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## **The Access, Influences and Motivations of Women Studying Information Technology in New Zealand**

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### **Abstract**

*This study aimed at investigating the different factors that influence men and women to study IT in New Zealand. A comparison of the type of access, influential people and personal motivations was made between men and women studying IT in New Zealand. The data for this study was collected from 148 participants, 42 of which were women. The results show that there are specific people namely friends, fathers, brothers, teachers and partners in women's lives and friends and fathers in men's lives that influence their decision to study IT. The access men and women had to computers was found to be largely the same across genders. The majority of men and women were introduced to computers at home between the ages of 6 and 12 and both genders reported having high access at home and university and limited access at primary and secondary school. The nature of their access differed between genders and age groups. Finally, in terms of motivation, men and women were found to have different weightings of motivation for studying a career in IT. Men tended to have more intrinsic motivations, for example interest and enjoyment, whereas women had more extrinsic motivations, for example job opportunities.*

### **Keywords**

Women in IT, careers in IT, motivation, structural influences, social influences

### **INTRODUCTION**

This paper reports on a study that investigated the different factors that influence men and women to study Information Technology (IT) in New Zealand. This paper firstly considers the social and structural influences and motivations of women studying IT in New Zealand. The social influences include people such as family, friends, teachers and relatives who influence women to use a computer, teach them to use it and who influence their final decision to study IT. Structural influences include the different types and level of access women had to computers at home, school and university. The motivations of women to study IT are also addressed.

The above three factors, social influences, structural influences and motivations are compared to the factors identified by men to see if there are any differences in the reasons the two genders study IT. The aim is to provide an understanding of the different factors that influence men and women to study IT. The findings can be used to inform activities such as marketing and publicity drives to increase the participation rates of women in the IT industry.

The overarching research question for this study is:

What are the factors that influence women in New Zealand to study a career in IT?

- Sub Question 1:

Are there specific people in women's lives compared to men's that influenced their decision to study IT?

- Sub Question 2:

Where did men and women have access to computers, growing up, and what was the nature and level of their access to computers?

- Sub Question 3:

What are the motivations of women compared to men to study a career in IT?

In this study women in New Zealand are referred to as those studying IT related courses in New Zealand.

## LITERATURE REVIEW

Cukier, Shortt & Devine (2002) explain that when discussing IT it is agreed that this industry is virtually synonymous with engineering and computer science. However taking this definition of IT limits the number of women in this field to computer scientists and engineers. Therefore this study broadens the definition of IT and will thus, as a result, increase the number of women included in the study. The definition of IT for this study will refer to the management technologies used in information handling, communication and processing as well as the scientific, technological and engineering disciplines.

Although much has been written in regards to the genderisation of careers in fields such as sociology, education, psychology, maths and science, little has been specifically written relating to the factors that influence women to pursue a career in IT (Adya & Kaiser 2005). In 1999 women were starting to break through previously male-dominated fields such as medicine and law, but more recently women are still continuing to be under represented in computing (Adya & Kaiser 2005, Trauth 2002).

### Under representation of women in IT

The under representation of women in IT has been an issue observed for the last 20 years and efforts have been made to increase the number of women in the IT discipline worldwide however progress has been slow. A number of United Kingdom, Australian and New Zealand based groups<sup>1</sup> have all attempted to influence women to participate in IT related degrees and careers. WISE reports that between the years 1984 and 2006 the number of women graduates in engineering in the United Kingdom only increased from 7% to 15%. This demonstrates the slow uptake by women into these careers.

The reasons for this ongoing under representation of women in IT are discussed in the section below as the factors that influence career choices of women in IT. WISE and WIT, New Zealand, have acknowledged that some of the factors explained below can result in the under representation of women in IT for example parents, teachers and role models. WISE, as a result, have provided information on their website ([www.wisecampaign.org.uk](http://www.wisecampaign.org.uk)) for parents as to how they can encourage daughters into the IT field. They also provide ideas to help teachers and career advisors with ideas that can demonstrate the benefits of a career in science or engineering. In terms of mentors and role models WISE provide profiles of women in science and engineering to show women what they can aspire to. WIT ([www.womenintechnology.co.nz](http://www.womenintechnology.co.nz)) has a mentoring program and in order to be involved in this a mentee needs to sign up and will be placed with a mentor. There is a cost involved in this; however the programme provides valuable knowledge for those wishing to pursue a career in IT. All these initiatives are helping to increase the number of women in the IT industry.

