TOI MAI
Workforce
Development
Council

Barriers for Women in Creative Technology Tertiary Training in Aotearoa

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Lead Researchers
Oli Wilson
Catherine Hoad
Dave Carter

Research Advisor
Warren Maxwell

Rōpū Whānau Lead
Jani Wilson

Project Data Analyst
Paula Maddigan

Research Assistants
Cecelia Faumuina
Jesse Austin Stewart
Josh Ellery

Ministry of Education Data Analyst
Ara Persson

Qualitative Data Collection
Cecelia Faumuina
Megan Rogerson-Berry
Henry Johnson

Toi Mai Chief Executive and Project Sponsor
Claire Robinson

Toi Mai Project Manager
Jeannette Troon

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MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

Contact details:
Assoc. Prof. Oli Wilson
Toi Rauwhārangi College of Creative Arts
Massey University Wellington
o.wilson@massey.ac.nz

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Executive Summary

This research was commissioned to identify barriers to entry for women in selected areas of tertiary-level creative technology training in New Zealand. Massey University researchers have completed desk research; analysed enrolments for 324 creative technology courses; and conducted interviews with a sample of educators and sector experts.

1. Tertiary offerings are poorly organised and categorised within extant SAC funding and NZSCED codes.

There are significant discrepancies in the way creative technology courses are represented within existing Ministry of Education (MoE) data:

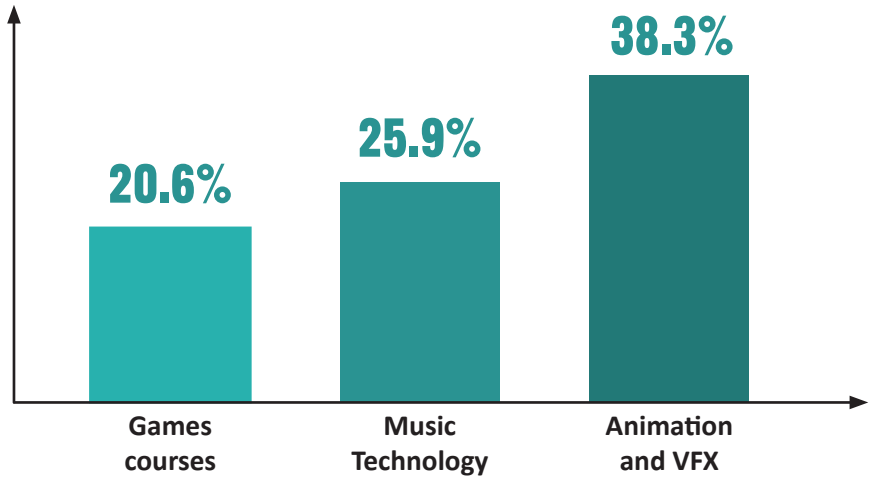
133 Music Technology courses had *9* different SAC codes and *5* different NZSCED codes;

126 Animation and VFX courses had *10* different SAC codes and *13* different NZSCED codes; and

65 Games courses had *6* different SAC codes and *15* different NZSCED codes

2. Women are underrepresented in creative technology at tertiary level across all years of study.

When averaged over 5 years, and across Levels 5, 6 and 7, the proportion of women in Games courses was 20.6%, 25.9% in Music Technology, and 38.3% in Animation and VFX.



3. Women are not progressing to tertiary study in creative technology from secondary education.

At Year 13, most Arts subjects related to creative technology show strong representation for women. The low proportion of women enrolled into creative technology subjects at tertiary level is present from Level 5, which is generally the first year of tertiary study.

4. There is no coherent 'pipeline' through our education system to the creative technology workforce.

Our qualitative data identifies the following issues within schools:

- There is a lack of coherent and systemically supported pre-tertiary creative technology education.
- Career advisers and teachers have insufficient knowledge of creative technology careers, and rarely encourage students to pursue this path.
- There is a widely held perception that creative technology industries are unfair and unsafe professional environments for women, Māori and Pacific Peoples.
- Teachers are not adequately trained, resourced, or provided with ongoing professional development.
- Classroom environments can perpetuate existing inequalities.

Introduction

Toi Mai has identified a workforce shortage in sectors where technology and the creative arts converge. Recent industry-led research into the digital technology and ICT workforce pipeline suggests that there are low proportions of women in tertiary and high school training, exacerbating workforce shortages. In international research, this phenomenon is characterised as a 'leaky pipeline' (c.f. Born & Devine 2015). To identify where and why these 'leaks' are occurring, this report considers barriers for women accessing creative technology tertiary training in Aotearoa.

Understanding the Problem

Why Creative Technology?

Creative technology (also referred to as createch) is broadly defined as an interdisciplinary and transdisciplinary field that encompasses a wide array of practices and occupations, including software engineering, digital cinematography, 3D animation, music production, virtual/augmented reality, game design, video production, and interface design and development. To this end, Andy Connor and Stefan Marks have defined creative technology as 'the blending of knowledge to create new experiences or products' that meet end user and organisational needs (2016:15).

Given this focus on innovation and value, it is unsurprising that the creative technology sector has been targeted as a key priority area for Aotearoa' economic future. MBIE's 'Digital Economies – Draft Industry Transformation Plan 2022–2023' features creative technology as an example of an area with considerable potential:

[1] In the Music Technology workforce, for example, women comprise 11.1% of developers and 12.5% of audio engineers *(Amplify Aotearoa 2020)*; in the Games industry, women represent 19% of employees *(New Zealand Game Developers Association 2021)*.

The creative industries of Aotearoa are at the forefront of technological innovation. Createch is the genre of activities in which technology enables creativity to produce new value-added products, services or experiences, and vice versa. Createch solutions are not limited to the creative sector as they are increasingly being applied to many other industries such as tourism, education, housing, health and elder care (2022: 32).

Despite such positive future outlooks for the sector, creative technology in the workforce of Aotearoa exhibits significant gender disparities[1], with poor representation and inequitable educational and professional outcomes for women. An immediate factor, MBIE notes, is 'an industry culture that does not always promote a safe and welcoming work environment' (2022: 16).

International research tells us that such issues begin well before women enter the workforce, where a series of obstacles emerge from the convergence of technical and economic issues with socio-cultural factors (Purushothaman & Zhou 2014).

Priorities for the Creative Technology Workforce in Aotearoa

Given the implications of this disparity for wellbeing, inclusivity, and productivity outcomes, extant reports[2] into the digital skills workforce in Aotearoa have identified a number of key priorities for the sector:

- Collaboration between industry, government, and the education sector to solve problems.
- Work with women, Māori, and Pacific communities to improve participation rates.
- Build a digital skills pipeline that begins at school, through promoting digital technology to students, parents, and whānau, and invest in upskilling educators.
- The industry must redress a lack of safety and inclusivity.
- Develop consistent data for training outcomes.
- Shift pedagogical models to better accommodate work-integrated learning and digital apprenticeship pathways.

Proactively engaging with these priorities is crucial for the development and sustainability of the creative technology workforce in Aotearoa, where diversity is vital for

- the numbers, wherein 'if the industry is only attracting talent from a pool of less than 50% of the population, it will not be possible to scale'; and
- strength – 'a diverse workforce is far stronger and ensures diversity of thinking that is more representative of the actual users of technology' (MBIE 2022: 27).

Current Scholarly Research – An Overview

We begin by noting the work of Stephanie Fisher and Jennifer Jensen, who urge researchers in the field of gender and technology relations to 'turn [their] focus from examining the "problem group" (girls and women) to the specific sociocultural conditions that produce and naturalise gendered exclusions' (2017: 87). It is in this spirit that we undertake this review of scholarly literature, where extant research exploring barriers to access in creative technology has identified a number of core conditions that function to preclude and exclude women and girls. Broadly, these encompass gendered attitudes to technology, wherein stereotypes of masculine and feminine behaviour are upheld and reproduced in advertising, schooling, and at home; experiences in the workforce, where masculinist 'bro culture' pervades professional contexts; and the pre-employment 'pipeline', where classroom experiences coincide with underrepresentation of women in secondary and tertiary creative technology spaces.

[2] Drawn from 'Digital Economies – Draft Industry Transformation Plan 2022-2023' (MBIE 2022), 'Digital Skills and Talent Plan' (2021), 'Digital Skills for our Digital Future' (2021) and 'Interactive Aotearoa Report' (2019).

