

# Is change on the horizon for Māori and Pacific female high school students' when it comes to ICT

*Scott Morton*  
Whitireia Polytechnic  
*Scott.Morton@whitireia.ac.nz*

*Dr Petrea Redmond*  
University of Southern Queensland  
*Petrea.Redmond@usq.edu.au*

*Dr Marta Vos*  
Whitireia Polytechnic  
*Marta.Vos@whitireia.ac.nz*

## ABSTRACT

This paper explore some of the factors that discourage the participation of Māori and Pacific girls in ICT in New Zealand. Despite many ICT job opportunities, there has been a steady decrease in the percentage of girls, especial Māori and Pacific girls entering into ICT study, and pursuing ICT careers. This study used a modified version of the conceptual framework designed by Bernhardt (2014) based on the “STEMcell” model. The STEMcell framework was used to explores the factors that discourage participation in ICT through such concepts as cultural, social, structural and social IT that contribute to the likelihood of student’s career choice in ICT. An online questionnaire gathered data from year 11 students studying at high schools within Wellington, New Zealand. The findings indicated that Pacific girl’s more than Māori girls reported that their family members were seen as role models, which could impact on their future career choices. The statistical results also show that stereotypes are still alive in both Māori and Pacific year 11 student’s perceptions and that both Pacific and Māori girls from year 11 are unlikely to follow a career in ICT. Currently, the number of Māori and Pacific girls enrolling in ICT subjects at secondary school is still substantially below that for boys and, until changes are made, Māori and Pacific girls going into the industry will be in the minority.

**Keywords:** Māori, Pacific, girls, ICT, school, stereotyping, role models, culture, #Social IT, STEMcell.

## 1. INTRODUCTION

This paper explores a problem that New Zealand has faced over many decades: female Māori and Pacific students have negative perceptions of ICT and do not perceive it to be a viable career choice. Researchers have concluded there is a problem, but have not found an answer to why the proportion of girls’ enrolling in ICT at school is low (Baruch, 2014; Craig, 2014). This research investigates attitudes and perceptions of Māori and Pacific girls and how it influences them regarding ICT and related career choices. This study identifies effects, including perceptions, gender differences, influences and role models that discourage girls following a career path into ICT.

Western countries are seeing a shortfall of graduates coming out of university to fill the ever-increasing ICT job market (Birrell, 2015; Cappelli, 2015). In a recent survey from the Auckland Chamber of Commerce, 61,000 students were surveyed across Auckland secondary schools. Barnett (2015) raises a concern that only 6% of students in Auckland would gain the ICT skills necessary to get a job in any industry immediately after high school. Having students being able to use technology and understand the importance of ICT will help them make an informed decision regarding their future career path.

The ICT industry over for example the last two decades have seen an increase in jobs globally, Facebook has gone from three employees in 2004 to 11,000 employees globally in 2015 (Roberts & Dörrenbächer, 2016). As of May 2018 across Australia and New Zealand, there were approximately 18,000 job vacancies in the ICT industry compared to 12,500 jobs in the healthcare sector (SEEK.co.nz, 2016). Clayton (2006)

talked about “pink collar” as the typical jobs girls tend to be associated with, such as nursing, childcare, education and beauty (p. 3384).

The current, Generation Z, Millennials or the Disruptive Generation (born after the year 1999) is quite different from previous generations of the Silent (born between 1926 – 1945), Baby Boomers (born between 1946 – 1964), Generation X (born between 1965 – 1980) and Generation Y (born between 1981 – 1999) (Wiedmer, 2015). Generation Z’s different values, attitudes and perceptions of work will impact on their outlook towards technology and whether they choose a career within the ICT industry (Wiedmer, 2015). Generation Z learners are going to be driven by graphical information, will expect instant feedback and will want to be able to customise their own learning (Renfro, 2012), which may change the way they choose a career path including whether they use established channels, such as receiving advice from teachers and career advisors. As of April 2016, Generation Y in America has overtaken the Baby Boomers as the biggest population segment (Fry, 2016). Generation Y has been brought up with technology and will have Generation Z children at school making choices regarding their future career, based on perceptions and influences gathered from family, friends and peers (Koulopoulos & Keldsen, 2014). However Māori and Pacific baby boomers were denied access to IT due to educational institutes in New Zealand not allowing them to study in elitist qualifications until the mid-80’s, creating a major disconnect for them and later their children regarding computing (Hamilton-Pearce, 2009).

### 1.1 Female Māori and Pacific students and ICT

New Zealand is a country where there are distinct cultures, it was a bicultural country, this is now becoming a multicultural society (Lomax & Lemon, 2007). Māori and Pacific societies differ in major ways from that of the European New Zealand

---

This quality assured paper appeared at the 9<sup>th</sup> annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2018) and the 31<sup>st</sup> Annual Conference of the National Advisory Committee on Computing Qualifications, Wellington, NZ, July 11-13, 2018 as part of ITx 2018.

society. Māori more than Pacific culture have been extensively colonised by the English and other European cultures (Lomax & Lemon, 2007). Only fifteen years ago only 27% of Māori households and 23% of Pacific households had a computer and the western society classification of material made it relatively in-accessible for Māori and Pacific families (Lomax & Lemon, 2007).

Some of the adoption problems faced by Māori and Pacific students when it comes to ICT comes from ICT teachers who are technical communicators and these teachers need to become more aware of differing communication patterns that arise because of these cultural differences (Lomax & Lemon, 2007). Lomax and Lemon (2007) points out that some of the variation in cultural differences are due to individualism, which is used in western education versus collectivism which is deeply entrenched in both Māori and Pacific culture. This lead to the mismatch between culture of the school and the ethnic culture of the student (McCarthy, 2008).

The adoption of ICT at high school and on to university for Māori and Pacific students, especially girls are at a disproportionate rate to New Zealand or European girls (McCarthy, 2008). McCarthy (2008) talks about a gap between Māori and non-Māori educational achievement; up to 35% of Māori students leave school with no qualifications and are five times more likely to enrol in remedial training in contrast to non-Māori being three times more likely to enrol in an academic qualification (McCarthy, 2008).

This study was guided by the research question: *What are the effects that discourage participation of Māori and Pacific girls in ICT?*

For the purpose of this research, the use of the word effects in the research question is defined by attitudes and perceptions. These attitudes of ICT will come through in the research from family, friends and teachers. It will also be shown through media, online, TV, Film and written. The perceptions will be shown through social, cultural, structural and disruptive (#Social IT).