### Factors that influence career choice

One of the main topics that continues to appear in the literature is the factors that determine a women's career choice in IT (Adya & Kaiser 2005; Ahuja 2002; Clegg, Mayfield & Trayhurn 1999; Ordidge 1997; Trauth 2002). The factors that influence career choice can be split into two categories, social and structural. Social factors include family, teachers/counsellors, role models and media. Structural influences include access to technology both at home and school. It is important to note that not all women experience the same influences and they do not all respond to these influences in the same way. Other factors that may influence career choices are personality and culture. Figure 1, shows the links and relationships between the social and structural factors and how they influence and determine career choice.

### Social influences

Family members, role models, media and teachers/counsellors are all social factors that influence women in their decisions to pursue a career in IT.

#### Family

Family is widely regarded as the most influential social factor in helping determine a person's career. Ordidge (1997) and Teague (2002) discuss how parents and siblings both play a part in influencing a family member's career. Research shows that parents are a strong influencing factor in helping women decide to pursue a career in IT. (Clegg, Mayfield & Trayhurn, 1999; Trauth, 2002; Teague, 2002). Women choosing IT careers generally have understanding parents, who will support any career path their daughters choose to follow (Clegg, Mayfield & Trayhurn, 1999; Trauth, 2002). Students are more likely to choose a technical career if they see their parents in contact with technology or their parents have IT careers themselves (Adya & Kaiser, 2005). Many

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<sup>1</sup> Women in IT (WINIT), Opportunity Now, Women into Science, Engineering and Construction (WISE), Women in Technology Australia (WIT) and Women in Technology New Zealand (WIT)

participants in the study conducted by Trauth (2002) who have pursued careers in IT referred to parents as having a large influence on their career choice.

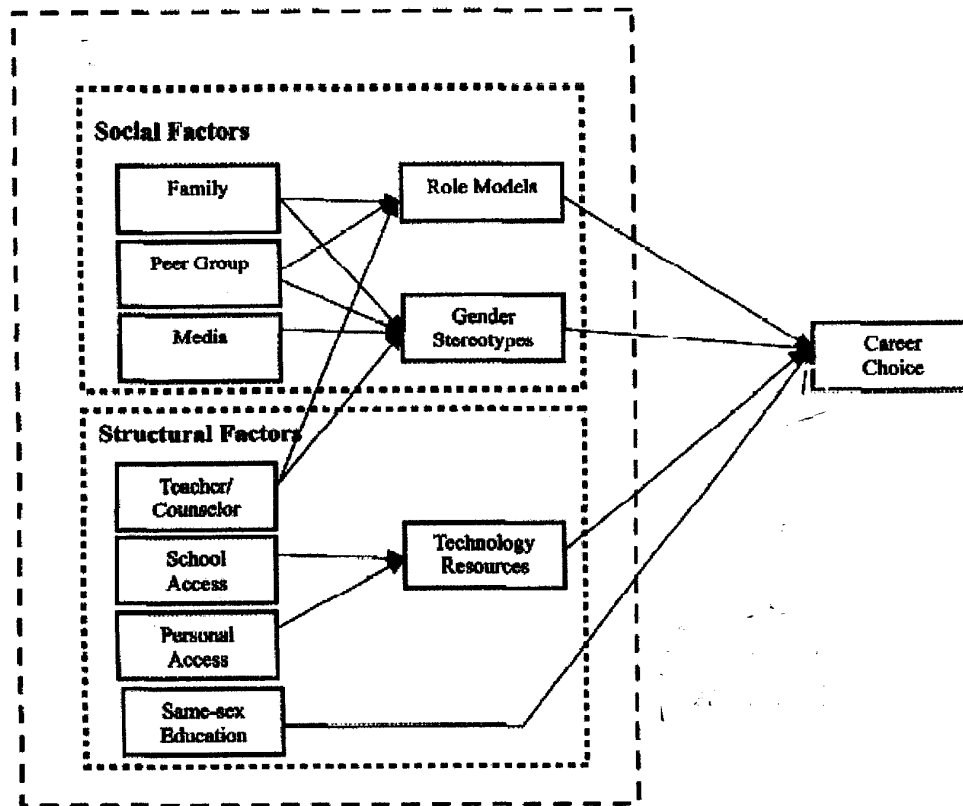


Figure 1: Factors influencing career choice (adapted from Adya & Kaiser, 2005)

