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ARTICLE

# The Influence of Peers on the Gender Divide Within Secondary Technology Education in Aotearoa, New Zealand

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**Abstract**
According to New Zealand government statistics, there is a consistent male–female divide within technology education in secondary schools, resulting in an ongoing underrepresentation of male students in fashion and textiles and female students in computer science and resistant materials learning areas. This underrepresentation is concerning as it contradicts the inclusion promoted in the New Zealand Curriculum and may contribute to reduced opportunities for a talented and diverse workforce. A large body of literature is dedicated to the underrepresentation of female students in STEM fields and has predominantly focused on female students in mathematics and science. However, minimal research focuses on the technology curriculum within the Aotearoa New Zealand context. This qualitative exploratory study investigated students' perceptions of gender-typing and gender stereotypes within technology education and the experiences of students engaged in technology subjects in which they are gender minorities. Data were gathered through semi-structured interviews. The findings from the thematic analysis revealed that peers and the need for social connection impacted the experiences of gender minority students in their class and influenced their subject selection.

**Keywords** Gender-Typing · Gender Stereotypes · Technology Education · Peers

## History of Technology Education in New Zealand

New Zealand government statistics show consistent male–female division in most secondary school technology subject areas between 2006 and 2020. Some subjects even show an increase in gender underrepresentation; for example, in 2006, 16.9% of fashion and textiles students were male, compared to 11.5% in 2020. Likewise, in 2006, 34.9% of computer science/programming students were female, whereas

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in 2020, this dropped to 24%. The gender stereotypes reinforced by this trend of underrepresentation could hinder students' identification with technology subjects and negatively affect their interest in taking these subjects (Makarova et al., 2019). The social barriers created by underrepresentation contradict the inclusive nature of the New Zealand Curriculum (MOE, 2007, 2017), which purports to ensure that all students' identities, languages, abilities, and talents are recognised and their learning needs are affirmed and addressed.

From the emergence of technology education in Aotearoa, New Zealand, in the 1890s to the 1970s, a compulsory gender divide prevailed. Men were considered the 'technically competent' breadwinners, and women were the 'domestic' caretakers (Lerman, 2010). Gender-specific technology education was developed—boys were taught metal and woodwork, and girls learned domestic skills such as needlework and laundry (Ferguson, 2009). A disruption to this gender divide started in the 1970s when design focus was introduced into the technology curriculum (Ferguson, 2009). The 1995 revised New Zealand Curriculum added more technological areas, including biotechnology, materials technology, electronics, information technology, and process technology (Harwood & Compton, 2007). Subsequently, the 2002 NZ Curriculum Framework review introduced the three technological strands still used today: Nature of Technology, Technological Knowledge, and Technological Practice (MOE, 2007, 2017).

Technological literacy means mastering practical skills and understanding how technology affects society and how society shapes technology (Jones et al., 2013). The evolution from practical outcomes to technological literacy (Jones, 2003) has broadened the view that technical education should be limited to a specific sector of the community for vocational/domestic purposes. This shift in ethos fits well with the aim of inclusion, which is now a priority of the New Zealand Curriculum (MOE, 2007, 2017). However, alongside these technology curriculum advances, a marked gender division still exists in specific technology subject areas. The ongoing underrepresentation of male or female students in technology subjects is a topic that warrants further exploration, as a dearth of existing research on the subject within the Aotearoa, New Zealand context underlines it.

### *Gender-Typing in Education*

The research mentioned in the subsequent sections was conducted within Western cultural contexts, from primarily English-speaking countries. This research was selected partly due to the availability of extant literature and similarities within school contexts and curriculum structure (Pavlova et al., 2006). However, the underrepresentation of women in STEM fields, particularly ICT and engineering and related fields such as construction, is an issue experienced across all 38 member countries of The Organisation for Economic Co-operation and Development (OECD, 2017).

An aspect of symbolic interactionism (Blumer, 1969) is the recognition that "persons acting in the context of social structures recognise and label one another as occupants of positions. Doing so, they invoke expectations for behaviour" (Stryker, 2001, p. 226). Masculine and feminine labels and expectations may reinforce gender stereotypes in social interactions. Evidence suggests that the most influential drivers reinforcing gender stereotypes are our interactions with and expectations of peers, caregivers, and educators (Chhin et al., 2008; Riegle-Crumb & Morton, 2017). Thus, educational institutes offer a social relational context where gender-typing can be established and reinforced (Paechter, 2012).

Raabe et al. (2019) found that same-sex friends had a significant influence on American adolescents during their selection of science, technology, engineering and maths (STEM) subjects. Such research strengthens the notion that peer influence can affect whether students reinforce or challenge gender norms. Further, a US study of 1,273 high school students found that female students in STEM subjects were significantly underrepresented. The gender-biased views of male students in the class negatively influenced female students' further intent to pursue STEM fields (Riegle-Crumb & Morton, 2017). In the same study, researchers found that having other female students demonstrate high levels of efficacy in STEM went some way towards counteracting the effects of male gender bias in the class. Moreover, European studies have shown that girls are more likely to pursue STEM fields when they have peer role models and can see other females represented in the STEM subject areas (Makarova et al., 2019). In summary, gender stereotypes are a barrier to females entering STEM. In contrast, research demonstrates that female peer role models and self-identification encourage female students to pursue STEM subject areas. There is minimal literature focusing on the experiences of students once they have decided to select a subject area that is assosiated with the opposite gender.