## 2. CONCEPTUAL FRAMEWORK

This study used a modified version of the conceptual framework designed by Bernhardt (2014) based on the “STEMcell” model (p, 18), where ‘STEM’ combines Information Technology (IT) in the broader STEM field (Science, Technology, Engineering and Mathematics) and the ‘Cell’ looks at the individual (Bernhardt, 2014) This framework is used as a lens to make a judgement about the likelihood of a student choosing ICT. The constructs of Cultural, #SocialIT, Structural and Social will provide a lens to analyse the data. Each of these constructs will filter into the likelihood of choosing ICT as a career. The conceptual framework is shown in Figure 2.1.

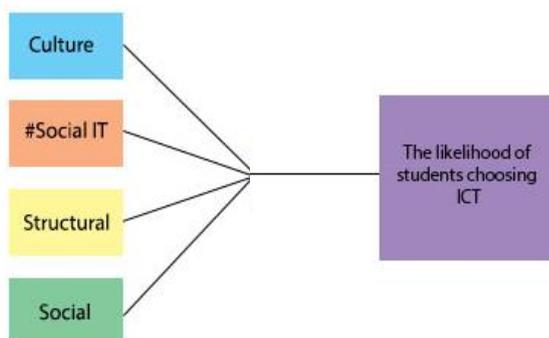


Figure 2.1. New Framework based on STEMcell model (Bernhardt,

The framework identifies the four external constructs: *Cultural*, *#SocialIT*, *Structural* and *Social*, each with their own context and factors which may encourage or discourage participation, or present obstacles that inhibit incentives or enhance disincentives to participate in ICT. Bernhardt’s (2014) conceptual framework, the STEMcell model, has been built using prior research and theories, and has yet to be tested (Adya & Kaiser, 2005; Clayton, Hellens, & Nielsen, 2009; Merchant, 2013; Miliszewska & Moore, 2010; Timms, Courtney, & Anderson, 2006). Each of the constructs from the framework are expanded on through the literature to give background into some of the perceptions and attitudes that are to be measured through the questionnaire. The output of the four constructs are synthesized in to the *Likelihood of students choosing ICT*, which will be based on how much influence the other four constructs have on the individual.

## 3. LITERATURE REVIEW

### 3.1 Culture

The *cultural* construct discusses the popular and parental factors that influence Māori and Pacific girls when it comes to ICT and the industry.

#### 3.1.1 Popular cultural

Popular cultural defined by Bernhardt (2014, p. 102) as “the entirety of ideas, perspectives, attitudes, images and other phenomena that are within the mainstream of a given culture”. These popular cultures can affect the way women view and interact with ICT. Popular culture for Māori started back in the 50’s based on urban drift into major cities within New Zealand (Rallu & Suva, 2009). This often meant many families moving from their rural communities to seek employment in the major cities around New Zealand, especially the North Island. For Pacific people this urban drift did not happen until later as more and more Islanders started to move to New Zealand for a better way of life in the 70’s and 80’s (Latham, 2003). So Māori children started to integrate into the western cultures through the baby boomer generation and Pacific children as generation X/Y.

Baby Boomers, Generation X and Y growing up had different popular cultures associated with each generation. Baby Boomers would have been the first generation that had access to television and easy access to music, both would have had an impact on their influences and choices (Wiedmer, 2015) The end of Generation X and beginning of Generation Y would have been the first generations to be fully exposed to computing. By the turn of the 80’s, Generation X was exposed to more information than the Baby Boomers through media, TV and films, and popular culture expanded into the computer field with the likes of computer games (Wiedmer, 2015). Generation Y was the first generation to have access to the internet, and through that medium, a new popular culture arose; the online community. TV shows in the 90’s brought new popular cultures to teenagers with the likes of ‘The Simpsons’ and ‘reality TV’. Computers started to appear in households across western societies and popular TV shows started to appear as video games (Koulopoulos & Keldsen, 2014).

Generation Z is the most connected generation when it comes to technology (Koulopoulos & Keldsen, 2014). The use of popular culture among Generation Z children could possibly change their perceptions through popular TV shows such as ‘Appsolute Genius on CBBC’ and computer games such as ‘Minecraft’, these popular cultures are exposing children at an early age to technology and future jobs (Bernhardt, 2014).

#### 3.1.2 Parental expectations

Parental expectations are influenced by their cultural norms, “the less rigid and less influential the freer and more

cosmopolitan the society is” (Bernhardt, 2014, p. 103). The generational influence of family members on children can become the catalyst for the direction they take while at school. Dimitriadi (2013) observed that family is the main avenue for children to discuss ideas for career choices. Family can be very influential and the desire to follow in the footsteps of one’s parents has long been a significant factor in the choice of career. If children view their parents as role models they will be strongly influenced by their choices of career (Adya & Kaiser, 2005).

Dimitriadi (2013) stated, “Within a culture of close-knit families, opinions of elders are respected and must be taken into consideration” (p. 5), also Hamilton-pierce (2009) stated, “There is respect for your elders, where the boys do show respect for us” (p.174).

Young’s (2003) research concentrated on year nine students across Tasmania and found many girls rejected a career in ICT due to misinformation and misguidance from parents who had limited or no knowledge of the subject or what jobs were available. As Generation Y become parents themselves the generational effect will affect how their children use and understand technology. Bernhardt (2014) stated, “Tomorrow’s parents are today’s highly e-connected teenagers” (p. 104).

## 3.2 #Social IT

The *#Social IT* construct discusses the factors of the ever-changing landscapes of social media, the terminology used and the technology that Generation Z are using. *#SocialIT* represents *#SocialEra*, the current disruptive technology, in its application as an influencing platform/environment for women in ICT. The *#SocialEra* or *Social Disruptive Era* is the name given to the new age of social technologies that are being used in the 21<sup>st</sup> century. Social technologies include Facebook, Instagram, WhatsApp, Tumblr, Google +, YouTube, Pinterest, Snapchat and many more. *Social* represents the transformation of technology and how it will shape the future of IT (Bernhardt, 2014). It considers some of the influential factors that young people will be faced with in the coming years such as social, educational and career implications of such a fast-moving landscape in the IT industry. Today’s Generation Z students have adopted these disruptive and enabling technologies at such a rapid rate that technology has become an integral part of their lives.