Technology and Gender Stereotypes

The socially-constructed nature of gender-technology discourses continues to perpetuate the binary opposition of masculine/technical, and feminine/non-technical. Such binaries mediate and reinforce gendered stereotypes that affect boys' and girls' representation and practices, including their educational and career choices (Ferreira 2017). This gender bias, made explicit through factors such as parental influence, advertising, and the 'male culture of computing', actively shapes girls' choices and upholds a dominant paradigm of ICT as 'culturally and historically male' (Sanders 2006). This technomasculinisation emerges from the intersections of the conditioning of gender roles; the influence of schooling, families, and community environments (Lopez-Inesta et al. 2020); and a wider consumer context wherein technology is framed as serving men's interests rather than women's (Joyce 2012).

The masculinising of technology (Yansen & Zukerfeld 2014) thus functions across multiple stages and contexts. During childhood, for example, boys are more assertive in voicing their desire for laptops, smartphones, and tablets (Ferreira 2017); adolescence is a 'period of heightened risk', where historically, computing has been actively claimed as 'guy stuff' by boys and men and passively ceded by girls and women (Margolis & Fisher 2002). Women are regularly objectified within such spaces when they do engage as participants (Armitage & Thornham 2021), and often framed within discourses of 'technicity', where technological competencies are more commonly associated with white men and masculine culture (Poutanen & Kovalainen 2017). The emphasis on gendered competencies has direct implications for the workforce, where 'females will avoid traditionally male-dominated occupations since they are discouraged from engaging in these occupations through the sex-role socialisation process' (Mozahem et al. 2020).

Experiences in the Workforce

Where women do enter the creative technology workforce, international research suggests they are underrepresented, experience significant barriers to career sustainability, and encounter hostile workplace cultures. The creative technology workforce itself is hence understood as perpetuating a 'gendered inequality regime' marked by 'everyday practices and discourses which create, rationalise, and hide inequalities' (Handy & Rowlands 2014), where 'gendered occupational segregation' (Prescott & Bogg 2013) is widespread across the sector. In the screen industry, for example, Handy and Rowlands' report on film crews in Aotearoa found that less than 23% of crew are women, and those women tend to work in 'conventionally female areas' (e.g. costume, wardrobe, makeup). In contrast, 'technical domains remain largely male' (2017). Such occupational segregation is also reported in the games industry, where women are more likely to work in areas such as Human Resources (Prescott & Bogg 2013).

Negative workforce experiences often stem from the reproduction of technomasculinity, where 'ideal workers' are framed as 'at odds' with stereotypically feminine gender roles (Handy & Rowlands 2014, Barna 2022). Prescott and Bogg note that there is an established culture of 'jobs for the boys' in Science, Engineering and Technology (SET) careers (2013) that manifests in professional practices; Ergin Bulut's research suggests that games workforces are environments informed by 'fraternity links' and marked by an entrenched 'bro culture' (2020). Such discourses are echoed in the SET workforce more generally, where women report hostile working environments, a lack of female co-workers and mentors, family-unfriendly policies, harassment, and stereotyping/tokenism (Yost et al. 2010). To this end, SET careers seem largely unsustainable for women, where the aforementioned factors, in addition to a lack of work-life balance and flexible working practices (Prescott & Bogg 2010), often result in women hitting 'breaking point' in their mid to late 30s and quitting their jobs (Cater-Steel & Cater 2010).

The Pre-Employment Education 'Pipeline'

The underrepresentation of women in university-level STEM qualifications is well-established through international studies (Wong & Kemp 2018). To this end, STEM training is often characterised as a 'leaky pipeline', an analogy developed to describe drop-off rates of women studying at higher levels (Blickenstaff 2005). However, within this literature the creative technology education pipeline is poorly represented and understood. Research that does exist tends towards exploring broader systemic issues rather than the specifics of creative technology teaching and learning. For example, in their study of tertiary music technology training, Born and Devine posit that educational environments offer a 'microcosm of broader processes relating to women and technology' (2015: 147), and that gendered preconceptions of classrooms, instruments, and technologies all contribute to the experience women have in learning environments. Hopkins and Berkers thus call for a critical understanding of women

in technology's educational experiences as they navigate 'male-dominated spaces', which feed into careers in a 'male-dominated field' (2019: 46), where the behaviour and language of male peers and teaching staff alike significantly impact upon women's educational outcomes.

Gender disparities nevertheless appear to emerge well in advance of higher education, where technomasculinisation and isolating environments are evident in classroom behaviours from a young age – in classroom engagements with technology, boys are seen to exert more control over classroom interactions, are more confident in asking for help, and monopolise computers; conversely, girls are framed as more passive, and less likely to assert themselves in terms of classroom technology use (Armstrong 2011). Such isolation for girls has roots beyond education: Seppo Poutanen and Anne Kovalainen note that, for example, girls have not been well-considered in game design markets, where an effort to make 'girls' games' has no real effects in a context where the industry is dominated by men (2017).

Looking Forward

It is clear that there is an established need to critically explore the role that education in creative technology might play in exacerbating gender inequities in the wider workforce. Examining training and dismantling preconceptions at pre-tertiary levels is crucial for reimagining the pipeline for women from education to the workforce, as is research that targets intersectional factors such as ethnicity and decile. As creative technology becomes a key employment area within Aotearoa, it is vital to continue to proactively reframe creative technology education as an inclusive and accessible space, and in doing so seek to disrupt a masculine hegemony; and the subsequent institutionalisation of a future gendered division of labour in the creative technology professions and in technology cultures more broadly (Born & Devine 2015: 151).

Exploring the Problem

Enrolment Data

Secondary school enrolment data is publicly available and easily analysed, given the standardisation of NCEA subjects across Aotearoa. At Year 9, most Arts subjects have relatively good gender balances with women comprising 46% of the cohort on average in the last six years. By Year 13, most Arts subjects show similarly strong representation for women (between 42% and 45% of the cohort); this is less pronounced in Technology subjects.

At tertiary level, little is known about the proportion of women in creative technology training in Aotearoa. This is largely because government data on tertiary enrolments is recorded and organised in a way that makes it impossible to automatically identify and analyse cohorts outside of existing subject categories and named qualifications, which do not adequately represent creative technology areas. This is despite the sizable amount of creative technology programmes across the tertiary sector.

At present, Teritary Education Organisations (TEOs) annually provide the Ministry of Education (MoE) with data on student enrolments into individual courses and qualifications. Generally, qualification data has been used to indicate national-level cohorts in specific subject areas through the New Zealand Standard Classification of Education (NZSCED) categories assigned to courses and qualifications. One such application of this method is found in the Digital Skills For Our Digital Future report.

However, creative technology courses and qualifications are not identifiable within existing NZSCED nor Student Achievement Component (SAC) funding codes, as both systems lack individualised codes for most creative technology subjects. It is therefore impossible to automatically identify creative technology cohorts within this system. Further, the MoE does not record major, pathway or other endorsements, meaning manual identification of specialisation within qualification data is also impossible.

To address this problem, Massey researchers devised a method for creating cohort samples via the algorithmic identification of highly specialised courses in three areas: **Music Technology**, **Games**, and **Animation and VFX**. Together with analysts from the MoE, a protocol was developed for extracting and analysing datasets of student cohorts in each area, for the purpose of examining the proportion of women enrolled into these subjects at a national level.

This method had the ability to refine and broaden course selection criteria based on selected keyword tags within both the MoE central database of courses as well as in all individual TEO websites. Courses were identified by tags developed in consultation with sector experts and were located in both course title and course descriptions, the latter of which are not integrated with MoE datasets. Exclusion rules then removed courses that had shared nomenclature with target specialisation, such as critical studies, history, or theory courses.

For this study, the method has been conservatively applied with highly targeted tags. This prioritises accuracy of specialised identification over accuracy of sample size; it is more likely to exclude relevant entries than inadvertently include irrelevant entries. This presents a limitation, in that inappropriately named or described courses may not be captured, but adds the benefit of being less likely to include errors by capturing courses and, subsequently students, that fall outside of scope.

The datasets developed for this report afforded the analysis of gender and intersections with school decile, ethnicity, and provider type across annual cohorts at Levels 5, 6 and 7. Our findings are based on data from 324 courses across Te Pūkenga, University, and Private Training Organisations (PTO) that ran at least once from 2017–2021.

	Te Pūkenga	University	PTO	Total
Music Technology	54	54	25	133
Animation and VFX	50	21	55	126
Games	12	22	31	65
Total	116	97	111	324

Table 1. Number of courses included in enrolment datasets by specialisation and training provider. A full list of these courses is provided at Appendix A.