### *Gender-Typing in Technology Education*

Ridgeway and Correll (2004) argued that the degree to which gender, as a background identity present in all interactions, biases both the performance and evaluation of individuals depends upon the situational context they are in and the salience of gender within this context. They (Ridgeway & Correll, 2004) noted that the salience of gender is particularly magnified in two social relational contexts, firstly within mixed-sex situations or situations where individuals consider themselves 'other' to a dominant gender and secondly, "in contexts that are gender-typed in that the stereotypic traits and abilities of one gender or the other are culturally linked to the activities that are central to the context" (p. 517). The second social relational context mentioned by Ridgeway and Correll (2004) is particularly relevant when considering the context of technology education and its historical and cultural gender-typed associations (Wajcman, 2010).

A long-standing gender stereotype underpinning technology education is the belief that male students are technologically competent and female students are incompetent (Faulkner, 2001). Abbiss (2009) explored gender patterns and trends in the information communications technology (ICT) curriculum by surveying Year 9 to Year 13 students across 198 New Zealand schools. It was found that male students were considered to be more adept at 'tinkering' with computers because of perceived interest in this area. In contrast, female students were regarded more as users than creators of technology. Abbiss (2009) suggested that constructed gendered identities continue to be a prevailing influence on gender inequities in technology education, particularly in relation to computer interests.

Further, a multiple case study of 12 Irish secondary schools explored the barriers to female students taking subjects involving resistant materials, such as metalwork and woodwork (Smyth & Darmody, 2009). From student interviews, gender stereotypical notions included female students not wanting to get dirty or break a nail; both male and female students voiced these. Male students also identified perceptions that there was something wrong with boys taking textiles and food technology subjects, including home economics.

There is minimal literature on male students in 'soft materials' subjects, such as fashion and textiles. However, some literature contributes insights into the potential barriers male students may experience when considering selecting fashion and textile subjects in school. When boys transgress from gender-typical behaviour, evidence suggests they may be judged more harshly by peers than girls (Smyth & Darmody, 2009). In adolescence, peer policing becomes prevalent among males, with the 'othering' of non-traditional masculine behaviour or tastes and limitations on their interpretation (Watson et al., 2019). In her qualitative study on the taste and culture of high school boys in the UK, Cann (2014) noted that both aggressive and subtle peer policing can cause fear-driven regulatory behaviour. Consequently, some boys may conceal interests in things that could be considered a violation of hegemonic masculinity (Cann, 2014). Significantly, corrective responses to gender-nonconforming behaviour in childhood may affect boys' interest in feminine-coded subjects in school (Leaper & Van, 2008) and careers in later life (Forsman & Barth, 2017).

Much of the literature on gender and technology education comes under the umbrella of STEM. Predominantly, literature investigating relationships between gender and STEM fields appears to focus on mathematics and science and, to a lesser degree, engineering; there is minimal reference to the area of technology. There is also a significant gap globally in literature focusing on male students in fashion and textiles and the stereotypes they may encounter in this subject. Given the vulnerability mentioned above of male students to peer policing, this area warrants further investigation. Technology literature most often refers to resistant materials and ICT, with little consideration for textiles or food technology. Consequently, literature pertaining to gender and technology within the context of Aotearoa, New Zealand, is scarce.

A contributing factor to the lack of research focused solely on technology education may be that the area is often overlooked and undervalued, particularly in comparison to other members of STEM (Williams, 2011). This lack of esteem is partly due to technology's association with trades (Nylund et al., 2018), stemming from the complex history of technical education (Lerman, 2010). The issue of gendered associations with technology fields is, however, a sperate issue. Given the unique history of technology education and its links to gender roles, this curriculum area deserves further scrutiny. According to a 2017 OECD report, while there have been improvements in the number of women entering maths and science fields, new entrants to ICT, engineering, manufacturing, and construction are still 76% male. As these fields represent areas of industrial growth with high employability rates, this has a significant knock-on effect on the labour market, highlighting the importance of exploring factors affecting gender-typed decision-making in secondary education when students select optional subjects that will lay the foundations for future tertiary study (OECD, 2017).

This article aims to establish a deeper understanding of the gender-related experiences and perceptions male and female students face within the context of resistant materials, computer science, and fashion and textiles classrooms, with a particular focus on the experiences of students of an underrepresented gender in their class.

It aims to answer the following research questions:

- What are students' experiences and perceptions of gender in the context of technology subjects?
- What are the experiences of students engaged in technology subjects in which they are in the gender minority?