### 3.2.1 Social Media Revolution

The power of social media has an opportunity to offer Generation Z girls a different outlet to express their creativity within a ‘net neutral’ world (Bernhardt, 2014). With the likes of Facebook, Twitter, Instagram, Snapchat and many more at the start of this revolution, girls can become anonymous within this new realm and have a great prospect to get in early and show the world that girls belong in the new disruptive world (Bernhardt, 2014). Using such technologies mentioned will allow teenage girls to ‘debunk’ the stereotypical perception and be gender neutral and stop the pressure of being part of a minority (Baruch, 2014).

### 3.2.2 Terminology

A study by Papastergiou (2008) noted that girls are still in the minority when it comes to ICT related studies and still have a misconception of the differences between Information Systems (IS) and Computer Science (CS) related courses. The girls’ perception in the study found CS to be more hardware and computer programming and IS to be the use of software products such as Microsoft Office. Female students did not relate to the human side of CS and IS studies and focused only on the negative aspects and the stereotypical views of ICT. The misrepresentation of both subjects stems from the teachers’ lack of understanding of how CS and IS have adapted over the

years to include Human-Computer Interaction (HCI) and the soft skills of communication. Bernhardt (2014) talked about the problematic use of acronyms in IT and ICT, people do not know what they mean. Bernhardt speculates that this may indicate a generational issue, the use of acronyms and their meaning will be different for different generations. As technology changes the acronyms do not, causing confusion.

### 3.2.3 Technology

Access to computers, tablets and laptops has increased to the point that most people in western society have one or can access one. Generation Z girls have grown up in this society and accept technology as part of their everyday lives (Bernhardt, 2014). The Internet and the social media have also changed the way we look at technology now compared to a decade ago. Akbulut and Looney (2007) found education has not moved forward as quickly as technology in the past two decades, and as a consequence the teaching, environment and culture trails behind. Until this imbalance can be rectified between boys and girls, the gap in ICT is likely to continue growing. With the cost of technology now being very affordable, access to technology can be empowering for girls as there is a shared medium where they can get information, support and guidance from anywhere at any time (Cummings & O’Neil, 2015).

## 3.3 Structural

The *structural* construct discusses the factors that influence generation Z through work and school, such as teachers, career advisors and the ICT industry. The *structural* influencing factors that interact with the construct include education, information, access, support mechanisms and government policies.

Most career paths are chosen early in the student’s educational life (Broadley, 2015) and the lack of understanding of what is available in the ICT industry could be a factor in putting girls off ICT opportunities (Dimitriadi, 2013). As suggested by Dimitriadi (2013) a reform of the curriculum has to take place to engage girls more in ICT subjects. Bernhardt (2014) talked about a change in curriculum and a more agile approach to the problem, Bernhardt stated: “We cannot properly teach modern ICT without embracing it ourselves.” (p. 142). The school education sector does have issues in recruiting new teaching staff into ICT subjects (Jones, Albion, & Heffernan, 2016). However, teachers that do take up the challenge are normally Generation Y, as they are more enthusiastic about technology.

### 3.3.1 ICT industry

A study carried out in Australia by Clayton (2006) showed female students are choosing healthcare and medical careers instead of ICT careers, even though those jobs on average are lower paid than those in the ICT industry (Jobs in the ICT sector, 2018). In 2010, according to an analysis of Labour Department data in the US, women held 23.9% of high tech jobs, down from 25.1% in 2005 (Fortt, 2013). The Australian Computer Society (ACS) in 2012 showed a decline to 19.73% (ACS, 2012) for women in the ICT industry. New Zealand census statistics showed in 2006, women represented 29% of employees in the ICT industry but by 2013, the 2013 census showed a drop to 27% (Statistics\_New\_Zealand, 2013). Craig’s (2014) research found that the percentage of girls entering degree courses for ICT related programmes is decreasing, and the number of girls being employed in the ICT industry is representative of the shrinking number coming through from universities. There has been a decline in the number of women entering the ICT industry in the last two decades due to them not wanting to take ICT subjects at a higher level (Broadley, 2015).

### 3.3.2 Information and Support Mechanisms

One influencing factor for career choice by girls can start at school. The learning experiences through teachers and the curriculum can have an important effect on both the student's self-efficacy and their outcome expectations (Brown & Lent, 2004). Adya and Kaiser (2005) noted a gender bias and stated, "Career advisors tend to reflect a gender bias when directing girls towards traditional careers and males to non-traditional careers" (p. 10). One reason Adya and Kaiser (2005) suggested this was that career advisors felt more comfortable when advising in more traditional fields as they lack understanding and sufficient background in ICT to be aware of potential career paths, further, they found that career advisors are out of touch with what is happening within the world of ICT. This problem is having a social impact on the ICT industry and Generation Z student's career path. Career advisors are ill prepared for this disruptive technology and cannot keep up to date with the industry (Piyasiri, Gamage, & Manathunga, 2014).

## 3.4 Social

The *social* construct discusses the factors that influence Generation Z through social interaction via media, peers, role models and mentoring.

### 3.4.1 ICT stereotypes

The preference for girls choosing healthcare and medical careers over ICT careers was described by Clayton (2006), who noted: "Australian girls are continuing to reject ICT careers partially due to negative perceptions and stereotypes" (p. 3388). This 'geeky' or 'nerdy' stereotype, which has been around for many decades, has a negative connotation putting many girls off studying ICT subjects at high school and beyond (Bernhardt, 2014). In contrast, Grant, Knight, and Steinbach (2007) suggested that most of the students they surveyed thought that the 'geek' and 'loner' image was not indicative of people working in the ICT industry. Generation Z is obsessed with technology and devices, using such devices to interact with social media or to play games. This 'obsession' is replacing these older stereotypical views, but this new label of 'obsession' could be more difficult to counter than the 'geek', and 'loner' image it is replacing (Almond, 2013).