Siblings also have some influence on choices of career although the influence is not as strong as parents (Adya & Kaiser 2005). For some girls, older brothers can influence them into a traditionally masculine career, whereas girls who only have sisters are more likely to choose occupations that are traditionally feminine (Adya & Kaiser 2005).

#### Role Models

Role models often influence a person's career choice however it has been acknowledged that a lack of role models in IT can be a factor that contributes to the lack of women in the IT field (Adya & Kaiser 2005; Ahuja, 2002; Crews & Butterfield 2003; Ray, Sormunen & Harris 1999; Teague 1997; Teague 2002). Women have a harder time finding role models and mentors who will give them advice and motivate their careers (Adya & Kaiser 2005). Ahuja (2002) states that the career choice stage<sup>2</sup> is when women make the critical decisions about their career and this is when role models can be 'instrumental in steering them in one direction or the other' (pp. 23). So it is at this stage that we need to introduce role models to young women.

#### Media

Media plays a vital part in influencing a person's career, particularly young women, as it provides them with images of "how they should look, think and behave" (Ordidge 1997, pp. 32). Young women's magazines like *Cosmo Girl* and *Seventeen* do nothing to reduce gender stereotypes or help portray women in professional, technological careers. The image of computing represented by the media is influential in career choices (Teague 1997). The media depicts women in passive roles, where they are either observing men working on computers or are under the direction of men on a keyboard (Selby, Ryba & Young 1998). Pictures portraying women in computer magazines, textbooks and software are seldom found and when they are represented it is in a stereotypical way which alienates women further from IT careers (Adya & Kaiser 2005). In 1995 manufacturers made a major change to the look and feel in the way companies use the media for advertising. This change saw

<sup>2</sup> Career choices are made during university education and entry-level jobs. This is referred to as the career choice stage.

images of women and young girls being represented as competent computer users. These images were shown in computer and traditional women's magazines and also on television and demonstrated women and daughters purchasing computers (Ordidge 1997).

#### Teachers/Counsellors

Teachers have a strong influence on students and their career choices (Adya & Kaiser 2005; Clegg, Mayfield & Trayhurn 1999; Ordidge 1997; Teague 2002; Trauth, 2002; Turner, Bernt & Pecora 2002). The examples below show that teachers are one of the major influential groups; this is because they have both strong positive and negative influences on career decisions.

Teachers can encourage and discourage their students and influence their choices. One woman in the study conducted by Trauth, (2002) spoke of a primary school teacher who was a large influence on her career choice by strongly encouraging her to do well. A study performed by Turner, Bernt & Pecora, (2002) found that teachers were the second most frequently cited people that encouraged a women's decision to pursue a career in IT, after fathers. Interestingly, in the same study 17% of women cited teachers as being discouraging in their choice of IT as a career.

Teachers can discourage women in pursuing a career in IT by favouring the boys in the class and letting them have priority over girls (Adya & Kaiser 2005; Klawe & Leveson 1995). In a study performed by Klawe & Leveson, (1995) one teacher openly admitted discouraging girls, and stated that computer resources should be given to boys as they "need to know about computers for their future careers".

### **Structural influences**

The following factors are structural influences that can determine career choices. Social influences impact structural influences; this is shown in Figure 1. For example, if a parent buys a computer it impacts computer access. Therefore the social influences affect structural influences especially access at home and school. Structural influences often then lead to the different attitudes people have towards computers.

#### Access at School

The access to computers in schools shows that boys are more likely to spend time on the computer before, during and after school (Volman & Van Eck 2001). Women who have IT careers cite that the most prominent reason for their interest in IT is due to the access they had to computers at school (Adya & Kaiser, 2005). Turner, Bernt & Pecora, found from their study in 2002, that school is an important factor in introducing women to computers, with 50% of women first using a computer at school, while only 23% first used a computer at home. Studies have shown that there is an apparent dominance of males and computer use at school (Ray, Sormunen & Harris 1999; Teague 1997) and males also have a more positive attitude towards them compared to women (Ray, Sormunen & Harris 1999).