## Method

### Research Design

Lim (2011) describes the characteristics of a generic qualitative design as "Providing narrative description, interpretation, and understanding about a specific aspect of people's life or social phenomenon…using categories and thematic analysis to identify recurring patterns and core elements in data" (Lim, 2011, p. 21). Percy et al. (2015) concur and suggest that when researchers aim to explore participants' subjective perceptions and experiences of the world, 'generic qualitative inquiry' is appropriate. Given that this study aimed to explore the perceptions and experiences of participants concerning the gendering of technology education, a qualitative design was deemed suitable.

### Research Context

The context of this study was a technology department within a private secondary school in Tāmaki Makaurau, Auckland. It should be noted that the school's academic drive, as reflected in its mission statement and ethos, may have impacted some participants' experiences of and feelings towards technology as a subject area. As Nylund et al. (2018) show, students often view technology as a less academic option. Furthermore, students who attended affiliated preparatory schools at primary and intermediate levels were in single-sex environments until Year 9. This school structure is unusual within New Zealand schooling and may also have an unexplored impact on perceptions and experiences of gendering and gender stereotypes within technology education.

As this study aimed to explore the experiences and perceptions of students on the gendering of technology subject areas, it is pertinent to provide a breakdown of gender within the classes included in the study; see Fig. 1 below. Data for Fig. 1 were obtained from the school management system with permission from the Principal and Board of Trustees.

## Sampling Strategy

Purposeful maximum variation sampling was used to seek participants for the study (see Robinson, 2014). This approach ensured a diverse range of perspectives from within three technology subject areas where the underrepresentation of male or female students was particularly apparent: fashion and textiles design (FTD), product design (PD), and computer science (CS). The Principal and Board of Trustees were emailed a Participant Information Sheet (PIS), and their written consent was gained via an electronic form. Students from senior CS, PD, and FTD technology classes were invited to participate, and a PIS and CF were sent; fifteen students volunteered.

## Participants

To answer the second research question, '*What are the experiences of students who are engaged in technology subjects in which they are a gender minority?*' it

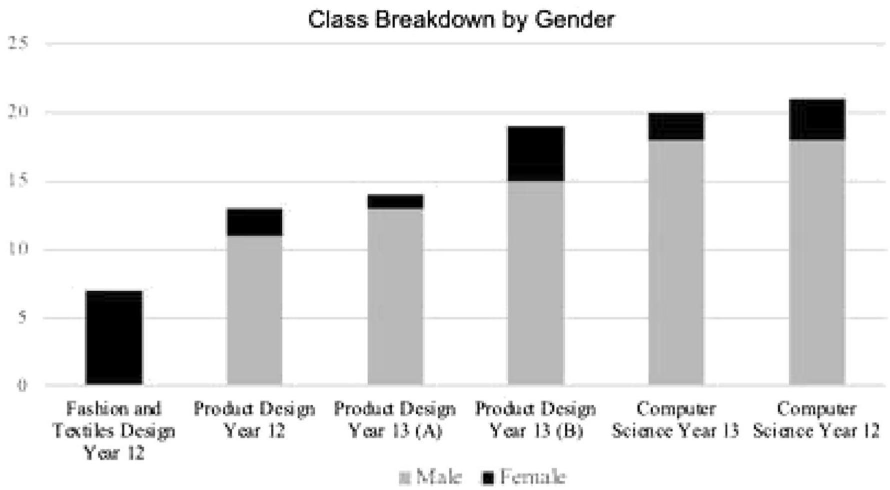


**Fig. 1** Breakdown of subject classes included in the study by gender

was imperative to include participants enrolled in subjects where they were in the gender minority. This was challenging to achieve, however. The nature of under-representation, for example, meant that the sample pool of students needed to be greater than the initial number of volunteers. Further, there were no male students in the Year 12 and 13 FTD classes and the male students in Year 11 were not keen to participate. Overall, volunteers from this subject area were minimal. Therefore, several ex-students were invited to participate; three students from the previous year accepted the invitation. The final sample size was $N=18$; see Table 1 below for a visual breakdown of participants.

## Data Collection

Focus group interviews were used to gather students' perspectives on gender stereotypes within technology education. Four focus group interviews with three or four student participants were organised according to subject areas. An additional focus group interview was held with the three ex-fashion and textile students. Students in each focus group knew one another and shared an interest in the subject area, creating a comfortable discussion environment (Krueger, 2015).

Students considered gender minorities in their class were interviewed individually to allow participants to safely share their experiences and perceptions of the research topic (Curtis, 2014). This was justified as the students may express potentially sensitive responses/experiences different from the majority of the class. All individual and focus group interviews lasted approximately 45 min. Interviews were held remotely via Teams and audio recorded, with participant consent, to allow for verbatim transcription. At the beginning of each interview, participants were advised that they were not required to answer questions they did not wish to and could stop the interview at any time. PISs and consent forms were explained.