### 3.4.2 Peers

Peers can have a powerful influence on teenagers' beliefs and behaviours when it comes to a career path (Bernhardt, 2014). Gardner, Sheridan, and Tian (2014) stated, "People's attitudes towards ICT are also influenced by their friends and peers. Especially when choosing a major, peers and friends' opinions are important to consider" (p. 122). In contrast, Adya and Kaiser (2005) noted that peer groups in the teenage years have limited impact on career, rather they influence social responsiveness, behaviours, fashion styles, and attitudes. If peers reinforce traditional gender role behaviours, then long-term goals and aspirations may distort those children's views. During teenage years, this gender difference, particular boys on girls, can have a major impact on girls' self-concept and self-efficacy (Clayton, 2007). Students will change their perceptions towards many courses at school, especially ICT if peers' views are different from theirs.

### 3.4.3 Media

Film, television, print and electronic media can influence and also enhance the stereotype that ICT is a male occupation (Bernhardt, 2014; Clayton, Beekhuizen, & Nielsen, 2012). However, media has little impact on motivating career choices; the media's focus is on enhancing gender stereotypes that centre on physical images (Adya & Kaiser, 2005; Clayton et al., 2009). This stereotype mainly focuses on visual images such as the 'geek' in the glasses, and the darkened room of a

teenage male in front of a computer screen, rather than representing ICT as a career choice and a viable option for girls (Gorden, 2011). Young adults' perceptions about ICT jobs are biased by media influences and how these depict people in the industry, rather than being influenced by facts and figures about actual people in the industry (Pau, 2009). Girls' perceptions of ICT jobs mirror the stereotypes they have been presented throughout their teen years through television, film and other popular media. Television programs such as 'Criminal Minds', give the perception of ICT as being geeky, stating "the tech with the glasses" (Clayton et al., 2009, p. 156) and when shown in the program the female character is always portrayed working alone in a small dark room. However, Generation Z is using more of a dynamic platform through social media, their stereotypical views will differ from those perceived by other generations that use traditional media such as newspapers and TV (Jones, Ramanau, Cross, & Healing, 2010).

### 3.4.4 Gender stereotypes

"The 'nerdy' image of the ICT industry is still seen a major concern for most girls" (Bernhardt, 2014, p. 105). Attitudes are evolving with every change in a generation with regards to stereotypes. The problem becomes a generational problem, as the older generation such as the Baby Boomers, keep the stereotypical image alive. Bernhardt (2014) talked about today's younger generation in respect to attitudes and beliefs and stated "if today's youths were surveyed in the absence of preconceptions from the industry's history the results would already be markedly different" (p. 107).

### 3.4.5 Role models

Student career choices can be influenced in many ways; role models are one of these influencers (Adya & Kaiser, 2005). (Perciva, 2014) found attractive looking female role models in STEM subjects not only decreased girls' interest in Science, Technology, Engineering and Maths (STEM) subjects but also decreased their beliefs in their own ability to succeed at those subjects and the likelihood of studying them. Seeing attractive women as role models became demotivating to girls as their own self-image do not match up.

Media attention in the past few years has focused on prominent males in ICT roles such as the late Steve Jobs, Bill Gates or Mark Zuckerberg. These role models reinforce the way girls and especially young girls view the ICT industry as being male-dominated (Gorden, 2011). This may or may not come down to the generational effect, as historically the majority of people employed in high profile ICT roles are predominantly male (Hunter & Boersen, 2015). However, as the Baby Boomer generation move out of the workforce and are replaced with Generation X or more than likely Generation Y workers, there could be a shift in appointments towards a more balanced workforce, and towards female workers (Wiedmer, 2015).

Māori and Pacific students, especially girls are at particular risk of being left behind or even left out entirely in ICT. Education towards ICT and a change in perception and attitude regarding the industry must be conveyed in a timely manner to these students for them to make a decision regarding their future. There is little research that has been carried out in Māori and Pacific girls and how to attract them into ICT and to the industry.

## 4. METHOD

Little research has investigated female Māori and Pacific students and ICT, this paper will present a case study approach which was taken to explore the issue. Data were collected through quantitative means by use of an online questionnaire. The analysis is based on year 11 students studying at high schools within the Wellington region. Eight schools responded to the initial research proposal, of those eight schools, six

allowed the research to take place. The questionnaire was distributed to the schools in the form of an online questionnaire using LimeSurvey. From the six schools that took part in the questionnaire a total of 358 responses were collected. However only 286 responses completed in full the questionnaire and could be used.

#### 4.1 Questionnaire description

The questionnaire is broken up into five sections. Each of the four sections are based on a framework proposed by Bernhardt and the fifth section which is the likelihood of students choosing ICT comes from the results of each section of the questionnaire.

The questionnaire uses a Likert scale from one to five, one being totally disagree to five being totally agree, however there are a couple of place in order or agreement questions as well. The questionnaire itself was designed solely for the purpose of the major research, this being the researchers PhD. Additional questions were modified from Abbiss (2005). These questions came from a national postal questionnaire designed and administered in the year 2000 (Abbiss, 2005).

The questions were piloted through a school that did not take part in the data collection phase. The questions were then modified from the results of the validation test and some questions completed dropped from the final questionnaire. Each construct has certain factors based on the type of information required to check perceptions and attitudes. As shown in the literature for each of these constructs different areas have been examined to elicit types of questions required to gather those perceptions and attitudes. Validation and reliability was carried out, that tested the constructs against each of the questions. This found errors of categorisation for some of the questions, which were then transferred into the correct construct.

Questions B1 through B9 determined the background and family values based on perceptions of family input into the participant future career path and knowledge about ICT and the industry. Questions C1 through C9 were devoted to social impact and the influence and perceptions that participants have through stereotypes, friends and role models. Questions D1 through D10 are all based on the structural factors that influence the participant through home, school and industry. Questions E1 through E7 are questions looking at perceptions participants have of the future of ICT and what it will look like when they leave education and what knowledge will be necessary to have to be part of an industry that uses ICT.

#### 4.2 Analysis techniques

For all analysis within this research, SPSS V.23 (Statistical Package for the Social Sciences) was used to calculate the results from the data gathered.

The first technique used for analysis was to conduct frequency analysis. Frequency analysis shows the number of students answering the questions and is part of descriptive statistics used for summarising frequency or measures of central tendency.

The second procedure carried out on the data was to normalise the data by using a normality test. This procedure tests the normality of continuous data. It is an assumption of parametric statistics that continuous variables achieve normality. This test checks the skewness and kurtosis of the data. This gives values for each and their standard error. However, from the analysis carried out on the question sets, the data is either skewed + or - and or has Kurtosis and cannot be manipulated by a mathematical formula to bring back into a normal distribution. This being the case, the use on non-parametric testing was carried out instead of parametric testing.