#### Access at home

Girls, at home, use computers less frequently and are less likely to have access to a computer at home compared to boys (Adya & Kaiser 2005; Frenkel 1990; Selby, Ryba & Young 1998; Teague 1997; Teague 2002; Volman & Van Eck 2001). Girls who have had home computers bought for them are expected to share with their siblings (Klawe & Leveson 1995). Parents often assume that boys should have more access to computers and are thus more inclined to buy them computers over girls (Frenkel 1990). Boys often receive more encouragement from parents to use the computer at home (Selby, Ryba & Young 1998). Boys demand more power and functionality from their home computer thus asking for better internet connectivity or more capable computer technology (Adya & Kaiser 2005). This then leads to IT use in college and results in students with home computers having more positive attitudes towards IT (Adya & Kaiser 2005). Allowing children access to computers at home helps familiarise them with the technology which can influence their attitudes towards IT careers (Adya & Kaiser 2005; Frenkel 1990).

#### Same sex and coeducational schools

From articles discussing the affect of same sex and coeducational schools on students and their career choices, it was found that students who attend coeducational schools receive more pressure from the opposite sex and face comparison in the classroom (Adya & Kaiser 2005). On the other hand, students who attend same sex schools face less pressure from the opposite sex and tend to have a more sense of belonging (Adya & Kaiser 2005). In a coeducational school girls also have to compete for teacher's time and attention (Dick & Rallis 1991).

In same sex schools, there may be a lesser focus on relationships and more of a focus on academic achievement. Same sex schools however can unintentionally reinforce gender stereotypes (Adya & Kaiser 2005) and gender segregation can also be present particularly with regard to computer courses (Trauth 2002). Two participants that were interviewed in a study performed by Trauth (2002) stated that, due to the segregation, they found

adjusting to university computing courses difficult as they did not receive the same preparation in secondary school as their male classmates.

A study performed by Olivieri (2005) investigated whether high school environments are a factor in encouraging girls' interest and attitudes towards computers. They concluded that girls in single sex schools to have higher involvement with and enjoyment of computers compared to girls attending coeducational schools. The girls from coeducational schools indicated a higher anxiety towards computers.

## RESEARCH METHODOLOGY

The chosen research method in this study is a quantitative approach. The approach chosen for this study is survey research. Questions were mostly closed and involved yes/no questions, circling answers or ticking boxes on a table, some more open ended questions were included to address how women were influenced to use a computer or to study a career in IT

The sample frame is a list or set of directions that identify all the sample units of the population (Alreck & Settle 1995). The sample frame is the list of relevant second and third year Computer Science, Information Systems and Electronic Commerce classes at one New Zealand University. Second and third year classes were used in this study as it was decided that students at these year levels are more likely to have chosen a career path to study as opposed to first year students.

Clustered sampling is where the population is divided into clusters. A random sample of clusters is then chosen and every person or object within that cluster is selected for sampling. Clustered sampling was the chosen method of selection. Once all 14 of the second and third level Computer Science, Information Systems and Electronic Commerce classes were identified, they were split into 6 groups. First they were split into the different majors and then divided again according to the year level. From each group only one class could be chosen. Each class, within the groups was chosen at random. Six classes that were selected, within each of these 6 classes all students were included in the sample.

With 50 people at most in each of the 6 classes there can be no more than 300 respondents. A further issue was the lack of women taking these courses and was expected that the response rate for women would be at least 30. In total the sample size aimed at being no less than 150 respondents. The number of surveys received after data collection was 148, 42 of which were women.

## RESULTS

### Research question 1

Are there specific people in women's lives compared to men's that influenced their decision to study IT?