Limitations of the Data

All datasets provided by the MoE, including totals, have been rounded to the nearest 5 to protect the privacy of individuals, so the sum of individual values may not add to the total. Totals for the year have not been included due to processing time limitations, but the overall sum should only be +/-25 (5 years, up +/-5 for each year). Completions data has been limited to 'strict' completions i.e., the record shows 'complete'. All other data (e.g. pending) has been considered as not-complete, and is not counted.

Data excludes all non-formal learning and on-job industry training. It includes those private training establishments that received Student Achievement Component (SAC) funding, and/or had students with student loans or allowances, and/or Youth Guarantee programmes.

Data on student enrolments from Private Training Organisations (PTO) was provided as 'suppressed totals' meaning analysis on individual courses at specific Year Levels is not possible. However, analysis on student headcount and enrolments is reported at Level and Year totals, rendering PTO data as directly applicable and comparable to the Te Pūkenga and University totals. Because of the suppression of PTO data, the MoE provided Massey with summary information about the PTO data for inclusion in this report.

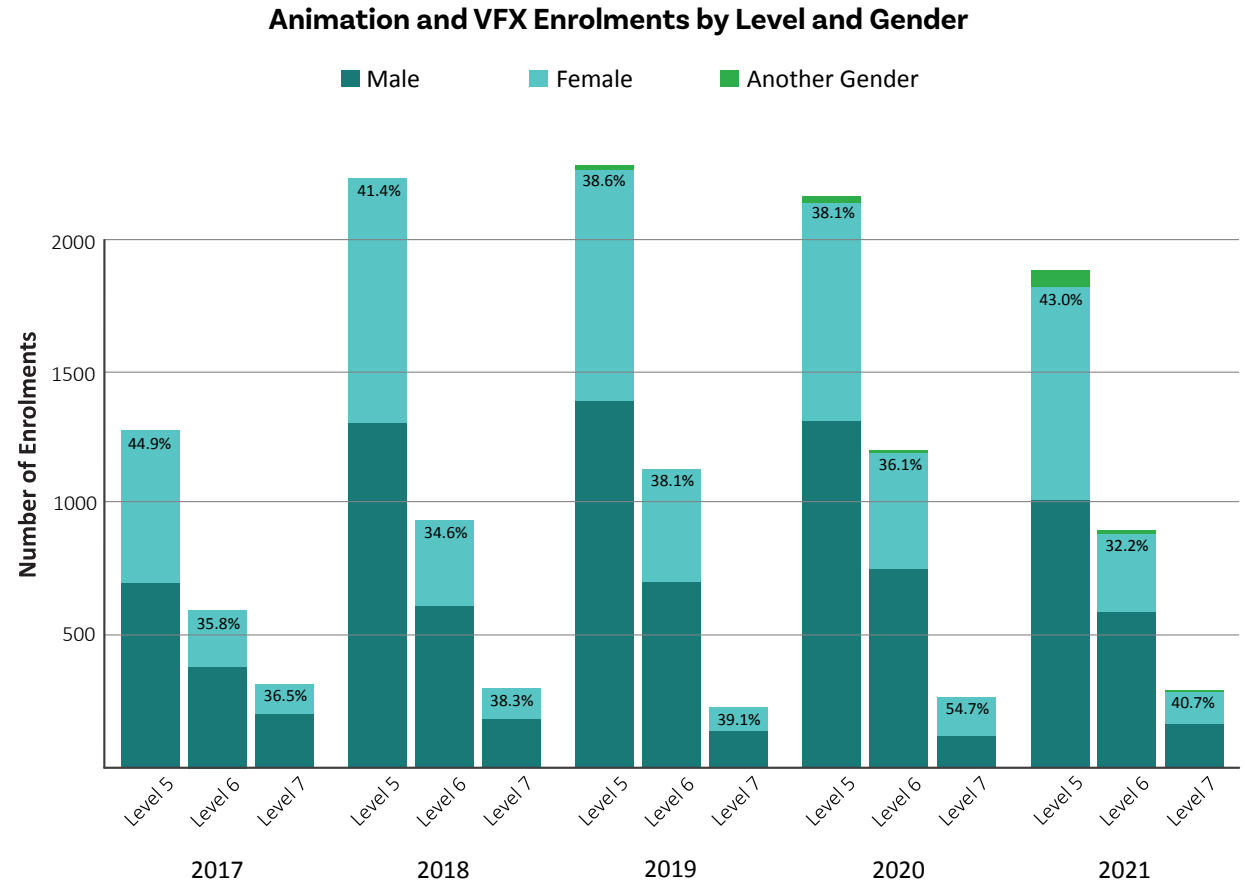
Key Findings from Enrolment Data

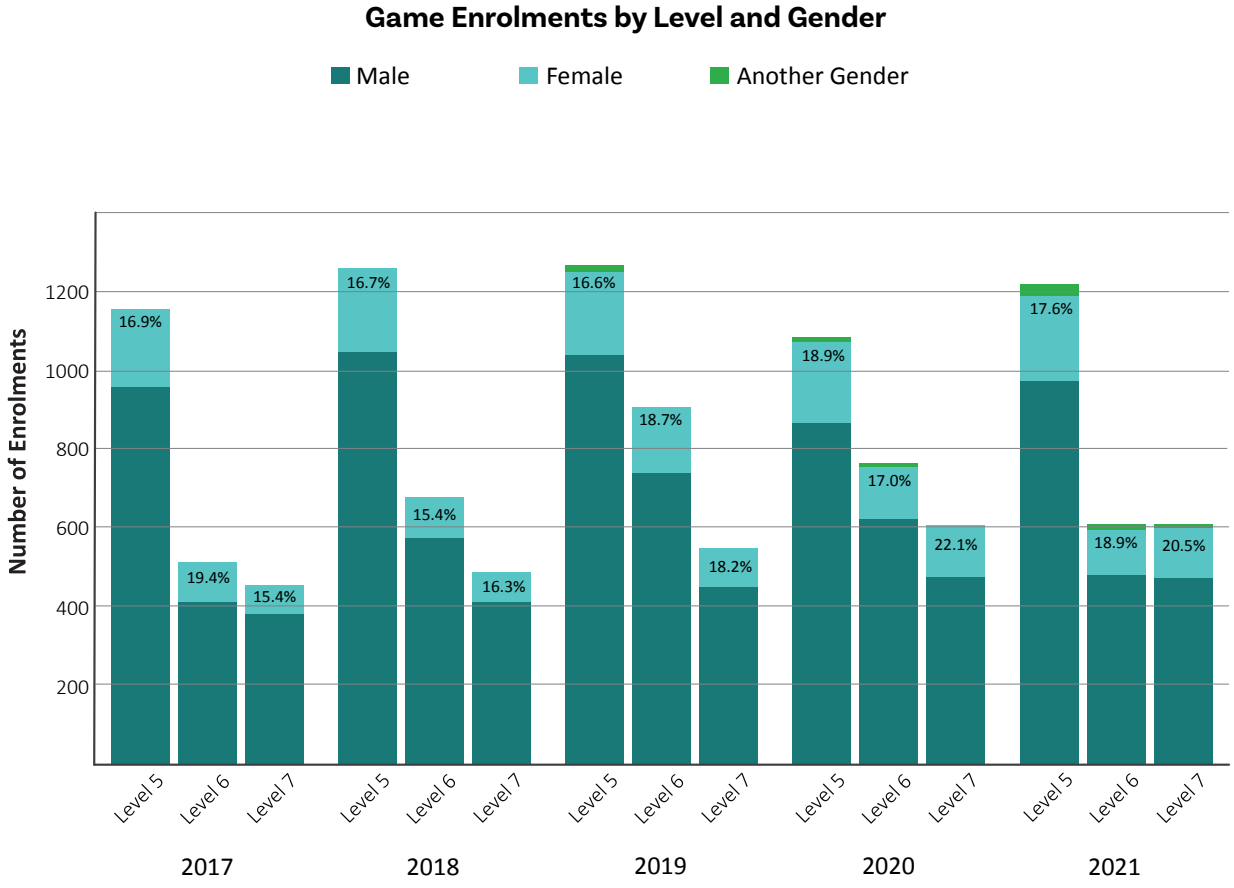
1. Tertiary offerings are poorly organised and categorised within existing MoE datasets, SAC, and NZSCED codes

