a clear marking rubric (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014). Things to consider include, do examples all involve men and will the context be familiar to all students (economic background, cultural background, gender etc).
- Ensure there are positive role models for students (Spencer, Logel, & Davies, 2016). Invite a diverse range of role models including different cultures and ethnicities (Tomoana, 2012). Make sure that role models share that they have faced and overcome challenges, which may include initial poor performance, in addition to emphasising the importance of the degree (Herrmann, Adelman, Bodford, Okun, & Kwan, 2016).
- Think about the invigilators you hire and whether there is a possibility to hire positive role models (must also have expert knowledge in the field) (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014).
- Think about the physical space, for example look at whether there are any posters or other visual cues that may trigger stereotype threat (Eschenbach, Virnoche, Cashman, Lord, & Camacho, 2014).
- It is important for the department to communicate that diversity is important and valued by the staff, including in classrooms (Eschenbach, Virnoche,

Cashman, Lord, & Camacho, 2014). The department needs to communicate that students from all backgrounds are welcome, valued and will be supported (Spencer, Logel, & Davies, 2016).

- Mindfulness training can also help students cope with stereotype threat, by reducing the working memory load caused by the stereotype threat (Spencer, Logel, & Davies, 2016).
- In some cases, allowing stereotyped groups to work in teams together has resulted in better performance (Spencer, Logel, & Davies, 2016). However, it is also important to consider intersectionality and the impact of multiple identities on student experience. It is also important not to assume or assign a social identity to others.
- Check admission and hiring practices for bias due to the importance of diverse students and staff (Spencer, Logel, & Davies, 2016).

6.7 Resourcing

The 2020 and 2021 lockdowns really highlighted the importance of on-campus facilities such as study spaces, libraries (both due to space and access to free textbooks), internet, computer labs and printing to vulnerable communities. The government funded devices and internet for tertiary students in 2020 (1 news, 2020). A lack of access to internet and an appropriate device created systemic inequities (Harris, 2020). Part of manaakitanga by the institution is ensuring that both staff and students have the resources they need to succeed and that staff have the freedom to adapt the learning environment to cater for their diverse student body, see (Sciascia, 2017) and the references therein.

In (Greenwood & Te Aika, 2009), they found that it was important to develop spaces where Māori knowledge is valued, values operate, people feel at home and iwi are welcome.

6.8 In-class content

It is important to incorporate Te Reo Māori and tikanga Māori into the learning environment (Hall & Jerram) (New Zealand Ministry of Education Te Tāhuhu o te Mātauranga, 2021). It needs to be a meaningful part of everyday teaching and learning (New Zealand Ministry of Education Te Tāhuhu o te Mātauranga, 2021). A detailed guide on teaching Māori content in University courses is provided in (Hall & Jerram) and tikanga tips for academic staff can be found at (Victoria University of Wellington, n.d.). For example, not sitting on tables, protocols for marae visits and the use of karakia (Greenhalgh, Walker, Tipa-Rogers, & Hunter, 2011). Principles to effectively support Māori students as Māori are given in (Hargraves). In order to support Pacific student success, look to create study tables, and use lots of discussion and group work (Tomoana, 2012). Study tables can be used to provide an opportunity for students to self-identify strengths for use in group work (Tomoana, 2012), while brainstorming encourages students to share their prior knowledge (Hargraves). Chunking learning combined with realistic examples to bring theory to life helps student learning (Tomoana, 2012).

Use diverse examples in class (ASEE), where diversity goes beyond male / female, so students can see themselves represented in the curriculum, be acknowledged in their individual identities (ASEE), and see multiple perspectives (Yale Center for Teaching and Learning, n.d.). It may also be worth considering strengths-based rather than deficit-based approaches (Simmons & Lord, 2019).

Shared courses and curriculum are a key component of an effective learning community. It is essential that there is excellent coordination and cooperation. The

learning community experience has more impactful learning outcomes if teaching staff require students to apply information from one course in the assessment of another course (Zhao & Kuh, 2004). It is also important to authentically weave together both academic and social experiences (Zhao & Kuh, 2004).

6.9 Group work

Ways to build "Cohort Citizenship" include teaching, modelling, enforcing, as well as positive and enriching collaborative work experiences. Group work came up time and time again in the focus groups and were probed in the surveys. It is evident from the data that students' feelings of connection with their peers can be largely influenced by their experiences in group assignments. As such, staff supporting students to work effectively and respectfully in groups will enhance the overall student experience, both in academic and social terms. We now discuss key aspects of creating cooperative learning groups.