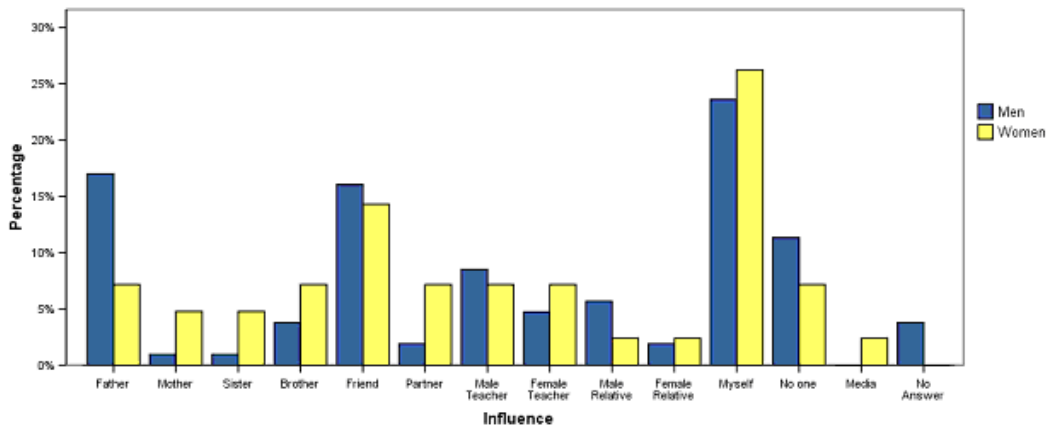


Figure 2: Person with highest influence on decision to study IT

The literature review identified family as the most influential factor in helping to determine a woman's career choice with parents being more influential than siblings. The findings from this study confirm that parents and siblings are strong influences in determining career choice for females. Male figures in the family are stronger influences than the females, for example fathers are more influential than mothers and brothers are more influential than sisters. This was also found to be the case for the men in the study; male figures in their lives had more of an influence than the female figures. The main differences between men and women is that fathers have a greater influence on men than they do on women and mothers, sisters and brothers are more influential

for women than they are for men. Male relatives and teachers are more influential for men and female relatives and teachers are more influential for women.

Teachers, as stated in the literature are also strong influences in a woman's career choice.

The findings show that in a woman's final decision to pursue a career in IT teachers have the same levels of influence as fathers and brothers. For males, fathers have a greater influence on the final decision to study IT than teachers. This shows that teachers have a significant influence on both men and women's decisions to study IT and it is therefore important for them to continue encouraging men and especially women to pursue a career in IT.

#### Recommendation 1

Table 1 shows how teachers influence men and women and Research Question Three discusses what motivates men and women to study IT. By putting this knowledge together teachers can help increase the number of women studying IT by discussing career options with them and encouraging them to follow their interests and abilities. They could also arrange for women in the IT industry to talk to female students about the industry, the different jobs available and the opportunities the industry has to offer as these are the factors that motivate women to study IT. In order to get more men to study IT teachers should find out what they enjoy doing and encourage them to follow their interests.

One thing that came out of the findings that was not mentioned in the literature is the level of influence friends have on career choice. Friends are the highest external influence that men and women have when choosing a career in IT. Friends influence men by being in the IT industry or discussing career options whereas friends influence women by talking about career options and encouraging them to follow their interests. Although friends influence men and women in different ways for both genders they are a greater influence than either parents or siblings.

Another interesting finding was the high internal influence men and women themselves had for wanting to study a career in IT. 'Myself' as a factor was rated the highest in influencing both men and women to study IT.