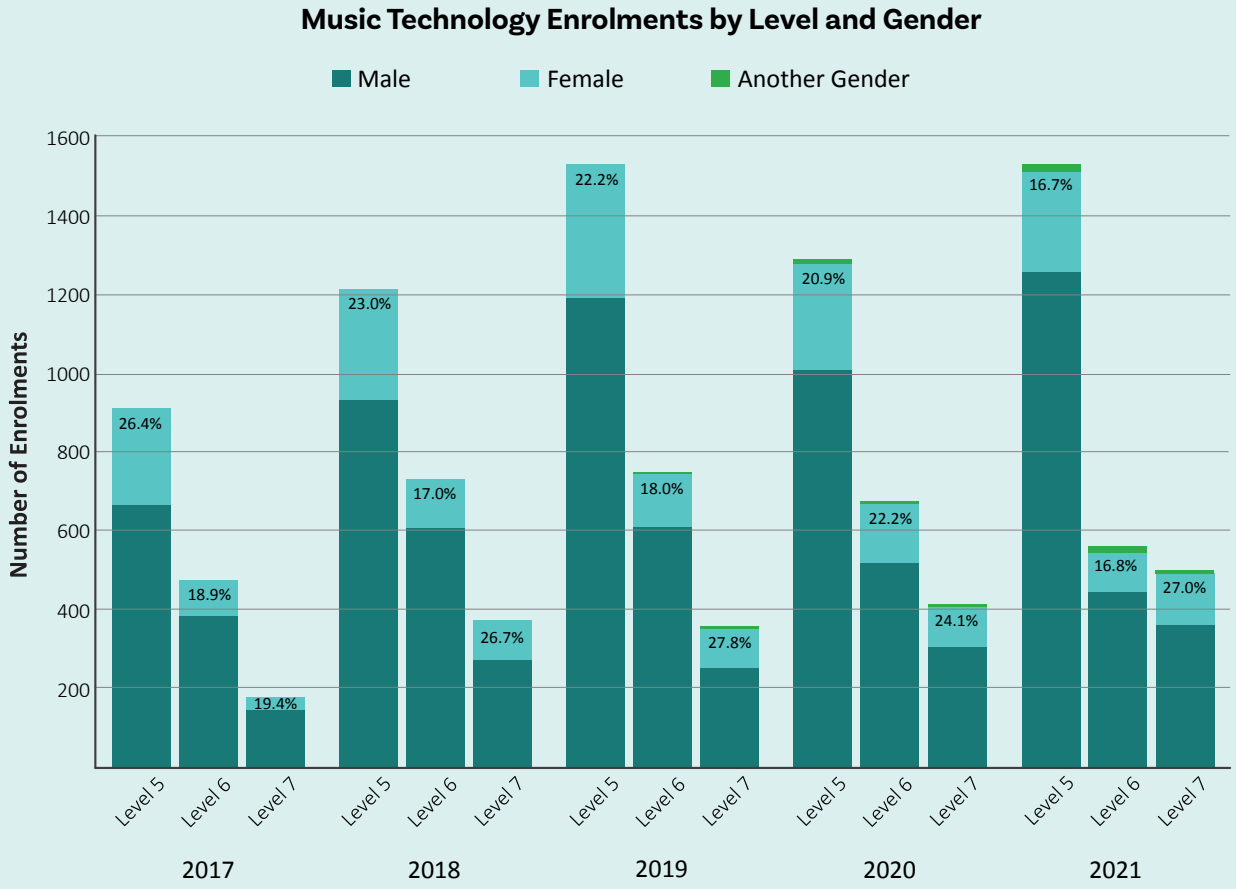
There are clear inconsistencies among TEOs in the structure and naming of qualifications and specialisations in creative technology areas. Our method reveals significant discrepancies in the way these creative technology courses are represented within existing MoE data: 133 Music Technology courses had 9 different SAC codes and 5 different NZSCED codes; 126 Animation and VFX courses had 10 different SAC codes and 13 different NZSCED codes; and 65 Games courses had 6 different SAC codes and 15 different NZSCED codes. These are listed at Appendix B. Students enrolled into at least one of these courses were thus nominally enrolled into 315 different qualifications.

2. Women are not progressing from secondary education to tertiary study in creative technology

When analysing the proportion of women enrolled into these courses, we found that all three areas had a consistently lower proportion of women than men (MoE reports gender as Male, Female and Another Gender). When averaged over 5 years, and across Levels 5, 6 and 7, the proportion of women in Games courses was 20.6%, 25.9% in Music Technology, and 38.3% in Animation and VFX. Our analysis showed no significant variations in the proportion of women between Levels 5, 6 and 7, despite significant decreases in total sample sizes at higher levels.


Animation and VFX Enrolments by Level and Gender
Male
Female
Another Gender
Number of Enrolments
2000
1500
1000
500
44.9%
35.8%
36.5%
41.4%
34.6%
38.3%
38.6%
38.1%
39.1%
38.1%
36.1%
54.7%
43.0%
32.2%
40.7%
Level 5
Level 6
Level 7
2017
2018
2019
2020
2021


Game Enrolments by Level and Gender
Male
Female
Another Gender
Number of Enrolments
1200
1000
800
600
400
200
16.9%
19.4%
15.4%
16.7%
15.4%
16.3%
16.6%
18.7%
18.2%
18.9%
17.0%
22.1%
17.6%
18.9%
20.5%
Level 5
Level 6
Level 7
2017
2018
2019
2020
2021



The proportion of women to men was also consistent across almost all intersections we tested, including provider type, school decile, and domestic and international cohorts. There are also proportionately less women across all ethnicities, with the exception of international students in Animation and VFX courses. Our analysis also showed that pass rates are, on average, slightly higher among women than men.

In summary, our analysis showed that the low proportion of women enrolled into creative technology subjects at tertiary level is present from Level 5, which is generally the first year of tertiary study, and cannot be correlated to any factors present in the data.

Gender is represented in MoE data as Male, Female and Another Gender.

Stakeholder Interviews and Rōpū Whānau

We undertook qualitative research to examine barriers for women within the transition from high school to tertiary study. We interviewed a convenience sample of 12 sector experts, comprising high school teachers, tertiary subject experts, and industry representatives involved in education and training initiatives. Alongside these interviews, we commissioned Rōpū Whānau hui (see accompanying report *Ngā Whakakōroiroi: Exploring Hindrances in Createch for Māori, Pacific Peoples and Wāhine* by Dr Jani K.T. Wilson) to further explore the experience of Māori, Pacific peoples, and wāhine in creative technology training and industry.

The qualitative interviews revealed the following key issues;

- There is no consistent creative technology pipeline through our school system into tertiary study. Participants told us that because most creative technology learning was informal or relied on the interest and expertise of individual teachers, embedded social and cultural norms perpetuate the low proportion of women taking creative technology at tertiary level. These issues are particularly impactful for Māori and Pacific students.
- Participants detailed a wide range of specific systemic barriers within tertiary study, NCEA, school management. The lack of continued professional development opportunities for teachers impacted the ability of the education system to support more women into creative technology training.
- Participants described poor career advising and the need for better evidence-based career information to be available for students, teachers, and parents.
- Participants described prevailing perceptions of creative technology industries as unsafe, unfair, and precarious for women as a factor in both career advising and the desirability of creative technology tertiary study for women.
- We heard a variety of solutions, ranging from more targeted resourcing into school-based initiatives. Many interviewees also felt that addressing inequities and safety issues within creative technology industries should be a priority.

Both our quantitative and qualitative analysis reveals a range of barriers that impact the experiences and opportunities available to women within tertiary training, and in the transition from high school to further education. Such issues, we suggest, directly inform industry outcomes, and must be pragmatically addressed to improve the working conditions and lived experiences of women in the creative technology sector.

Stakeholder Interviews

To further our understanding of how the barriers for women in creative technology training manifested as lived experience, the research team conducted stakeholder interviews with a convenience sample of twelve participants. Participants were identified from the following areas:

- Tertiary educators in Music Technology, Games, and Animation and VFX.
- Personnel involved in the recruitment of students from school into tertiary institutions.
- High school educators who teach in Arts, Design, Music and/or Technology.
- Career advisors (formal or informal) for students entering tertiary study.
- Personnel involved in extracurricular activities at either early tertiary levels and/or high school levels.
- Key industry stakeholders across the screen, music, and games sectors.

The diversity of participants was also factored into the process for inviting individuals to take part in an interview, and our sample comprised women, men, and Māori and Pacific participants. Anonymised interviews underwent thematic and descriptive coding.