The third procedure carried out on the data was a reliability and validity test using Cronbach's Alpha. This procedure was used to determine the internal consistency and reliability of scaled data. Reliability analyses are run on data where each variable contributes to a single construct. The results of the test showed a 0.8 result, this showed that the data was reliable and valid. From the reliability test, further questions were deleted from the questionnaire.

The fourth procedure carried out on the data was a Chi-Squared Goodness of Fit. This statistic is used to test the Ns on the level of a single variable to see if they significantly differ from what is expected. The test is undertaken when data results cannot be normalized by using a normality test. This test was to determine if there are significant differences in the level of a single variable in relation to the frequencies of those levels. Each of the questions that were left were then synthesize from Likert to Yes, No and Don't Know results. This allowed the results to be better shown with such small numbers of participants with the use of a simple frequency analysis.

### 5. RESULTS

#### 5.1 Section A - Demographics

The questionnaire went live early September 2017 and was available for just over one month. In that month, 358 responses were received to the Lime Survey application server, with 286 students completing the questions. However, out of the 358 responses, 72 student's results had to be removed, due to not enough questions completed. From the 286 completed questionnaires, 167 completed questionnaires were from girls and 119 completed questionnaires from boys. This is illustrated in Table 5.1, which presents the gender details of the participants. There is slightly a bigger percentage of girls than boys in the study. This conforms to New Zealand statistics for high school populations ("2006/2013 New Zealand Census," 2013).

Table 5.1 Gender

Gender	Frequency	Percent
Male	119	41.6
Female	167	58.4
Total	286	100.0

Table 5.2 shows how many of the participants that took part in the questionnaire came from a Māori or Pacific background.

Table 5.2 Ethnicity

Ethnicity			Māori	Pacific
Gender	Male	Count	5	11
		% within Gender	4.20%	13.40%
		% within Ethnicity	33.30%	48.50%
		% of Total	1.70%	5.60%
	Female	Count	10	17
		% within Gender	6.00%	10.20%
		% within Ethnicity	66.70%	51.50%
Total	% of Total	3.50%	5.90%	
	Count	15	28	

## 5.2 Section B - Cultural Factors

The next set of questions engage participants from the influence of background, culture and family. These questions tried to understand where the participants got information about careers and how it would impact their own perceptions on ICT.

It was hypothesised that parents/guardians would be influential over their child's future career? This hypothesis was tested using Chi-Square Goodness of Fit statistic (CS). More Pacific Girls (N=12) agreed than disagreed (N=1) regarding the hypothesis, however, when the question was asked to Māori girls, it did not find any significance

Pacific Girls,  $\chi^2(1, N=17) = 14.07, p < 0.05$

It appears that Pacific girls are more inclined to seek guidance from family members when thinking about their future career than Māori girls.

It was hypothesised that ICT was just programming, CS was used and it was found that there was significance for Pacific girls (N=15) than Māori girls (N=10).

Pacific Girls,  $\chi^2(1, N=17) = 10.33, p < 0.05$

Pacific girls agreed that ICT was just programming, however, Māori girls did not agree or disagree with the hypothesis.

## 5.3 Section C – Social Factors

The next set of questions asked the participants about their perceptions of stereotyping and roles models that would influence them about ICT. These questions tried to understand if stereotypes play a role in year 11 participants perceptions if role models can influence them towards a certain career path and also do peers have any impact on their decision making.

### 5.3.1 Stereotypes

Do participants believe there is still a problem with stereotypes within the ICT community and would participants be put off following a career in ICT because of such stereotypes? First, it was hypothesised that there is still a problem with stereotyping within the ICT community. The hypothesis was tested using CS. It was found that more Māori girls (N=9) agreed with the hypothesis of a problem with stereotyping within the industry than Pacific girls (N=6)

Table 5.1, Question C1

Ethnicity	Agree	Disagree	Neutral
Māori	9	1	0
Pacific	6	3	8

Question C1 - I still believe there is a problem with stereotypes within ICT, technology or computing?

The next hypothesis asked, would the stereotype problem put you off ICT. A difference was found between Pacific girls and Māori girls. Pacific Girls (N=3) agreed that it could put them off ICT, whereas Māori girls was (N=5).

Pacific Girls,  $\chi^2(1, N=17) = 11.20, p < 0.05$

It appears that Pacific girls see stereotypes as a potential problem that could put them off following a career path into ICT.

Do film and TV shows show females and males in a stereotypical view when it comes to ICT. It was found that more Pacific girls (N=14) than Māori girls (N=7) agreed

Pacific Girls,  $\chi^2(1, N=17) = 14.60, p < 0.05$

Māori Girls,  $\chi^2(1, N=10) = 1.40, p > 0.05$

It appears that Pacific girls still view the ICT industry from the influence of film and TV, giving the perception that key roles show actors as 'geeky' or 'nerdy'. From the data, it can be established that the link between stereotypical views within TV/Film is propagated through to what people watch and Pacific girls are picking up more on these subtle nuances about stereotypes than Māori girls.

Table 5.2, Question C4

Ethnicity	Agree	Disagree	Neutral
Māori	7	3	0
Pacific	14	2	1

Question C4 – Film and TV show women and men in a stereotypical view (geek or nerd) when it comes to ICT, technology or computing

### 5.3.2 Role Models

Do role models play a big part of you choosing your future career? It was found that both Pacific and Māori girls, especially Māori girls agreed. Both Pacific and Māori girls like to look up to a role model that they can relate to.

Pacific Girls,  $\chi^2(1, N=17) = 19.20, p < 0.05$

It appears that both Pacific and Māori girls use role models as part of them choosing their future career. This is interesting not only for family and guardians but also for teachers to actually know that students are still looking towards role models whether it from family or guardians, teacher or industry.

## 5.4 Section D – Structural Factors

The next set of questions that the participants were exposed to come from external factors that influence the participant from school and industry. It also looks at the perception of ICT and the type of work they could be doing in a future career.

### 5.4.1 School

Do you want ICT to be compulsory in high school? It was found that more Pacific girls (N=11) than Māori girls (N=7) disagreed that ICT should be compulsory.