Positive interdependence can be introduced into formal cooperative learning groups by getting all members of the group to decide on a single group answer (group product-goal interdependence), by making sure every member of the team can explain the group answer (learning goal interdependence) and by assigning role responsibilities to members of the group (role interdependence) (Smith, Sheppard, Johnson, & Johnson, 2005). Typical ways to structure positive interdependence are shared rewards or grades (reward interdependence), shared resources (resource interdependence) or to divide tasks (task interdependence) (Smith, Sheppard, Johnson, & Johnson, 2005).

Instructors need to ensure that students engage and interact with the group to complete the assigned task, and help each other succeed (Smith, Sheppard, Johnson, & Johnson, 2005), which is called **face-to-face promotive interaction**. This requires students to teach, explain, help, encourage, share thinking and support each other (Smith, Sheppard, Johnson, & Johnson, 2005).

It is important to ensure every individual group member develops from the experience, which means they must have **individual accountability and personal responsibility** for their role in the group. Part of this is making sure nobody gets a free ride from others, but more importantly it is about the group knowing who needs help completing the assignment (Smith, Sheppard, Johnson, & Johnson, 2005). Ways to achieve this include self and peer assessment, individual assessment and randomly asking members to report on group progress and work (Smith, Sheppard, Johnson, & Johnson, 2005).

Teamwork skills are essential and must be intentionally taught (Smith, Sheppard, Johnson, & Johnson, 2005). One approach is to assign roles in the team, which develop the various teamwork skills. For example, having a task recorder (documentation skills), process recorder (strategy and monitoring progress), coordinator (provide direction) or checker (ensure individuals understand and can explain work) (Smith, Sheppard, Johnson, & Johnson, 2005).

To unlock the true power of effective groups instructors need to make sure there is effective **group processing**, which involves not only discussing how the project is going, but describing what actions from group members are helping or not helping and making decisions as a team about what to stop doing, change or keep doing (Smith, Sheppard, Johnson, & Johnson, 2005). One way of achieving this is to require each group to list three things the group did well and one it could improve on (Smith, Sheppard, Johnson, & Johnson, 2005). This requires clear expectations, engaged students, specific instructions and feedback and sufficient time to do it properly (Smith, Sheppard, Johnson, & Johnson, 2005). The instructor must help students through this project, which includes

- Going over ground rules/expectations for working with groups and to come up with a lexicon/possible dialogue for students to use should trouble arise (i.e. how to confront team members who are not collaborating up to a high enough standard).
- Providing venues for feedback on group performance (anonymously).

Pierratt suggests three key aspects of collaborative work (Pieratt, 2019):

- Calibrating collaboration: It is important to give students clear messages on what collaboration is expected, how it is assessed, when it is allowed or should happen and how it should be done (Pieratt, 2019). Set the ground rules at the start for why collaboration is important and have a shared philosophy in the department for learning outcomes around this pedagogical strategy.
- Assessing collaboration: Consider what skills and capabilities graduates need around collaborative work. In particular, think about what collaboration is like in industry. Construct a common rubric for assessing student collaboration (Pieratt, 2019).
- Scaffolding collaboration: Focus on one skill at a time. See (Pieratt, 2019) for links to resources.

There is great value in inter-disciplinary teamwork. Courses with students from multiple cohorts allows this. However, it is also important to allow cohorts to work on projects together. This needs to be mindfully coordinated across the programmes.

6.10 Engineering experiences and industry connections

Students are more likely to persist if they know an engineer or have had exposure and meaningful experiences with engineering (Pierrakos, Beam, Constantz, & Johri, 2009). Experiences could include summer camps, competitions or school coursework (Pierrakos, Beam, Constantz, & Johri, 2009), highlighting the influence of outreach activities. In (Pierrakos, Beam, Constantz, & Johri, 2009), it was found that students who left engineering didn't have strong social connections in engineering. The first year is crucial in helping students learning about engineering and what it means to be an engineer (Pierrakos, Beam, Constantz, & Johri, 2009). Engagement in engineering activities and formation of both professional and social networks was seen in students who persisted with engineering (Pierrakos, Beam, Constantz, & Johri, 2009). A sense of being part of a "community of practice" and being able to identify with the profession can be encouraged by (Pierrakos, Beam, Constantz, & Johri, 2009):

- Encouraging students to get involved in engineering activities.
- Providing positive and diverse role models for students, in the form of staff, students (current and recent graduates) and external speakers. The engineering role models brought in should reflect the diversity and cultures of the student body (Tomoana, 2012).
- Including course content covering the engineering profession.