**Table 1** Participant breakdown by student, subject and gender

| Participants | Fashion and textiles design | Product design | Computer Science | Total |
|---|---|---|---|---|
| Students | 2 × Female<br>2 × Female former students | 3 × Male | 5 × Male | 12 |
| Students of an underrepresented gender in their subject area | 1 × Male former student | 2 × Female | 3 × Female | 6 |
| Total | 5 | 5 | 8 | 18 |

*Note*. The participant category titled "***Students***" refers to participants of a gender that accounts for the majority of the class

*Note*. The terms 'female' and 'male' have been used for this table and throughout the article. However, this choice is not intended to reinforce a binary notion of gender, and the researcher acknowledges that not all individuals fall into these two categories

Focus groups and individual interviews utilised semi-structured interview techniques with broad, open-ended questions to elicit perceptions and experiences from participants.

Example of focus group question;

> What are your thoughts/opinions about there being mainly male or female students in your technology class?
> [PROBE/FOLLOW UP: What makes you say that? Do you think it matters? Why/why not?]

Example of individual student interview questions;

> Can you give any examples of stereotypes you might encounter about being a male or female taking your technology subject?
> [PROBE/FOLLOW UP: What makes you say that? Can you share any examples/experiences?]

## Analysis

Thematic analysis allowed for an inductive approach whilst identifying themes (Lim, 2011). This process followed the six steps guided by Braun and Clarke's reflexive thematic analysis approach (2019, n.d.):

1. **Familiarising yourself with the dataset**: Each interview was listened to, transcribed, and read, and notes of initial thoughts were made. Participants were sent their interview transcripts and encouraged to give feedback on their accuracy.
2. **Coding:** Key text from each interview transcript was highlighted and iteratively organised into groups of ideas, then coded. This process was conducted in two rounds. The inclusion of multiple interviews from a range of students across different classroom contexts allowed for the triangulation of data sets, providing a multifaceted view of the topic and adding to the credibility of the data collected (Tracy, 2010).
3. **Generating initial themes:** Codes from each dataset were organised into clusters of potential themes and sub-themes.
4. **Developing and reviewing themes:** The entire dataset was then collectively examined and considered alongside the coded data and initial themes, allowing larger patterns to become apparent. Initial themes were reviewed and consolidated.
5. **Refining, defining and naming themes:** Themes were analysed for sub-themes or overlaps to avoid repetition, then named and arranged into a hierarchy based on significance to the topic and prevalence in the data.
6. **Writing up:** The most revealing and relevant quotes were extracted within each theme in relation to the research questions and literature reviewed and used to illustrate and authenticate the report.

## Results

### Importance of Peers

The theme of peers was prevalent in the data, falling into two sub-themes. The first sub-theme, Influence on Subject Selection, focuses on peer-related reasoning for selecting or not selecting technology subjects. The second sub-theme, Safety in Numbers, focused on the peer-related experiences of students who selected a subject where their gender was underrepresented. The two sub-themes are closely interlinked, with one affecting the other.

### Influence on Subject Selection

Student participants identified peers as a motivating factor when selecting optional subjects; in most instances, this related to peers of the same gender. This influence fell into three areas: students choosing not to take a subject because they were the only male or female student in the class; students choosing classes that either had their same-sex friends in them or had people they identified with; and possible peer policing as a motivator to not take a subject.

One participant decided to drop computer science in Year 13 because she had become the only female in the class. While she mentioned having male friends in the class, she felt that, socially, it would not be the same without another female student. As it was her last year, she felt “[it] would be a bit more boring for me if I was sat on a table by myself.” (CS, Yr12, Female).

Student participants noted the importance of having other students similar to them in their classes. This self-identification, or lack thereof, could be a reason to take a subject or not. For example, a male participant noted that “…people tend to seek out those who they’re similar to…you’re probably going to choose the one with your friend” (Computer Science Focus Group Interview (CSFGI), Male, Yr13). Another explained that he took computer science “secure in the knowledge that there will be people there that I’m able to get along with, people that are similar to me…” (CS, Yr12, Male). He noted, “I know one guy that’s done fashion. Like ever.”

Student participants also identified peers’ opinions as an important influencing factor. The two female students in PD both noted conversations they had with friends concerning their subject choice. One felt that some of her peers were sad for her being the only girl, and they thought it must be boring in class, but she explained, “It’s not like a gender-specific thing…cause you can see that the girls that do it really enjoy it. So it’s obvious that it’s not…boring or anything for girls” (PD, Yr12, Female). The second student recalled that some peers thought it “weird” that she was the only girl in class and asked if she did the same tasks as the boys. She retorted, “I do the exact same as what the boys do. [Seeing] a whole class of boys with one girl…might seem weird [to them], but for me, it’s not, I don’t mind.” (PD, Yr12, Female).

When asked about the potential impact of taking FTD as a subject choice, a male CS student noted the following:

> You lose your social status, like your social position in it, because you're viewed as less of a cool guy or less of a man because you take something that girls take (CSFGI, Yr12, Male).