Key Findings from Stakeholder Interviews

Our analysis of the interviews identifies the following key issues within schools that contribute to barriers within creative technology training and employment. The following sections offer a general overview of common themes that emerged across the interviews, where participants emphasised a lack of consistent creative technology education; the need for better teacher development; improvements in careers advising; the gendered classroom environment; and perceptions of unfair and unsafe professional environments in the sector.

1. There is a lack of coherent and systemically supported creative technology education

Interviewees generally suggested that issues with gender imbalances in creative technology begin prior to high school, and that by the time students enter high school and tertiary environments, it is already 'too late' to redress inequities in these contexts. Interviewees noted the pre-high school 'pipeline' was shaped by vast disparities in the types of resourcing and infrastructure schools had access to. Teachers felt that higher decile schools were more readily able to invest in creative technology, and also noted disparities in what students have access to beyond classrooms, where much creative technology learning happens through friends and family members, online platforms such as YouTube, or tutorials created and distributed by software providers.

It was commonly expressed that there is no systematic support that enables consistent, coherent creative technology education across Aotearoa. Teachers suggested that the NCEA system does not support creative technology education, where there are no dedicated Animation or VFX standards, and Games standards require teachers to have pre-existing, highly specialised skillsets. A further issue emerges in the categorisation of some creative technology skills (e.g., Music Technology) as 'Unit' standards, which are seen as less academic than 'Achievement' standards and, anecdotal evidence suggested, more likely to be seen as attractive by young men looking towards trade pathways rather than higher education.

The general infrastructure and management of schools was also a contributing factor for interviewees. Teachers felt that school management and Ministry of Education models prioritise STEM outcomes above creative skills, and thus limited opportunities and resourcing in these areas. Teachers also noted that timetabling and delivery structure created hierarchies that privilege STEM subjects above Arts electives, and that meaningful collaborations across different subject departments were rare. Teachers, advisors, and industry personnel felt that there are not enough partnerships between schools and industry to encourage work-integrated learning in both secondary and tertiary offerings, and that as a result students were often leaving tertiary qualifications ill-equipped with professional skills needed in the workforce.

2. Teachers are not adequately trained, resourced, or provided with ongoing professional development

Educators suggested that the current success of creative technology training was largely contingent on the approaches, knowledge, and skillsets of individual teachers. Creative technology subjects often require teachers to have pre-existing, highly specialised skillsets, creating a number of issues in recruitment. Incorporating creative technology into the curriculum hence happens at the discretion of individual teachers, who go 'above and beyond' (e.g., by staying late to supervise students' use of equipment). As a result, teachers' own skills and interests drive curriculum design in creative technology subjects, and the extent and quality of creative technology education varies considerably from school to school. Some educators suggest that the lack of structured and strategic delivery sustains assumptions about gender and technology.

Continued professional development was regularly mentioned as a key priority to increase teachers' skills and confidence in creative technology contexts. However, many of the educators stated that they were not supported to undertake continued professional development, due to high workloads, a lack of funding, and very limited opportunities in creative technology. As such many teachers report upskilling in their own time, and at their own expense. Interviewees also felt that continued professional development and informal development represented particular obstacles for educators who are women, who often take on greater pastoral responsibilities and were anecdotally more likely to have greater responsibilities in their home lives than their male colleagues.

3. Career advisers and teachers have insufficient knowledge of creative technology careers, and rarely encourage students to pursue them

Creative technology, interviews suggested, was regularly seen as a 'hobby' subject by students and teachers alike rather than an employment pathway. Teachers noted that they do not feel equipped to offer advice on training and careers in creative technology, and feel limited in their understanding of the future of the sector, particularly in terms of technological advances. Teachers also expressed that they feel unaware of the full array of tertiary offerings, and tended to perpetuate the status quo in terms of tertiary training by directing students towards similar degree programmes to their own. Educators also felt that career advice is often provided by non-experts, and often too early, where students as young as Year 9 feel pressured to choosea career. It was also noted that careers advisors and parents alike tend to reinforce gendered career expectations – for example, technology careers were framed as broadly masculine, and teaching as feminine.

4. Classroom environments can perpetuate existing gender inequities

Classroom environments were regularly mentioned as spaces that reinforced gender inequities, and experiences of 'imposter syndrome' were common amongst young women. Teachers reported that anecdotally, the most confident users of technology tend to be boys, and that they found it easier to prioritise students who asserted themselves by asking for help, or students with prior knowledge who, again, tend to be young men. To this end, university educators felt that men tended to enter tertiary training with more pre-existing technical knowledge and, furthermore, that university educators in these spaces tend to be men, which reinforces a rhetoric of 'men as experts'. Underpinning this imbalance, interviews suggested, was a lack of creative technology role models for women and girls at school, university, and in industry. Moreover, educators suggested that creative technology facilities and spaces are less welcoming for women, and that young men feel more 'entitled' to occupy spaces where technical learning takes place (e.g., recording studios, computer labs). Precarious careers for women at university-level also impact student perceptions, where it was suggested that women are anecdotally more likely to be employed as casual tutors rather than full-time staff, thus discouraging young women from pursuing careers in their area of study.

5. There is a widely held perception that creative technology industries are unfair and unsafe

Educators at high school and tertiary levels reported that the career perceptions of young women, as well as those of their parents and teachers, were negatively impacted by the experiences of women in creative technology industries reported online and in media. The examples raised in interviews included pay disparities, lack of career advancement, workplace discrimination, harassment, and sexual abuse. Creative technology is seen as an unwelcoming and unsafe space for women, where there is a lack of visibility for women in the sector.

Creative technology careers were generally perceived as precarious, with poor working conditions, a lack of flexibility, a highly competitive job market, and a lack of targeted government support for the sector. Educators noted that employment often relied on existing connections where, anecdotally, students were more likely to pursue a career in creative technology if their parents were already working in the sector. Educators, advisors, and industry personnel also felt there were limiting perceptions of the nature of work in the creative technology industries that denied the plurality and diversity of roles in the sector, and the different skillsets these require. A further issue emerged in the conflation of creators and users, where interviewees suggested that gendered representations within music, screen and games of both characters and celebrities, as well as end 'users', is often conflated with the profile and culture of creators. Here women are often highly sexualised, and seen as being male gaze-centred, and 'users' are commonly perceived to be men. As a result, interviews suggest, women may see careers in creative technology not necessarily as less 'feasible', but more so less 'desirable'.

Rōpū Whānau

Alongside qualitative interviews, Dr Jani Wilson and Dr Cecilia Faumuina conducted Rōpū Whānau hui with participants who had studied at tertiary institutions in the last 10 years. Rōpū Whānau is a Māori research methodology based on the facilitation of whakawhiti kōrero (crossing of conversations) in a formal hui setting. A detailed report on this process and findings, Ngā Whakakōroiroi, was authored by Dr Wilson and is included alongside this document. Key findings are summarised below, highlighting the experiences of Māori, Pacific peoples and wāhine in tertiary education settings.

Ngā Mea Hurahura Matua – Key Findings from Rōpū Whānau

1. Māori, Pacific peoples and wāhine want to use technologies as a survival mechanism for Pacific histories, but teachers often commented their work is 'too cultural'

All participants felt they were pressured away from developing in their cultural storytelling, swaying students from expressing their identity. This left them questioning their place in the university and in the industry.

2. Cultural preservation and supporting whānau/family/aiga/famili are more important than career

All participants commented about the stress they felt to choose between family responsibilities (some parental, others were financial contribution to the household in an expensive city) and class attendance and assignments.

3. Creative technology teachers are generally unskilled on new technologies

Participants articulated that teachers were not skilled on software used in class, which forced students to exchange skills amongst themselves. Students skilled on technology helped those who were good at essay writing, and vice-versa.

4. Isolated, penalised, and/or ignored for thinking outside the status quo, Māori and Pacific peoples are pressed to partake in 'mainstream' approaches

Generally, participants approached their classroom tasks through cultural lenses, but these were not appreciated by markers. The experience of participants points to the inadequacy in student services skilled in advising Māori and Pacific students.

5. Māori, Pacific peoples and wāhine are disrespected in the creative technology industries, irrespective of experience and/or university qualification

All participants experienced discrimination when working in creative technology industries. Participants variously described that their skills and experience were not recognised or respected by their peers or managers; resulting in precarious and exploitative employment conditions.