Inviting engineers from industry to come in to present the many faces of an engineer could help students to identify with what comes after graduation. A significant connection to industry can help with engineering identity (Han, Cook, Shuman, Mason, & Turns, 2018). Changes can be split into 4 areas (Han, Cook, Shuman, Mason, & Turns, 2018):

- Shared vision: create a hub of engineering activity, where staff, students and engineers from industry can share ideas and experiences in order to cultivate identities as engineers. Connect to companies as well as professional groups.
- Reflective faculty: increase interaction with industry. This could go as far as staff spending time in industry, but could also involve having an industry advisor

to help staff and students bridge the gap between courses and industry practices.
- Industry relevant curriculum and pedagogy: incorporate current industry practice into the curriculum. Try to have activities that actually mimic what engineers would do in industry. Consider vertically integrated courses employing experiential learning and containing significant industry content. Allow students from different years to work on projects together.
- Supportive policies: ensure staff are recognised for their efforts in reviews and that assessment policies acknowledge this broader view of assessment.

The undergraduate years are a complex time for students as they make educational and career decisions. It is important for staff to strive to understand what these students are facing and support them to make informed decisions (Meyers, Ohland, Pawley, Silliman, & Smith, 2012). How we recognise students as engineers is an important component of engineering identity, this acknowledges the role of social recognition in identity (Meyers, Ohland, Pawley, Silliman, & Smith, 2012). Some key messages from (Meyers, Ohland, Pawley, Silliman, & Smith, 2012) are:

- What we call engineering students matters. By simply calling them engineers we may be able to increase their connection to engineering and reduce isolation.
- Making first year engineering students feel welcome and part of the engineering community is critical. For example, peer mentoring, social media, learning communities, study groups or even groups in halls of residence could be used. Talk to students who have not continued with engineering to hear their feedback and experience (e.g. exit survey).
- Having a professional work plan helps with persistence, so look at how to weave this into curriculum and social events.

6.11 Whānau and community connections

In a NZ context, it is important to integrate tikanga Māori into the programme and institution. Part of this is affirming student's connection to the community (Greenwood & Te Aika, 2009). It is acknowledging that for Māori, education is not just for individual benefit, but for the benefit of the community (Greenwood & Te Aika, 2009). It is important for the institution to have diverse industry and community connections, especially in supporting minority and under-represented groups into recruitment, retention and career development. For example, see (Sciascia, 2017) and the reference therein on the importance of whanaungatanga between the institution and iwi, hapū and marae. Strong iwi support changes how Māori students perceive the programme (Greenwood & Te Aika, 2009). The importance to student success of mutually beneficial relationships and collaborations with Māori and Pacific stakeholders is highlighted in (Tomoana, 2012). These connections also provide a possible source of industry mentors for students, invited speakers, industry and community projects and internships. When thinking about such connections, there should also be thought to providing opportunities for whānau to engage (Tomoana, 2012). This is important for both Māori and Pacific students.

6.12 Inclusion training and advocacy

Research shows that appointing and developing Māori staff is an important way to support Māori student success and the bicultural goals of the institution (Greenwood & Te Aika, 2009). This means proactively developing Māori talent and looking at the inclusivity of hiring processes and the diversity of staff and tutors hired for the programme delivery (Greenwood & Te Aika, 2009).

It is important to train staff and teaching assistants in diversity and inclusion (Simmons & Lord, 2019). In a NZ context it is important to support staff in developing their knowledge of Te Reo Māori and tikanga Māori (New Zealand Ministry of Education Te Tāhuhu o te Mātauranga, 2021). Staff need to learn and acknowledge whakapapa including the historic contexts of colonisation, subjugation and discrimination for Māori students and the contexts these students are still operating in, see (Sciascia, 2017) and the references therein. Staff need to develop an understanding of current issues for Māori students including cultural ones (Curtis, et al., 2012). A bicultural approach is needed to support Māori students, this means acknowledging Tangata Whenua status and focusing on partnering with Māori (Greenhalgh, Walker, Tipa-Rogers, & Hunter, 2011). When speaking about tikanga, we refer to both Māori and local iwi values and protocols (Greenwood & Te Aika, 2009). In a NZ context it is also important to have a culturally responsive pedagogy approach for Pacific learners, based around values such as respect, metaphors, stories, humility, humour and relationships (Tomoana, 2012). It is important that tutors believe that all students have the ability to succeed and achieve in their studies (Sciascia, 2017) (Tomoana, 2012).

Research has shown that students noticed and appreciated tutors attempting to pronounce Māori words and names (Greenhalgh, Walker, Tipa-Rogers, & Hunter, 2011). A willingness to try was more important than their competence at pronunciation (Greenhalgh, Walker, Tipa-Rogers, & Hunter, 2011). If students have adopted an English name, ask them what their name is in their own language and which they prefer (Tomoana, 2012).