In the same interview, student participants revealed the pressure they felt to take subjects that aligned with the opinions of their friendship groups. One participant pointed out that "…everyone [in my group], except for me, takes the same subjects…I didn't want to base my Year 13 subjects on what they were doing. I wanted to do…what I wanted…" (CSFGI, Yr13, Male). For him, social influence plays a big part in his friends' subject choices: "They're all doing the same subjects, and they're all doing it together".

Interestingly, this focus group noted a potential barrier to female students taking CS in relation to friends and peer pressure, as one explained:

> "Friends? It's a big part...if you miss the first and second year, you just won't get into it. And since a lot of the girls don't have friends who want to get into it in Year 9, they just don't do it." (CSFGI, Yr13, Male)

This observation highlights a problematic scenario. Suppose students are not intrepid enough to select subjects outside the expectations of their friendship groups in early secondary education, by the time they realise they are interested in the subject area they will have missed out on foundational skills. In that case, they may have a significant gap in the knowledge and confidence needed to succeed.

### Safety in Numbers

Descriptions of the perceived or experienced impact of being in a subject area where their gender is underrepresented included the separation between male and female students in classrooms and, sometimes, the isolation felt by students of underrepresented genders. A female CS, Year 13 student recalled being the only girl in her Year 10 class and how she felt overwhelmed at first, keeping to herself, especially after the only other girl left the class. When asked to describe her feelings about being the only girl in the class, she said she found it "very overwhelming; I would say I didn't really have any friends in the class until probably late term three, term four. I kind of just kept to myself, did my own work". Asked whether she would have chosen to take the class had she known she'd be the only girl, she replied, "It would have changed my mind".

> I remember that first day, there was one other girl in the class, and I was so glad that I just happened to know her. I was like, oh, I'm so glad we have a class together. She was like, actually, I'm dropping the subject. And it was horrible…then, I went to class every time and sat by myself.
> (CS, Yr13, Female)

All female CS students mentioned sitting alone or with other female students, separate from the male students. When asked how being one of only two female students in her class impacted her, one participant responded:

> Obviously, it's nicer if there's more [girls] because the social aspect is bigger...I do have some friends in there that aren't girls, which is good too. It's a little bit bad when one of us [female students] isn't there though because you sit at a table by yourself. But that's ok [laughs nervously]. (CS, Yr12, Female)

In CS, male students were also aware of the classroom gender separation. One male CS student (Yr12) used the word "segregated" to describe the classroom. Others, during a focus group interview, discussed the reasons for this segregation: they felt it was either confidence "…they might be shy…or something like that", or the result of social differences:

> …'cause obviously, as much as you want to say that guys and girls are no different, it's very different socially…guys will want to talk [certain things], and girls will want to talk about [other things]. (CS, Yr12, Male)

Interestingly, the experience of the two female PD students differed from that of the CS female students. Both mentioned enjoying being in a predominantly male class and feeling camaraderie with their male counterparts. One described how she disliked being in an all-girls class, while the other explained she liked being friends with guys as "There's less drama… [laughs]" (PD, Yr13, Female). The Year 12 PD female participant recalled her misconceptions prior to opting for the subject. Being the only girl, she thought the boys would judge her, but she found "when I got in there…they weren't judgmental at all. They were actually really cool". While both participants commented that the space was positive, they still sensed the masculine nature and their comfort and enjoyment in this space appeared to be tied to their ability to 'be one of the boys'. "Getting used to their [male students] jokes and how they work in class…I definitely wouldn't call it a feminine space [Laughs]…I feel like you could almost be seen more as one of the boys (PD, Yr13, Female).

When asked why they thought male students were underrepresented in FTD, a male former FTD student replied, "In creative fields, you have to get personal and be vulnerable. And that's not promoted in male culture, I guess." He also felt, in his experience of schooling, that "gender stereotypes…they come more from homophobia and like stigmas around queer people than it does about sexism". For this student, the FTD classroom offered a haven, which he felt was due to its lack of male students: "I felt safe in a classroom of mostly girls. 'Cause that's how high school works…also, then I could avoid getting bullied at lunchtime [FTD students could come in at lunch]."

These findings highlight the complex relationship between gender and technology subject areas. A number of the experiences felt by the girls in this study could be comparable to the experiences felt by female students in other areas of STEM and, indeed, further national and domain contexts. Thus, in the case of female students, the findings of this study bolster those of existing literature. The experiences of male students within FTD appear to be unique and, to my knowledge, are missing from current literature, although they could be comparable to experiences of male students in other feminine-typed subjects such as music (Watson et al., 2019). The experiences of male students who identify as LGBTQ + add another layer of complexity. As the male student above has alluded to, the gender stereotypes faced by male students in feminine-typed subjects are interwoven with hegemonic views of heterosexuality, and transgressions may be met with harsher reactions than female counterparts (Watson et al., 2019).

## Discussion

This section will discuss the study's findings in relation to each research question.