6. The industry is hostile, transactional, and toxic, which forces skilled Māori, Pacific peoples and wāhine to either become teachers who are conscious of 'filling a gap', or to 'go alone' in the industry

Participants identified the creative technology industry as consistently hostile towards Māori, Pacific peoples and wāhine, and shared experiences of exclusion and exploitation.

Stakeholder interviewees and Rōpū Whānau hui participants suggested a number of changes that could address widespread underrepresentation, and positively impact creative technology industry and training pathways. These are presented below with the caveat that these suggest directions for future enquiry only. Further work needs to be done to produce actionable recommendations.

- Reform how Technology and Arts are taught in schools, with better collaboration and connectivity between the two.
- Enable better supported learning pathways for parents and others with caring responsibilities.
- Support better continued professional development for teachers and advisors to increase technical skills, cultural competency, and confidence to support women and other underrepresented learners.
- Upskill Māori and Pacific tertiary student services to academically mentor, challenge, and encourage in cultural relevant ways; and pay them for their skillset.
- Invest in targeted scholarships and training incentives for women, Māori, and Pacific peoples in creative technology.
- Improve relationships and communication between school teachers and TEOs.
- Review NCEA standards.
- 'Fix what is broken first', by making the industry a more inviting place to work. Specifically, addressing issues of exclusion, recognition, exploitation and pay parity.

Appendix A

List of Included Courses from Te Pūkenga, Universities and PTOs

Level	Course Code	Course Title	TEO
Level 5	10107	Music Technologies and Internet	Unitec New Zealand
(55)	133177	Music Production	Massey University
	133178	Introduction to Ableton Live	Massey University
	133185	Music and Sound Engineering 1	Massey University
	133186	Musical Interface and Interaction 1	Massey University
	133187	Live Technologies - Sound and Light	Massey University
	AEP503.01	Applied Production 1	Southern Institute of Technology
	AEP505.01	Applied Audio Engineering 2	Southern Institute of Technology
	AEP506.01	Electronic Music Production 1	Southern Institute of Technology
	AUD502.01	Applied Audio Engineering 1	Southern Institute of Technology
	AUD503.01	Applied Audio Production 1	Southern Institute of Technology
	AUD504.01	Information Technology and Audio Software 1	Southern Institute of Technology
	AUD506.01	Audio Electronics 1	Southern Institute of Technology
	AUD602.01	Applied Audio Engineering 2	Southern Institute of Technology
	BAP145.01	Music Technology	Southern Institute of Technology
	BCM502.01	Music Technology 1	Southern Institute of Technology
	BMA0R115	Audio Technology	Te Pūkenga TA Waikato Institute of Technology
	CAP150.01	Audio Software Basics	Southern Institute of Technology
	CMPO185	Introduction to Digital Music, Sound Synthesis and Audio Effects	Victoria University of Wellington
	CMPO186	Introduction to Recording, Production and Sound Engineering	Victoria University of Wellington
	DHCUDTKKAM01	Music Production	Te Pūkenga TA Toi Ohomai Institute of Technology
	DHCUDTKKAM03	Global Music Production	Te Pūkenga TA Toi Ohomai Institute of Technology

	DHCUTCMPP57	Music Technology 2	Te Pūkenga TA Toi Ohomai Institute of Technology
	DIGI125	Music Technologies	University of Canterbury
	DJEMP403.01	Electronic Music Production 1	Southern Institute of Technology
	DJEMP502.01	Electronic Music Production 2	Southern Institute of Technology
	DM5.10	Single release	Eastern Institute of Technology
	DM5.80	EP Package	Eastern Institute of Technology
	EMP403.01	Electronic Music Production 1	Southern Institute of Technology
	MU5005	Recording Music 1	Whitireia Community Polytechnic
	MUS10104	Music Technology	Universal College of Learning
	MUS119	Introduction to Music Technology	University of Auckland
	MUS130	Introduction to Music Technoloy	University of Auckland
	MUS180	Creative Prac in Pop Music 1	University of Auckland
	MUS501	Sound Engineering and Production for Contemporary Musicians	Nelson Marlborough Inst of Technology
	MUS50107	Recording	Universal College of Learning
	MUS502	Advanced Live and Studio Sound Production	Nelson Marlborough Inst of Technology
	MUS5205	Recording I	Whitireia Community Polytechnic
	MUSA125	Music Technologies	University of Canterbury
	MUSA152	Acoustics and Recording Techniques	University of Canterbury
	MUSIC140	Audio Technology: Communication and Creativity	University of Waikato
	PERF5011	Advanced Music Technology	Te Pūkenga TA Toi Ohomai Institute of Technology
	AP501	Chamber	SAE
	AP502	Church	SAE
	AP503	Stage	SAE
	AP504	Post	SAE
	CC506	Tirohanga	SAE
	MP501	House	SAE
	MP502	Hip-Hop	SAE
	MP503	Downtempo	SAE

	MP504	Hunter-Gather	SAE
	MP505	Pioneer	SAE
	MUSIC-505	Music Technology 2	Excel Ministries School of Performing Arts
	RA102	Acoustics	SAE
	RA104	Introduction to Studio Equipment	SAE
Level 6	133277	Electronic Music	Massey University
(44)	133281	Musical Interface and Interaction 2	Massey University
	133285	Music Software Development 1	Massey University
	133286	Music Hardware and Electronics 1	Massey University
	133288	Music and Sound Engineering 2	Massey University
	AEP602.01	Production Styles	Southern Institute of Technology
	AEP603.01	Applied Audio Engineering 3	Southern Institute of Technology
	AEP604.01	Applied Audio Engineering 4	Southern Institute of Technology
	AEP605.01	Electronic Music Production 2	Southern Institute of Technology
	AEP606.01	Applied Production 2	Southern Institute of Technology
	AEP608.01	Advanced Live Sound	Southern Institute of Technology
	AEP609.01	Audio Electronics	Southern Institute of Technology
	AUD603.01	Applied Audio Production 2	Southern Institute of Technology
	AUD606.01	Audio Electronics 2	Southern Institute of Technology
	BAP115.01	Audio Equipment	Southern Institute of Technology
	BAP215.01	Audio Equipment	Southern Institute of Technology
	BAP245.01	Music Technology	Southern Institute of Technology
	BMA0D235D	Music Production 2	Te Pūkenga TA Waikato Institute of Technology
	CMPO210	Electronic Music and Experimental Sound Design	Victoria University of Wellington
	CMPO281	Computer Music Programming for Live Electronics	Victoria University of Wellington
	CMPO283	Recording, Mixing and Audio Production	Victoria University of Wellington
	CMPO285	Interactive Sound Art	Victoria University of Wellington
	CMPO286	Studio Recording and Production	Victoria University of Wellington

	CTEC605	Creative Audio	Auckland University of Technology
	DHCUDTKKAM06	Studio Production	Te Pūkenga TA Toi Ohomai Institute of Technology
	DJEMP404.01	Electronic Music Production 2	Southern Institute of Technology
	MU6004	Recording Music 2	Whitireia Community Polytechnic
	MUS219	Sound Recording and Prod 1	University of Auckland
	MUS230	Music Production 1	University of Auckland
	MUS231	Music Production 2	University of Auckland
	MUS280	Creative Prac in Pop Music 3	University of Auckland
	MUS6205	Recording II	Whitireia Community Polytechnic
	MUSA226	The Creative Sound Studio	University of Canterbury
	MUSA227	The Computer as a Musical Tool 2	University of Canterbury
	MUSC.5003	Music Production	Te Pūkenga TA Toi Ohomai Institute of Technology
	MUSI232	Music Production 2	University of Otago
	MUSI233	Electronic Music Production	University of Otago
	AP601	Remix: Rethink	SAE
	AP603	Audio Collaboration: Aotearoa 1	SAE
	CC604	Futurist/Anarchist	SAE
	CC606	Production Profile	SAE
	MP601	Recreate: Recompose	SAE
	MP603	Music Collaboration: Aotearoa 1	SAE
	RA201	Digital Recording	SAE
Level 7	133381	Musical Interface and Interaction 3	Massey University
(34)	133385	Music Software Development 2	Massey University
	133386	Music Hardware and Electronics 2	Massey University
	133387	Music Technology Major Project Pre-production	Massey University
	133388	Music Technology Major Project	Massey University
	133389	Advanced Sound and Music Technologies	Massey University
	BAP730.02	Applied Audio Engineering and Production 3	Southern Institute of Technology