Pacific Girls,  $\chi^2(1, N=17) = 11.20, p < 0.05$

Māori Girls,  $\chi^2(1, N=10) = 1.6, p > 0.05$

It does appear that Pacific girls are very averse to having ICT made compulsory within the high school.

Table 5.3, Question D1

Ethnicity	Agree	Disagree	Neutral
Māori	3	7	0
Pacific	3	11	4

Question D1 – ICT, technology or computing should be a compulsory subject at secondary school

Do you seek career advice from: family, friends, teachers, career advisors or online media TV magazines and newspapers? It was found that Pacific girls (N=12) chose family for their first advice.

Pacific Girls,  $\chi^2(1, N=17) = 14.80, p < 0.05$

The Pacific girls also chose teachers as an important career advice support (N=11), however, Māori girls really disagreed with career advice from the career advisors (N=9), but was not a significant result.

Māori Girls,  $\chi^2(1, N=10) = 6.40, p > 0.05$

It appears that both Pacific girls and Māori girls look to parents or guardians for career advice, slightly more for Pacific girls.

The next set of questions hypothesised some of the most common types of questions the students ask about ICT. The questions asked were as follows: ICT is more for men than women, Studying ICT lock you into a specific job, ICT work is fun, ICT work is repetitive, ICT means working on your own and ICT is not necessary for my future career. A significance was found with two of the questions asked with Pacific girls. The questions were regarding repetitive work and future career. Pacific girls agreed that their perceptions of the industry regarding ICT would be repetitive (N=14), they also believed that ICT is not essential in their future career (N=15).

1. *Repetitive work*, Pacific Girls,  $\chi^2(1, N=17) = 10.80$ ,  $p < 0.05$

2. *Future career*, Pacific Girls,  $\chi^2(1, N=17) = 11.20$ ,  $p < 0.05$

Table 5.4, shows levels of agreement towards ICT

Ethnicity	Agree	Disagree	Neutral
Māori			
1	10	0	0
2	9	1	0
Pacific			
1	14	1	2
2	15	1	1

Question D10 – Indicate your level of agreement with these statements towards ICT (1 = repetitive work and 2 = future career).

## 5.5 #Social IT Factors

The next set of questions that the participants were exposed to, come from factors affecting the participant perceptions of what the future holds for ICT? #Social IT is about perusing passions, creating amazing things using existing, evolving and future technologies and adjust quickly to an ever-changing technical world.

Do you have to be technically minded to be able to work in the ICT industry? It was found that Māori girls (N=3) agreed on regards the hypothesis, however, this was not a significant finding. Pacific girls (N=9) agreed that you have to be technically minded to be able to work in the ICT industry.

Pacific Girls,  $\chi^2(1, N=17) = 10.8$ ,  $p < 0.05$

It appears that stereotypical views of a person working in the ICT sector have to be technical to thrive in the industry.

## 5.6 ICT as a Career

The final question asked: From answering the questionnaire has it changed your attitude or perception of ICT, and would you pursue a career in the industry? Both Pacific and Māori girls unanimously agreed that it would not change their mind regarding their own future career.

Out of the 286 students that completed the questionnaire, 17 were Pacific girls and 10 Māori girls. None of the Māori or Pacific students wanted to pursue a career in the ICT field.

## 6. DISCUSSION

From the questions asked of the year 11 students, it appears that from the result of the questionnaire, Māori girls more so than Pacific girls appeared to know what they wanted when it came to their future career. Māori girls also reported that influential factors such as family do not appear to have a major impact in changing their minds regarding their future careers. Pacific girls reported looking towards family for insight and guidance for their future career path. These result differ from Dimitriadi (2013) who suggested that cultural influences are strong based on parental roles for Māori, however for Pacific girls these match with the outcomes from family influence over their child.

With regards to stereotyping, it was reported that stereotypes are still alive in both Māori and Pacific year 11 student's perceptions. These results have not really changed in the past 20 years as described by Clayton (2006), who noted: "Australian girls are continuing to reject ICT careers partially due to negative perceptions and stereotypes" (p. 3388). It does not seem to be a cultural thing but a social theme, however these results differ greatly from Grant et al. (2007) who talked about geek and loner as not being indicative of the stereotypes that students thought of when referring to people in the industry.

Role models on future career play a big part in Māori and Pacific year 11 girl's decision making, especially Pacific girls. Pacific girls reported they see their family members as being role models, which could impact on them changing their minds about their own future career. This strengthens Dimitriadi (2013) findings around culture for Pacific girls and looking up to family members as role models, however Perciva (2014) found girls where turned off STEM subjects when pretty young females were role models. This could indicate a difference in western culture to those of Pacific and Māori culture.

When it comes to ICT being compulsory at high school, Pacific girls appear to believe that ICT should not be compulsory, however, Māori girls were unsure if ICT should be part of a compulsory curriculum. These results back up the evidence from Dimitriadi (2013) who concluded that the classroom experience becomes a major factor for girls to choose other avenues when it comes to their future career path, as the experience in ICT, technology or computing compounds their perceptions about the subject as being boring.

When it came to career advice, Pacific girls reported looking towards family for advice first and foremost, unlike Māori girls who did look towards family for support but this was not a significant finding. A surprise in the findings came when looking at career advice from career advisors. Māori girls reported that they really disagreed with career advice from career advisors and did not seek their guidance. This backs up the literature that career advisors are very low down the list of people that teenagers go to for support when it comes to their career advice and pathway into the ICT industry (Adya & Kaiser, 2005; Morton, 2013; Piyasiri et al., 2014).

Some perceptions have changed over the decades regarding the ICT industry and the work carried out by ICT employees. Both Pacific and Māori (Hunter & Boersen, 2015) girls recognise that ICT employees no longer work in solitude but in collaboration with other colleagues. This result is at odds with Broadley (2015) who found that western teenage girls still perceive the industry as working on your own. When it comes to the perception of year 11 students about ICT employees, Pacific girls reported that you have to be technically minded to work in the industry. This backs up the literature from Dimitriadi (2013) that suggests that students still do not recognise the multiple avenues that they can take in the industry, these stereotypes for Pacific and Māori girls is still prevalent today regarding the industry and career options available.