### What Are Students' Experiences and Perceptions of Gender in the Context of Technology Subjects?

The results suggest that students are more likely to select subjects their friends are also interested in taking. This finding aligns with Raabe et al.'s (2019) work, which found that their friends' favourite subject areas influenced both male and female students. As adolescents are more likely to have same-sex friends (Barry & Wentzel, 2006), this could contribute to the lack of gender balance seen in some technology subject areas. Interestingly, Raabe et al. (2019) also found that male students were more influenced by their friends than female students. If peers have more influence on male students, this could have implications for FTD, for example, where male students are significantly underrepresented.

It was interesting to note that attitudes towards female students taking CS or PD were generally positive and encouraging. In contrast, the notion of male students taking FTD was met with a more complex response. Although peer policing was not a prevalent topic within the data, student participants did share the perception that others might consider male students taking FTD to be 'less of a man' for taking a subject considered feminine. Peer policing can manifest in many ways, including more subtle forms (Cann, 2014). One participant mentioned knowing one male friend who had taken FTD and noted that his friend was briefly teased for doing so. These findings align with the work of Cann (2014), who suggested that hegemonic ideas of masculinity can be used to police gender boundaries within a school setting. Consequently, male students were more likely to receive judgment for taking feminine-typed subjects, whereas female students entering subjects associated with masculinity were primarily viewed as empowered.

This scenario is reflective of Owen-Jackson et al.'s (2013) observation that although there are global initiatives for girls to enter masculine-typed areas of the curriculum, there are no similar initiatives to encourage boys to enter feminine-typed subject areas, reflecting a lack of importance placed on these areas. According to government statistics (MOE, 2020), no single-sex boys schools in New Zealand had students enrolled in FTD in 2020; this number has been consistent since 2010. In contrast, 33 single-sex girls' schools had students enrolled in resistant materials classes in 2020, again with reasonably consistent numbers since 2010. It is unclear whether this disparity is due to students' lack of interest or opportunity.

Several student participants discussed the need to take classes where they felt students would be similar to them. They described similarities as shared interests with peers or as 'seeing themselves' within the subject area and the classroom context, suggesting that students were more likely to select subjects they felt aligned with their self-image. These findings are similar to those of Makarova et al.'s (2019) empirical study on student identification with STEM subjects; researchers found that a "lack of similarity between their [students'] self-image and the image of an academic subject" (p. 9) could lead to students not selecting subject areas in school, and consequently not pursue careers in these areas.

### What Are the Experiences of Students Engaged in Technology Subjects in Which They Are in the Gender Minority?

Of the six 'gender minority' student participants interviewed, four discussed experiences in which they felt isolated within their class due to gender. These experiences involved them sitting separately in their classrooms, with either another same-sex student, or on their own if no other same-sex students enrolled. This segregation aligns with Murphy's (2006) observation that students who crossed the gender divide into gender-minority subject areas were often met with challenging and isolating experiences that risked their engagement.

Mainly, the isolating experiences described in this study occurred in the first year of taking the subject, prior to building relationships within the class. Most female gender minority students described adaptive behaviour. They learnt to understand male students' ways of working and social characteristics. For female PD students, this involved becoming 'one of the boys'; for one female CS student, this meant asserting herself as a feminist within the class. The one female student who did not describe adaptive behaviour dropped the subject when she discovered she would be the only girl the following year, perhaps indicating the importance of adaptive behaviour as a survival tool. Paechter (2007) suggests that school structures, and the subject areas within them, have the power to shape the gender identities of students by either aligning with gender-normative behaviour or subverting it within the situational context of the classroom. Perhaps the adaptive behaviour of the female students in this study demonstrates a subverting of gender normative behaviour. It should be noted, however, that some of these students adapted to reflect the behaviours of the majority in the class, thus shedding their 'otherness' in relation to it. Contrastingly, the male student within FTD, who did not conform to hegemonic masculinity, found a place of safety amongst his female peers but felt unsafe amongst his same-sex peers.

## Study Implications

The results discussed have several implications for students choosing which technology subjects to engage with and for students who have crossed the gender divide into classes where their gender is the minority. First, male students may be more likely to receive judgment from same-sex peers for selecting subjects associated with femininity. Although female students may be empowered to pursue masculine subject areas, male students pursuing female-associated areas appear disempowered. This disparity may be because subjects associated with masculinity are often held in higher esteem than feminine-associated subjects, like FTD (Owen-Jackson et al., 2013).

Disempowerment of gender-transgressive male students within school contexts could have further negative implications for the mental health and well-being of these students, as well as their academic success (Watson et al., 2021). Researchers have found a positive relationship between the acceptance of an individual's self-defined gender identity and a decrease in scholastic and peer-pressure-related stress (Watson et al., 2021). These findings support the need for increased education around self-acceptance within school environments and the creation of identity-safe educational spaces where students are supported to be "uniquely gendered individuals" (Watson et al., 2021, p. 130). Technology has a history of entrenched gender associations, making this especially important.