	BMAMP315	Post Production and Mastering	Te Pūkenga TA Waikato Institute of Technology
	CAP700.01	Major Project Planning	Southern Institute of Technology
	CAP701.01	Major Project Planning	Southern Institute of Technology
	CAP702.01	Major Project Planning	Southern Institute of Technology
	CMPO310	Electronic Music, Sound Design and Spatial Audio	Victoria University of Wellington
	CMPO385	Projects in Creative Audio Coding	Victoria University of Wellington
	MUS318	Sound Recording and Prod 2	University of Auckland
	MUS319	Sound Recording and Prod 3	University of Auckland
	MUS330	Music Production 3	University of Auckland
	MUS331	Music Production 4	University of Auckland
	MUS333	Music Production Project 2	University of Auckland
	MUS358	Musical Interface Design	University of Auckland
	MUS380	Creative Prac in Pop Music 5	University of Auckland
	MUS383	Pop Music Recording and Production	University of Auckland
	MUS701.01	Major Project Planning	Southern Institute of Technology
	MUSI132	Music Production 1	University of Otago
	MUSI332	Music Production 3	University of Otago
	MUSI333	Electronic Music Production (Advanced)	University of Otago
	MUSI334	Music Production Projects	University of Otago
	MUSIC340	Music Technology 3: Creative Project	University of Waikato
	SON701.01	Sonic Art and Applied Production	Southern Institute of Technology
	SON703.01	Sonic Art and Applied Production	Southern Institute of Technology
	AP703	Audio Collaboration: Aotearoa 2	SAE
	CC704	Fundamental Project Design	SAE
	CC705	Fundamental Project Production	SAE
	MP702	Creative Music Specialisation	SAE
	MP703	Music Collaboration: Aotearoa 2	SAE

Animation and VFX Courses (126)

Level	Course Code	Course Title	TEO
Level 5	11641	Introduction to Animation	Unitec New Zealand
(42)	289103	Introduction to Computer Animation	Massey University
	289104	Introduction to Visual Effects	Massey University
	289111	Introduction to 3D Modelling and Texturing	Massey University
	A16534	A&M523 Animation 1	Nelson Marlborough Inst of Technology
	BDMD512	Design Principles - 2D Animation	Ara Institute of Canterbury
	BDMD522	3D Animation	Ara Institute of Canterbury
	BPC190.01	Introduction to 2D Animation	Southern Institute of Technology
	BSA126.01	Principles of Animation	Southern Institute of Technology
	BSA127.01	2D Animation	Southern Institute of Technology
	BSA526.01	Principles of Animation	Southern Institute of Technology
	BSA527.01	2D Animation	Southern Institute of Technology
	CGI501	Professional Practice 1	Nelson Marlborough Inst of Technology
	CGI502	3D Modelling 1	Nelson Marlborough Inst of Technology
	CGI503	Rigging and Animation 1	Nelson Marlborough Inst of Technology
	CGI504	Dynamic Effects 1	Nelson Marlborough Inst of Technology
	CGI505	Lighting and Post-production 1	Nelson Marlborough Inst of Technology
	CGI506	Technical Development 1	Nelson Marlborough Inst of Technology
	CGI507	CGI Project 1	Nelson Marlborough Inst of Technology
	CT5014	Animation 1A	Wellington Institute of Technology
	CT5015	Animation 1B	Wellington Institute of Technology
	DAM52314	523 Animation 1	Ara Institute of Canterbury
	DIGD503	Introduction to 3D Animation	Auckland University of Technology
	DIGD506	Motion Capture I	Auckland University of Technology

	DSDN132	Animation and Visual Effects I / Pakiwaituhi me nga Atataunaki I	Victoria University of Wellington
	01CLA-ANI	2D Animation	Yoobee
	3D1G01A	Foundation 3D: Animation and Rigging	Media Design School
	3D1G01B	Animation and Rigging I	Media Design School
	3D1G02A	Foundation 3D: Modelling, Surfacing, Lighting	Media Design School
	3D1G02B	Foundation 3D	Media Design School
	3D1G03	Traditional Art and Design for Visual Effects	Media Design School
	3D1G06A	3D Modelling	Media Design School
	3D1G07A	3D Rendering	Media Design School
	AF03	Animation Principles	Yoobee
	AF04	Visual Effects	Yoobee
	AN5-03	Key Animation	Yoobee
	BAR04	2D Animation Foundations	Yoobee
	BARO6	3D Foundations	Yoobee
	DA501	Animation Principles	Yoobee
	DA521	Animation Studio 1	Yoobee
	DA522	Animation Studio 2	Yoobee
	SP504	Invent	SAE
Level 6	289208	Computer Animation Production	Massey University
(56)	289209	Visual Effects Production	Massey University
	6605.62086	Animation, Motion Graphics and VFX	North Tec
	7706.66086	Animation, Motion Graphics and VFX	North Tec
	133186	Musical Interface and Interaction 1	Massey University
	133187	Live Technologies - Sound and Light	Massey University
	ANFX201	Animation and Visual Effects II / Pakiwaituhi me nga Mariko Ataata II	Victoria University of Wellington
	ANFX211	Character Animation I / Pakiwaituhi Kiripuaki I	Victoria University of Wellington
	ANFX221	Digital 2D Animation I / Pakiwaituhi Matihiko Ahurua I	Victoria University of Wellington

	BMADM215	Digital 3D Modelling	Te Pūkenga TA Waikato Institute of Technology
	BSA225.01	3D Animation	Southern Institute of Technology
	BSA226.01	3D Character Animation	Southern Institute of Technology
	BSA227.01	Visual Effects Compositing	Southern Institute of Technology
	BSA625.01	3D Animation	Southern Institute of Technology
	BSA626.01	3D Character Animation	Southern Institute of Technology
	BSA626.02	3D Animation Production	Southern Institute of Technology
	BSA627.01	Visual Effects Compositing	Southern Institute of Technology
	CGI602	3D Modelling 2	Nelson Marlborough Inst of Technology
	CGI603	Rigging and Animation 2	Nelson Marlborough Inst of Technology
	CGI604	Dynamic Effects 2	Nelson Marlborough Inst of Technology
	CGI612	Lighting and Post-production 2	Nelson Marlborough Inst of Technology
	CGI613	Technical Development 2	Nelson Marlborough Inst of Technology
	CGI614	CGI Project 2	Nelson Marlborough Inst of Technology
	COMP607	Visual Effects and Animation	Te Pūkenga TA Waikato Institute of Technology
	CT6016	Animation 2A	Wellington Institute of Technology
	CT6017	Animation 2B	Wellington Institute of Technology
	DA210059	87.659 Animation	Universal College of Learning
	DIGD605	Motion Capture II	Auckland University of Technology
	DIGD606	Motion Capture Live	Auckland University of Technology
	IT6121	Introduction to 3D Modelling and Animation	Whitireia Community Polytechnic
	IT6321	Introduction to 3D Modelling and Animation	Whitireia Community Polytechnic
	IT6421	Introduction to 3D Modelling and Animation	Whitireia Community Polytechnic
	12115903	VFX Studio	Yoobee
	12144903	Animation	Yoobee
	12144904	VFX	Yoobee

	02CGI-AAN	Advanced animation	Yoobee
	02CGI-RIG	Rigging 3D models	Yoobee
	3D2A01A	Animation: Workflow and Principles	Media Design School
	3D2A01B	Animation: Mechanics. Expressions and Gestures	Media Design School
	3D2A01C	Animation: Non Verbal Communication	Media Design School
	3D2A02A	Animation: Workflow and Principles	Media Design School
	3D2A02B	Animation: Acting and Expressions	Media Design School
	3D2A02C	Animation: Non Verbal Communication	Media Design School
	3D2AT02A	Advanced Rigging	Media Design School
	3D2V01	Motion Design Animation	Media Design School
	3D2V03	Visual Effects 2D Compositing	Media Design School
	3D2V03A	Visual Effects 2D Compositing	Media Design School
	3D2V04	Visual Effects 3D Compositing	Media Design School
	3D2V05	Visual Effects Compositing Production Techniques	Media Design School
	3D2V05A	Visual Effects Compositing Production Techniques	Media Design School
	3D2V06	Visual Effects Preparation and Workflows	Media Design School
	CS205	Integrated Studio 3 - AR/VR projects	Yoobee
	DS609	Advanced Principles of Animation	Yoobee
	DS621	Advanced Animation Studio 1	Yoobee
	DS622	Advanced Animation Studio 2	Yoobee
	GAM04	Animation	Yoobee
	GAT210	Real Time Animation	Media Design School
	GAT240	Advanced 3D Modelling	Media Design School
Level 7	289308	Advanced Computer Animation Practice	Massey University
(28)	289309	Advanced VFX Practice	Massey University
	ANFX301	Animation and Visual Effects III / Pakiwaituhi me nga Mariko Ataata III	Victoria University of Wellington
	ANFX311	Character Animation II / Pakiwaituhi a-Kiripuaki II	Victoria University of Wellington