## 7. IMPLICATIONS

From the discussion, it can be concluded that Pacific girls more than Māori girls seek approval from family when it comes to their future career. This appears to show that Māori teenage girls are starting to pick up more on westernised culture than Pacific teenage girls. The urban shift that Māori families undertook in the 50's and 60's in New Zealand to be able to find better jobs has now infiltrated their culture and is starting to impact on millennials and generation Z girls perceptions and attitudes towards some of the deeply ingrained Māori culture.

However, Pacific families started the urban shift later into the 80's and 90's and have not been entrenched in those western cultures as long, so the millennials and generation Z girls have not been exposed as much and still hold those Pacific family cultures more than Māori. They also see stereotyping as a problem within the ICT industry and this would be enough to put them off wanting to pursue a career in ICT. Pacific girls also perceived that you have to be technical to be employed in the industry.

If the industry cannot start to show a diverse gender balance and gender neutral workforce, then it will have an impact on students perceptions which 'fans the flames' of those stereotypes of the industry. If Pacific and Māori girls cannot see likeminded people within the industry then it starts to promote those doubts about, are you the right colour and gender fit for ICT. Many larger companies in New Zealand need to start to think about moving into a 21<sup>st</sup> century disruptive business model rather than the old 20<sup>th</sup> century industrial model of doing business.

Schools also need to be more agile when it comes to teaching ICT. There is a sticking point with the curriculum for schools but the need to change is a must for the future of the industry and making it gender neutral. New Zealand education needs to embrace change more rapidly to allow this new disruptive environment to flourish. Being able to offer ICT, technology or computing to students which is embedded into all subjects and allows collaboration across subjects is a definite must for all generation Z students.

## 8. LIMITATIONS AND FURTHER RESEARCH

This research only had a limited number of participants in both Māori and Pacific students, having a greater number of participants would allow the research to start to explain some of the questions that did not have enough representation of both cultures. Being able to re-run the questionnaire again with more input from both Pacific and Māori would expand the results and give a clearer conclusion rather than more of a generalisation.

It would be recommended that this questionnaire was also delivered across main centres, such as Auckland, Hamilton, Christchurch and Dunedin to acquire a better cross section of the country.

It would be recommended that the questionnaire also was delivered to rural areas, to see if the urban shift has had such an impact to both Māori and Pacific students.

To follow on from the questionnaire, an interview phase needs to be carried out to address some of those underlying perceptions in greater detail to fully understand why the participants perceived ICT in that way.

## 9. CONCLUSION

This research has focused on Pacific and Māori girls studying at high school in year 11 within the Wellington region in New Zealand. Due to the limited number of participants from both Pacific and Māori girls, some generalisations has been taken into account for the discussion and conclusion. The results are part of a PhD study which is still on-going and both groups of students are a subsection of a bigger pool of year 11 students.

## 10. ACKNOWLEDGMENTS

I would like to acknowledge the help and support given from the Wellington schools, without their help this would not have been possible to complete. I would also like to acknowledge my supervisors for being patient with me and allowing me to pursue a topic that I am very passionate about. Last but not

least, everyone that I have pestered to help in supporting this research.

Until industry and schools starts to recognise that there are still big issues for Māori and Pacific students and are proactive in change, then the majority of these students that will be heading into the workforce in the next couple of years will not even contemplate seeking employment in the ICT industry.

## 11. REFERENCES

- Abbiss, J. (2005). IT is a gender thing, or is it? Gender, curriculum culture and students' experiences of specialist IT subjects in a New Zealand high school (Unpublished doctoral dissertation). University of Canterbury, Christchurch, New Zealand.
- ACS. (2012). 2012 Australian ICT Statistical Compendium. Retrieved from Sydney, NSW: [http://www.acs.org.au/data/assets/pdf\\_file/0014/13541/2012\\_Statcompendium\\_final\\_web.pdf](http://www.acs.org.au/data/assets/pdf_file/0014/13541/2012_Statcompendium_final_web.pdf)
- Adya, M., & Kaiser, K. M. (2005). Early determinants of women in the IT workforce: a model of girls' career choices. *Information Technology & People*, 18(3), 230-259. doi:10.1108/09593840510615860
- Akbulut, A. Y., & Looney, C. A. (2007). Inspiring Students to pursue computing degrees. *Communications of the ACM*, 50(10), 67-71.
- Almond, S. (2013). My kids are obsessed with technology, and it's all my fault. *The New York Times*. Retrieved from <https://www.nytimes.com/2013/06/23/magazine/my-kids-are-obsessed-with-technology-and-its-all-my-fault.html>
- Barnett, M. (2015). ICT skills essential for getting a job, say Auckland business leaders. Retrieved from <http://tinyurl.com/h52377q>
- Baruch, R. (2014). Women and Information Technology: How Do Female Students of Education Perceive Information Technology, and What is Their Approach toward It? *Journal of International Women's Studies*, 15(1), 190-214.
- Bernhardt, S. (2014). Women in IT in the New Social Era: A Critical Evidence-Based Review of Gender Inequality and the Potential for Change. Hershey, PA, USA: IGI Global.
- Birrell, B. (2015). Too few or perhaps too many STEM graduates. *Australian Universities' Review*, 57(2), 71-78.
- Broadley, K. (2015). Entrenched gendered pathways in science, technology, engineering and mathematics: Engaging girls through collaborative career development. *Australian Journal of Career Development*, 24(1), 27-38. doi:10.1177/1038416214559548
- Cappelli, P. H. (2015). Skill Gaps, Skill Shortages, and Skill Mismatches: Evidence and Arguments for the United States. *ILR Review*, 68(2), 251-290. doi:10.1177/0019793914564961
- Clayton, K. (2006). Attitudes Towards ICT in Australian High Schools. *Encyclopedia of Gender and Information Technology*(2002), 3384-3390.
- Clayton, K., Beekhuyzen, J., & Nielsen, S. (2012). Now I know what ICT can do for me! *Information Systems Journal*, 22(5), 375-390. doi:10.1111/j.1365-2575.2012.00414.x
- Clayton, K., Hellens, L. V., & Nielsen, S. H. (2009). Gender Stereotypes Prevail in ICT; a Research Review. Paper presented at the Proceedings of the special interest group on management information system's 47th annual conference on Computer personnel research, ACM, Limerick, Ireland.