Peer relationships and being with friends are highly motivating factors for students' subject selection. As adolescents are more likely to have same-sex friends, particularly in their early teens when subject selection begins (Barry & Wentzel, 2006), this has additional implications for gender balance in technology subject areas. In addition, the potential cost of selecting a subject area based on being with friends may result in students lacking the foundation skills needed once they realise their interest in a new subject area. Conversely, students brave enough to pursue subjects where they comprise the gender minority often find themselves isolated. Although participants in this study have demonstrated their ability to adapt their behaviour to fit in with the gender majority, students who do not adapt may be at risk of disengaging with the subject area.

## Limitations

One limitation of this study was an inadequate representation of male FTD students in the participant sample because there were no male students in FTD Year 12 or Year 13 at the time. There is a significant gap in the literature addressing the underrepresentation of male students in FTD subject areas, demonstrating the need for further exploration in this area. Secondly, the data included in this study came from one private school, which is not necessarily representative of a typical secondary classroom in Aotearoa, New Zealand. In future research, it would be beneficial to explore the topic of gender division in technology education across a range of schooling contexts to provide a broader picture of the experiences and perceptions of students in technology subject areas relating to male or female students' underrepresentation.

## Conclusion

The issue of gendering in technology education is persistent, demonstrated by the consistent gender divide within technology subject areas over the last twenty years (MOE, 2020). Indeed, as mentioned in the introduction, some areas have even shown an increase in male or female underrepresentation. This continuing trend reflects the complexity and embeddedness of the issue and the need to raise awareness of barriers to equitably gendered participation in a range of subject domains and their causes if we wish to combat gender bias in technology education. Further research in this area is vital to provide the equitable and inclusion the New Zealand Curriculum promises (MOE, 2007).

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## References

Abbiss, J. (2009). Gendering the ICT curriculum: The paradox of choice. *Computers & Education, 53*(2), 343–354. https://doi.org/10.1016/j.compedu.2009.02.011

Barry, C. M., & Wentzel, K. R. (2006). Friend influence on prosocial behaviour. *Developmental Psychology, 42*(1), 153–163. https://pubmed.ncbi.nlm.nih.gov/16420125/

Blumer, H. (1969). *Symbolic interactionism perspective and method*. Prentice-Hall.

Braun, V., Clarke, V., Hayfield, N., & Terry, G. (2019). Thematic analysis. In P. Liamputtong (Ed.), *Handbook of research methods in health social sciences* (pp. 843–860). Springer Singapore. https://doi.org/10.1007/978-981-10-5251-4_103

Braun, V., & Clarke, V. (n.d.). *Doing reflexive TA*. https://www.thematicanalysis.net/doing-reflexive-ta/

Cann, V. (2014). The limits of masculinity: Boys, taste and cultural consumption. In S. Roberts (Ed.), *Debating Modern Masculinities* (pp. 17–34). Palgrave Pivot. https://doi.org/10.1057/9781137394842_2

Chhin, C. S., Bleeker, M. M., & Jacobs, J. E. (2008). Gender-typed occupational choices: The long-term impact of parents' beliefs and expectations. In H. M. G. Watt & J. S. Eccles (Eds.), *Gender and occupational outcomes: Longitudinal assessments of individual, social, and cultural influences.* (pp. 215–234). American Psychological Association. https://doi.org/10.1037/11706-008