Table 1. Influential people and how they influence men and women to study IT

<b>Women</b>		<b>Men</b>	
<b>Influence</b>	<b>How they Influence</b>	<b>Influence</b>	<b>How they Influence</b>
Fathers	<ul style="list-style-type: none"> <li>• Discuss career options</li> </ul>	Fathers	<ul style="list-style-type: none"> <li>• Encourage to pursue interests</li> </ul>
Mothers	<ul style="list-style-type: none"> <li>• Discuss career options</li> </ul>	Mothers	<ul style="list-style-type: none"> <li>• Discuss career options</li> </ul>
Sisters	<ul style="list-style-type: none"> <li>• In IT industry</li> <li>• Discuss career options</li> </ul>	Sisters	<ul style="list-style-type: none"> <li>• Discuss career options</li> </ul>
Brothers	<ul style="list-style-type: none"> <li>• In IT industry</li> </ul>	Brothers	<ul style="list-style-type: none"> <li>• In IT industry</li> <li>• Discuss career options</li> <li>• Encourage to pursue interest</li> </ul>
Friends	<ul style="list-style-type: none"> <li>• Encourage to pursue interests</li> </ul>	Friends	<ul style="list-style-type: none"> <li>• Encourage to pursue interests</li> </ul>
Male Teachers	<ul style="list-style-type: none"> <li>• Encourage to pursue interests</li> </ul>	Male Teachers	<ul style="list-style-type: none"> <li>• Encourage to pursue interests</li> </ul>
Female Teachers	<ul style="list-style-type: none"> <li>• Discuss career options</li> <li>• Encourage to pursue interest</li> </ul>	Female Teachers	<ul style="list-style-type: none"> <li>• Encourage to pursue interests</li> </ul>
Male Relatives	<ul style="list-style-type: none"> <li>• Discuss career options</li> </ul>	Male Relatives	<ul style="list-style-type: none"> <li>• In IT industry</li> </ul>
Female Relatives	<ul style="list-style-type: none"> <li>• In IT industry</li> </ul>	Female Relatives	<ul style="list-style-type: none"> <li>• Discuss career options</li> <li>• Encourage to pursue interest</li> </ul>

The literature discusses who the people are that influence men and women, but not necessarily how they achieve that influence. From the findings there are clear differences between the people that influence men and women to study IT and how they achieve that influence. Table 1 shows these differences. Parents influence women by discussing career options with them however for men, though mothers influence them by discussing career options; fathers encourage them by urging them to pursue their interests. Sisters influence women both by being in IT themselves and discussing career options, on the other hand brothers are more influential if they are in the IT industry. For men, sisters are more influential if they discuss career options with them, whereas brothers are influential in a number of ways: they may be working in IT, they can discuss career options or they can encourage their brothers to pursue their interests.

Friends tend to be influential when they encourage both men and women to pursue their interests. Teachers have the same amount of influence on both men and women when they encourage them to pursue their interests. The one difference is that for women, female teachers also discuss career options with them. Male relatives influence women by discussing career options with them, and female relatives by actually being in the IT industry. In comparison, for men, male relatives have an influence if they are in the IT industry while female relatives influence by discussing career options and encouraging them to follow their interests.

This study shows that different people influence men and women in different ways. Family members influence women by discussing career options with them, those outside the family also discuss career options but focus more on encouraging women to pursue their interests. In comparison to this, men report that family, friends and teachers all encourage them to follow their interests, rather than focussing on career options..

**Recommendation 2**

If more women are to enter into the IT field they need to be encouraged to follow their interests and abilities by their family as well as by teachers and friends. None of the women wrote that their parents were influential because they were in the IT industry. Parents who work in IT should consider discussing what their work involves with their daughters to encourage their interest.

**Research question 2**

Where did men and women have access to computers, growing up, and what was the nature and level of that access?

The following three graphs have been chosen from the results of the study to show the different types of access men and women had at home at different stages of their lives.