In addition, it is important to have advocacy, and equity and diversity groups and committees (Simmons & Lord, 2019). Peer-led support through student clubs and mentoring schemes can help improve access (Simmons & Lord, 2019). If the support group is oriented around a single marginalised identity, then care needs to be taken to acknowledge multiple identities and systems of oppression that members might be experiencing or be able to relate to (Secules, Sochacka, & Walther, 2018). For example, explicitly advertise supporting multiple populations experiencing discrimination (Secules, Sochacka, & Walther, 2018). Here is a New Zealand example for those experiencing gender discrimination in STEM: “WiTSoc (Women in Tech Society) is a free to join social club at the University of Canterbury, New Zealand. It is open to anyone who identifies as a woman (cis or trans) and is studying a STEM degree at University of Canterbury. (Non-binary folk are welcome too!) STEM degrees include all Science, Technology, Engineering and Mathematical degrees. We aim to support and connect the women studying technical papers at UC.” (WiTSoc, n.d.). Marginalized and under-represented groups (and allies from dominant groups) may be able to find common goals to work on in order to get further leverage for change (Secules, Sochacka, & Walther, 2018). This might require intergroup dialogue groups with facilitators for each identity group (Secules, Sochacka, & Walther, 2018). The goal here would be to empower students to use their insights on mechanisms of oppression to push for institutional change (Secules, Sochacka, & Walther, 2018).

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8 Appendix: Surveys

The questions to the survey sent to second and third year EEE and CE students are given below.

1. Please indicate your current Professional year.
2. You are now in the Engineering Professional years. What does "professional" mean to you?
3. It is often said that each cohort (e.g. 1st Pro. EEE 2018) has a distinct personality. How do you think others would describe the “personality” of your cohort?
4. During the First Professional year, how did this "personality" develop?
5. What was the influence of your engineering intermediate year on how the cohort formed?

Questions 6-11 refer to social interactions in the cohort and the wider department(s). Select from strongly disagree / disagree / neither agree or disagree / agree / strongly agree.

6. I feel comfortable in the department(s).
7. I feel comfortable in the cohort.
8. I feel accepted in the cohort.
9. I have friends in the cohort.
10. I hang out with classmates socially outside of university.
11. I have people I can study with in the cohort.

Questions 12-17 refer to communication within the cohort and the wider department(s). Select from strongly disagree / somewhat disagree / neither agree or disagree / somewhat agree / strongly agree.

12. I feel comfortable participating in class.
13. I feel comfortable speaking out when I disagree with something.
14. I feel comfortable speaking out about health and safety.
15. I feel comfortable speaking out about unprofessional behaviour.
16. I feel that I can talk to staff in the department(s) about academic matters.
17. I feel that I can talk to staff in the department(s) about personal matters.

Questions 18-25 refer to teamwork within the cohort. Please draw upon your experiences in team projects and group-based laboratory experiments to answer the following questions. For questions 18-21 select from strongly disagree / somewhat disagree / neither agree or disagree / somewhat agree / strongly agree.

18. I feel valued by team / group members.
19. I feel respected as a team / group member.

20. I feel comfortable in my team / group.
21. I can express my opinion to team / group members.
22. What positive experiences have you had with team / group members?
23. What negative experiences have you had with team / group members?
24. What behaviour would you like to see in team / group members? Why?
25. What behaviour would you dislike to see in group members? Why?
26. What were the positive aspects of your First Professional year cohort experience? Please explain.
27. What were the negative aspects of your First Professional year cohort experience? Please explain.
28. Would staff-student mentoring during First Professional year have been useful? Please explain.
29. What could UC Engineering have done differently to enhance your First Professional year?
30. What advice do you have for current / future First Professional year students (e.g. teamwork, cohort formation, team building, study habits, etc.)?

9 Appendix: ECE reorientation worksheets

ECE Reorientation Bingo

Write the names of 16 people you met who....

Had an adventure over the break	Discovered a new food favourite over the break	Has a cause they are passionate about	Recently had an “aha” moment
Has a signature dish	Belongs to a UC club other than UCSA	Has a quote that inspires them	Has lived in another country
Overcome something they are afraid of	Enjoys the same hobbies	Has a cool story about how they got their name or what it means	Has studied a course outside science and engineering
Plays a musical instrument and / or sings	Is passionate about a long term goal	Speaks more than one language	Was inspired by someone last semester

Sheet for phase 3 of reorientation session – setting intentions for the semester.

My intentions for semester 2, 2021

What excites or interests you about electrical or computer engineering and becoming an engineer?

What are your best hopes for your studies this semester?

What is one small thing you will do this week to move you towards this?