	ANFX390	Animation and Visual Effects Capstone	Victoria University of Wellington
	BCG7B112	82.762 Animation	Universal College of Learning
	BDMI730	3D Media and Interaction 7	Ara Institute of Canterbury
	BMADM300	3D Animation	Te Pūkenga TA Waikato Institute of Technology
	BSA324.01	Animation Project	Southern Institute of Technology
	BSA326.01	Advanced Animation Production	Southern Institute of Technology
	BSA724.01	Animation Project	Southern Institute of Technology
	BSA726.01	Advanced Animation Production	Southern Institute of Technology
	COMP.7117	Advanced Animation and Rendering	Te Pūkenga TA Toi Ohomai Institute of Technology
	COSC422	Advanced Computer Graphics	University of Canterbury
	DIGD707	Motion Capture Project	Auckland University of Technology
	SMST318	Animation: Theory and Practice	University of Waikato
	03DDM-CRE	Create an animation for project	Yoobee
	03DDM-CRE2D	Create animation for project	Yoobee
	03DDM-DIR	Direct an animation for project	Yoobee
	03DDM-DIR2D	Direct an animation for project	Yoobee
	03DDM-STO	Storyboard an animation project	Yoobee
	03DDM-STO2D	Storyboard an animation project	Yoobee
	3D3A01	Advanced Creature Animation	Media Design School
	3D3T01	Advanced 3D Technical Studies	Media Design School
	3D3V01	Advanced Visual Effects Compositing	Media Design School
	BAW01	Contexts (World Building and Visual Effects)	Yoobee
	BAW02	Studio (World Building and Visual Effects)	Yoobee
	BAW03	Capstone (World Building and Visual Effects)	Yoobee

Games Courses (65)

Level	Course Code	Course Title	TEO
Level 5	159103	Introduction to Games Programming and Simulation	Massey University
(17)	289106	Introduction to Game Technologies and Mechanics	Massey University
	CGRA151	Introduction to Computer Graphics and Games	Victoria University of Wellington
	COMP.5110	Game Design Principles and Concepts	Te Pūkenga TA Toi Ohomai Institute of Technology
	PROD121	The Game Development Process	University of Canterbury
	CS104	UX Principles for Game Design	Yoobee
	CS105	Development Principles for Mobile Games	Yoobee
	GAT130	Game Production Foundation	Media Design School
	GAT170	Technical Art I	Media Design School
	GD1J01BSE	Game Design Principles	Media Design School
	GD1M01BSE	Fundamental Mathematical and Engineering Principles	Media Design School
	GD1M02	Mathematics for Graphical Games	Media Design School
	GD1P01	Introduction to Software Engineering for Games	Media Design School
	GD1P02	Algorithms and Data Structures	Media Design School
	GD1P03	2D Game Programming	Media Design School
	GD1P04	3D Graphics Programming	Media Design School
	GDV110	Game Design Principles	Media Design School
Level 6	11315	Visual Game Design	Unitec New Zealand
(25)	11482	Game Programming	Unitec New Zealand
	11632	Advanced Game Programming	Unitec New Zealand
	159261	Game Programming	Massey University
	289210	Game Technologies Project	Massey University
	7706.66085	Digital Game Design	North Tec
	IT608.01	Game Development 1	Southern Institute of Technology
	IT710.01	Game Development 11	Southern Institute of Technology

	MDDN221	Game Design I / Hoahoa a-Kemu Rorohiko I	Victoria University of Wellington
	MDDN243	Introduction to Computer Game Design	Victoria University of Wellington
	PROD221	Game Design in Context	University of Canterbury
	PROD223	Immersive Game Design	University of Canterbury
	PROD224	Computation for Games	University of Canterbury
	SD6504	Game Development	Wellington Institute of Technology
	GAM01	Game Design fundamentals	Yoobee
	GAT270	Technical Art II	Media Design School
	GD2J01	People and Games	Media Design School
	GD2J03BSE	Game Mini Project II - Rapid Game Prototype	Media Design School
	GD2P02	Physics Programming	Media Design School
	GD2P03	Technology Leverage for Games	Media Design School
	GD2P04	Advanced Graphical Games Programming	Media Design School
	GD2S02	Software Engineering for Games	Media Design School
	GD2S03	Advanced Software Engineering and Programming for Games	Media Design School
	GDV210	People and Games	Media Design School
	IT6034	Game Development	Whitecliffe College of Arts and Design
Level 7	159361	Advanced Games Programming	Massey University
(23)	289310	Advanced Game Practice	Massey University
	COMP313	Computer Game Development	Victoria University of Wellington
	COMP436	Advanced Graphics and Computer Games	University of Waikato
	COMP706	Game Development	Te Pūkenga TA Waikato Institute of Technology
	COMP710	Game Programming	Auckland University of Technology
	COSC360	Computer Game Design	University of Otago
	IN737001	Gate Development	Otago Polytechnic
	ITB7337	Games Programming for 2D and 3D	Te Pūkenga TA Waikato Institute of Technology

	IX737001	Gate Development	Otago Polytechnic
	MDDN321	Game Design II / Hoahoa a-Kemu Rorohiko II	Victoria University of Wellington
	MDDN343	Advanced Computer Game Design	Victoria University of Wellington
	MDDN344	Game Engines for Design / Pukaha Kemu mo te Hoahoa	Victoria University of Wellington
	PROD322	Gaming Project Studio 2	University of Canterbury
	PROD323	Game Engines and Artificial Intelligence	University of Canterbury
	GAT320	World Design	Media Design School
	GD3J02	Preproduction	Media Design School
	GD3J03BSE	Game Development Team Production Alpha	Media Design School
	GD3J05	Game Development Team Production Gold	Media Design School
	GD3P01	Game Engine Development	Media Design School
	GD3S02BSE	Software Engineering Game Development Capstone Project	Media Design School
	GDV310	Game Project: PreProduction	Media Design School
	GDV320	Game Project: Alpha	Media Design School

Appendix B

SAC and NZSCED Codes

Music Technology SAC

SAC Code	Number of Courses
A1	8
A2	2
B1	3
B2	53
C1	28
C2	42
I2	2
J2	1
Z	79

Music Technology NZSCED codes

NZSCED Code	Description	Number of Courses
100701	Audio Visual Studies	33
031399	Electrical and Electronic Engineering and Technology nec	20
031303	Electronic Engineering	2
100101	Music	59
100199	Performing Arts nec, mixed or nfd	19

Animation and VFX SAC codes

SAC Code	Number of Courses
A2	2
B1	53
B2	73
B3	1
C1	3
C2	13
J1	2
N2	4
T1	1
Z	60
Unknown	1

Animation and VFX NZSCED codes

NZSCED Code	Description	Number of Courses
020115	Multimedia Computing Science	17
020301	Conceptual Modeling	4
020305	Systems Analysis and Design	2
020399	Information Systems nec, mixed or nfd	1
031305	Computer Engineering	2
080101	Accounting	1
100301	Fine Arts	2
100501	Graphic Arts and Design Studies	81
100599	Graphic and Design Studies nec, mixed or nfd	5
100701	Audio Visual Studies	23
100703	Journalism, Communication and Media Studies	2
100799	Communication and Media Studies nec	3
109999	Creative Arts nec	3
Unknown	Unknown	1

Games SAC codes

SAC Code	Number of Courses
A2	6
B1	3
B2	60
C2	13
N2	3
Z	30
Unknown	1

Games NZSCED codes

NZSCED Code	Description	Number of Courses
010101	Mathematics	1
020103	Computer Applications and Programming	24
020105	Computational Theory	4
020111	Data Structures	1
020115	Multimedia Computing Science	10
020119	Artificial Intelligence	1
020199	Computer Science nec, mixed or nfd	17
020399	Information Systems nec	2
039999	Engineering and Related Technologies nec	2
090399	Studies in Human Society nec	4
100301	Fine Arts	2
100501	Graphic Arts and Design Studies	11
100599	Graphic and Design Studies nec, mixed or nfd	1
100701	Audio Visual Studies	2
109999	Creative Arts nec	1
Unknown	Unknown	1

Appendix C

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