Curtis, W. (2014). *Research and education*. Routledge.
Faulkner, W. (2001). The technology question in feminism: A view from feminist technology studies. *Women's Studies International Forum, 24*(1), 79–95. https://doi.org/10.1016/S0277-5395(00)00166-7
Ferguson, D. (2009). *Development of technology education in New Zealand schools, 1985–2008.* Ministry of Education.
Forsman, J. A., & Barth, J. M. (2017). The effect of occupational gender stereotypes on men's interest in female-dominated occupations. *Sex Roles, 76*(7), 460–472. https://doi.org/10.1007/s11199-016-0673-3
Harwood, C., & Compton, V. (2007). *Moving from technical to technology education: Why it's so hard.* TENZ Biennial Conference, https://www.academia.edu/30499025/Moving_from_technical_to_technology_education_Why_its_so_hard
Jones, A. (2003). The development of a national curriculum in technology for New Zealand. *International Journal of Technology and Design Education, 13*(1), 83–99. https://doi.org/10.1023/a:1022355410425
Jones, A., Buntting, C., & Vries, M. (2013). The developing field of technology education: A review to look forward [Article]. *International Journal of Technology & Design Education, 23*(2), 191–212. https://doi.org/10.1007/s10798-011-9174-4
Krueger, R. A. (2015). *Focus groups: A practical guide for applied research* (5th ed.). SAGE.
Leaper, C., & Van, S. R. (2008). Masculinity ideology, covert sexism, and perceived gender typicality in relation to young men's academic motivation and choices in college. *Psychology of Men & Masculinity, 9*(3), 139–153. https://doi.org/10.1037/1524-9220.9.3.139
Lerman, N. E. (2010). Categories of difference, categories of power: Bringing gender and race to the history of technology. *Technology and Culture, 51*(4), 893–918. https://www.jstor.org/stable/40928031
Lim, J. H. (2011). Qualitative methods in adult development and learning. In C. Hoare (Ed.), *The Oxford handbook of reciprocal adult development and learning* (2nd ed.). https://doi.org/10.1093/oxfordhb/9780199736300.013.0020
Makarova, E., Aeschlimann, B., & Herzog, W. (2019). The gender gap in STEM fields: The impact of the gender stereotype of math and science on secondary students' career aspirations [Original Research]. *Frontiers in Education, 4*(60). https://doi.org/10.3389/feduc.2019.00060
MOE. (2007). *The New Zealand curriculum*. Learning Media.
MOE. (2017). *The New Zealand curriculum*. Learning Media.
MOE. (2020). *School subject enrolment*. https://www.educationcounts.govt.nz/statistics/subject-enrolment
Murphy, P. (2006). Gender and technology: Gender mediation in school knowledge construction. In J. R. Dakers (Ed.), *Defining technological literacy*. https://doi.org/10.1057/9781403983053_15
Nylund, M., Per-Åke, R., Eiríksdóttir, E., Holm, A.-S., Isopahkala-Bouret, U., Niemi, A.-M., & Ragnarsdóttir, G. (2018). The academic–vocational divide in three Nordic countries: Implications for social class and gender. *Education Inquiry, 9*(1). https://doi.org/10.1080/20004508.2018.1424490
OECD. (2017). *The pursuit of gender equality*. https://doi.org/10.1787/9789264281318-en
Owen-Jackson, G., Bell, D., & Huges, C. (2013). The (continuing) gender debate. In G. Owen-Jackson (Ed.), *Debates in design and technology education*. Taylor & Francis Group. http://ebookcentral.proquest.com/lib/auckland/detail.action?docID=1356354
Paechter, C. (2007). *Being boys, being girls*. McGraw-Hill Education. http://ebookcentral.proquest.com/lib/auckland/detail.action?docID=316312
Paechter, C. (2012). Bodies, identities and performances: Reconfiguring the language of gender and schooling. *Gender and Education, 24*(2), 229–241. https://doi.org/10.1080/09540253.2011.606210
Pavlova, M., de Vries, M. J., & Mottier, I. (2006). International handbook of technology education: The state of the art. In *Comparing perspectives: Comparative research in technology education* (pp. 19–32). Brill. https://doi.org/10.1163/9789087901042
Percy, W. H., Kostere, K., & Kostere, S. (2015). Generic qualitative research in psychology. *The Qualitative Report, 20*(2), 76–85. https://doi.org/10.46743/2160-3715/2015.2097
Raabe, I. J., Boda, Z., & Stadtfeld, C. (2019). The social pipeline: How friend influence and peer exposure widen the stem gender gap. *Sociology of Education, 92*(2), 105–123. https://doi.org/10.1177/0038040718824095

Ridgeway, C. L., & Correll, S. J. (2004). Unpacking the gender system: A theoretical perspective on gender beliefs and social relations. *Gender and Society, 18*(4), 510–531. https://doi.org/10.1177/0891243204265269

Riegle-Crumb, C., & Morton, K. (2017). Gendered expectations: Examining how peers shape female students' intent to pursue stem fields. *Frontiers in Psychology, 8*, 329. https://doi.org/10.3389/fpsyg.2017.00329

Robinson, O. C. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology, 11*(1), 25–41. https://doi.org/10.1080/14780887.2013.801543

Smyth, E., & Darmody, M. (2009). 'Man enough to do it'? Girls and non-traditional subjects in lower secondary education. *Gender and Education, 21*(3), 273–292. https://doi.org/10.1080/09540250802415124

Stryker, S. (2001). Traditional symbolic interactionism, role theory, and structural symbolic interactionism: The road to identity theory. In J. H. Turner (Ed.), *Handbook of sociological theory* (pp. 211–231). Springer US. https://doi.org/10.1007/0-387-36274-6_11

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative Inquiry, 16*(10), 837–851. https://doi.org/10.1177/1077800410383121

Wajcman, J. (2010). Feminist theories of technology. *Cambridge Journal of Economics, 34*(1), 143–152. https://doi.org/10.1093/cje/ben057

Watson, P. W. S. J., Rubie-Davies, C. M., & Hattie, J. A. (2019). Adolescent males in New Zealand school choirs: The contradictory business of being in the gender vanguard. *Gender and Education, 31*(3), 425–444. https://doi.org/10.1080/09540253.2018.1468417

Watson, P. W. S. J., Sotardi, V. A., Park, J. J., & Roy, D. (2021). Gender self-confidence, scholastic stress, life satisfaction, and perceived academic achievement for adolescent New Zealanders. *Journal of Adolescence, 88*, 120–133. https://doi.org/10.1016/j.adolescence.2021.02.009

Williams, P. J. (2011). Stem education: Proceed with caution. *Design and Technology Education: An International Journal, 16*, 26–35.