- Craig, A. (2014). Australian interventions for women in computing: Are we evaluating? *Australasian Journal of Information Systems*, 18(2), 91-110.
- Cummings, C., & O'Neil, T. (2015). Do digital information and communication technologies increase the voice and influence of women and girls. A rapid review of the evidence. Overseas Development Institute. Retrieved from [https://assets.publishing.service.gov.uk/media/57a08971e5274a31e0000ac/Rapid\\_Review\\_March\\_2015.pdf](https://assets.publishing.service.gov.uk/media/57a08971e5274a31e0000ac/Rapid_Review_March_2015.pdf)
- Dimitriadi, A. (2013). Young women in science and technology: the importance of choice. *Journal of Innovation and Entrepreneurship*, 2(1), 5-5. doi:10.1186/2192-5372-2-5
- Fortt, J. (2013). More women in technology jobs? If only it were true. Retrieved from <https://www.cnbc.com/2013/11/21/more-women-in-technology-jobs-if-only-it-were-true.html>
- Fry, R. (2016). Millennials overtake Baby Boomers as America's largest generation. Retrieved from <http://www.pewresearch.org/fact-tank/2016/04/25/millennials-overtake-baby-boomers/>
- Gardner, L., Sheridan, D., & Tian, X. E. (2014). Perceptions of ICT : An Exploration of Gender Differences. *World Conference on Educational Multimedia, Hypermedia and Telecommunications*, 2014(1), 120-129.
- Gorden, C. (2011, October 31). Women in Tech: Why is there no female Steve Jobs? Retrieved from <http://jobs.aol.com/articles/2011/10/31/women-in-tech-why-is-there-no-female-steve-jobs/>
- Grant, D. M., Knight, L. V., & Steinbach, T. A. (2007). Young Women ' s Misinformation Concerning IT Careers : Exchanging One Negative Image for Another. *Informing Science Journal*, 10, 91-106.
- Hamilton-Pearce, J. (2009). *Mana wāhine in information technology: Ngā kaiwhatu kākahu me te kākahu* (Unpublished doctoral dissertation). Auckland University of Technology.
- Hunter, A., & Boersen, R. (2015). Pragmatism not Passion: Adult Women decide on an ICT Career. Paper presented at the 6th annual conference of Computing and Information and the Technology Research and Education New Zealand (CITRENZ2015) and the 28th Annual Conference of the National Advisory Committee on Computing Qualifications, Queenstown, New Zealand.
- Jobs in the ICT sector. (2018). Job Availability. Retrieved from [www.seek.co.nz](http://www.seek.co.nz)
- Jones, C., Ramanau, R., Cross, S., & Healing, G. (2010). Net generation or Digital Natives: Is there a distinct new generation entering university? *Computers & Education*, 54(3), 722-732.
- Jones, D., Albion, P., & Heffernan, A. (2016). Mapping the digital practices of teacher educators: Implications for teacher education in changing digital landscapes. Paper presented at the Society for Information Technology & Teacher Education International Conference, Savannah, GA.
- Koulopoulos, T., & Keldsen, D. (2014). *The Gen Z Effect*. Brookline, MA: Bibliomotion.
- Latham, A. (2003). Urbanity, lifestyle and making sense of the new urban cultural economy: notes from Auckland, New Zealand. *Urban Studies*, 40(9), 1699-1724.
- Lomax, T. C., & Lemon, R. (2007). Demographic Impacts in IT Education: Research Agendas. *PACIS 2007 Proceedings*, 61-68. Retrieved from <https://pdfs.semanticscholar.org/8b7b/1dc5226bb326f7adf81e93b2a31ed4a869d8.pdf>
- McCarthy, C. (2008). To what extent are Maori studying ICT: The poly implementation gap? Paper presented at the PACIT, Naiper, New Zealand.
- Merchant, N. (2013). *11 Rules for Creating Value in the Social Era*: Boston, Massachusetts: Harvard Business Press.
- Miliszewska, I., & Moore, A. (2010). Encouraging Girls to Consider a Career in ICT : A Review of Strategies Gender-related Issues in ICT Education. *Journal of Information Technology Education: Innovations in Practice*, 9, 143-166.
- Morton, S. (2013, October). The odd one out: Gender imbalance in tertiary ICT education. Paper presented at the 4th Annual Computing and Information Technology Research and Education New Zealand, Hamilton, New Zealand.
- Papastergiou, M. (2008). Are Computer Science and Information Technology still masculine fields? High school students' perceptions and career choices. *Computers & Education*, 51(2), 594-608. doi:10.1016/j.compedu.2007.06.009
- Pau, R. (2009). *Experiential factors which influence how female students perceive computing and computing careers at different stages in their education. (Doctor of Philosophy)*, University of Southampton, UK. Retrieved from <http://eprints.soton.ac.uk/159613/>
- Perciva, J. (2014). No George Osborne! Girls will not follow glamorous role models into science, Higher Education Network The Guardian. Retrieved from <http://www.theguardian.com/higher-education-network/blog/2014/may/28/no-george-osborne-girls-will-not-follow-pretty-role-models-into-science>
- Piyasiri, T. A., Gamage, Y. G. P., & Manathunga, Y. S. (2014). *Study on Career Guidance in General Education in Sri Lanka*. (8). Nugegoda, Sri Lanka: National Education Commission.
- Rallu, J. L. (2009). Urban drift, urban growth, urban youth. In M. Rao (ed.), *A new generation of youth lifestyle. Influence and impact*, 68-96. Hyderabad, India: Icfai University Press.
- Roberts, J., & Dörrenbächer, C. (2016). Renewing the call for critical perspectives on international business: Towards a second decade of challenging the orthodox. *Critical perspectives on international business*, 12(1), 2-21. doi:doi:10.1108/cpoib-12-2015-0057
- Statistics\_New\_Zealand. (2013). 2006/2013 New Zealand Census. Retrieved from <http://nzdotstat.stats.govt.nz/wbos/Index.aspx#>
- Timms, C., Courtney, L., & Anderson, N. (2006). Secondary girls ' perceptions of advanced ICT subjects. *Australian Educational Computing*, 21(2), 3-8.
- Wiedmer, T. (2015). Generations Do Differ: Best Practices in Leading Traditionalists, Boomers, and Generations X, Y, and Z. *Delta Kappa Gamma Bulletin*, 82(1), 51-58.
- Young, J. (2003). The Extent to which information communication technology careers fulfil the career ideals of girls. *Australasian Journal of Information Systems*, 10(2), 115-125.