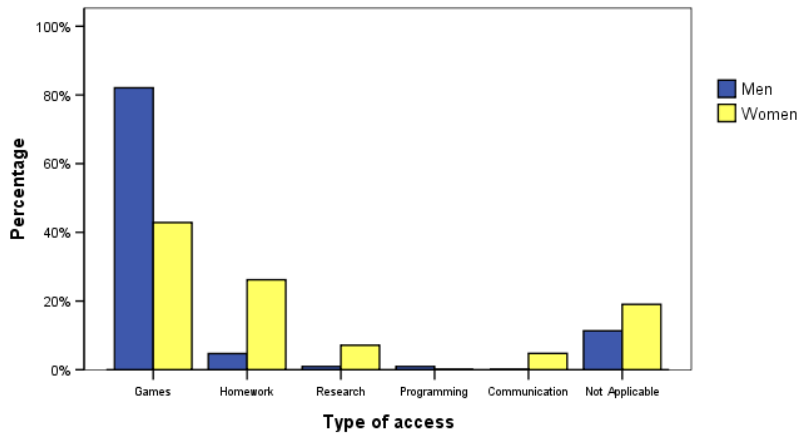


Figure 3: Type of access at home for men and women between ages 5-12

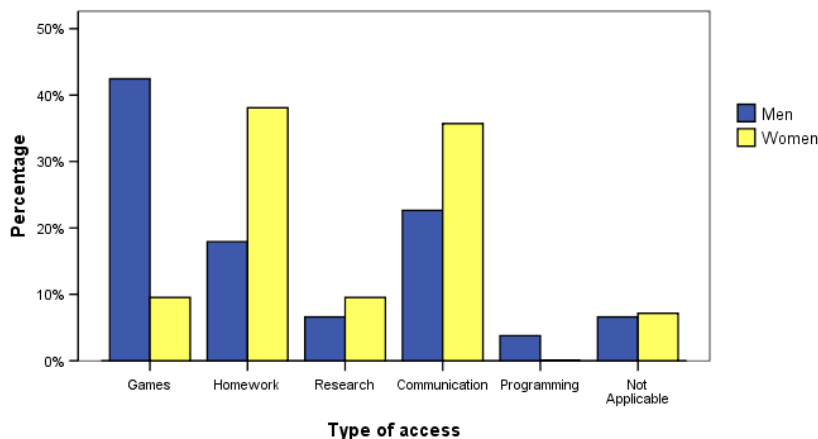


Figure 4: Types of access at home for men and women between ages 13-17



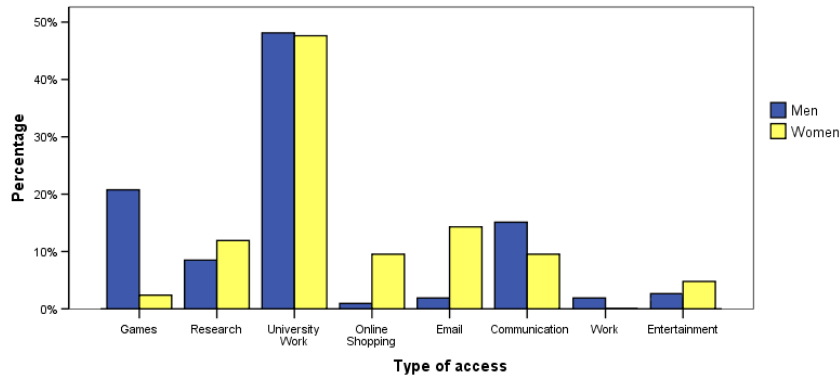


Figure 5: Type of access at home for men and women aged 18 and over

In the literature review school emerged as an important factor in introducing women to computers, with 50% of women first using a computer at school and 23% first using a computer at home. No distinction was made in the literature between primary and secondary school. The results of the study found that 52% of women were first introduced at home while 44% were first introduced to computers at school. For men 56% were introduced to computers at home and 40% first used a computer at school. This shows that in terms of access a higher percentage of men were introduced to computers at home and a larger number of women were introduced to computers at school, however these percentages are not high enough for there to be a significant difference between the two sexes. School is still important in introducing men and women to computers, however home is now where the majority of men and women first use a computer.

Although school was where 44% of women and 40% of men were introduced to computers, access both at primary and secondary school was limited. This was due to limited resources, functionality, time and computers only being available in certain classes.

### Recommendation 3

Though some of these factors are unavoidable for example, the limited time available on computers, however others can be changed for example, limiting the computers to specific classes. Teachers should not limit the use of computers to certain classes, if students take an interest in computers but are not taking computing as a subject they should still be allowed access to IT equipment. All school students should be given the opportunity to use computers.

In terms of computer use, this study found that men use the computer more for games than women do; this supports the findings from the literature. 82% of men and 42% of women report that their primary activity on a computer between the ages of 5 and 12 was playing games. Between the ages of 13 and 17 the number of men playing games drops by nearly half to 42% and only 10% of women report playing games as their primary activity. When aged 18 and over, 20% of men as compared to only 4% of women, are using the computer primarily for playing games.

The literature review also stated that girls tend to use home computers more for work related tasks as opposed to computer games. This study concludes that this is true for women over the age of 12. Those between the ages of 5 and 12 use the computer primarily for computer games, however from 13 years on girls use the computer more for work related tasks for example homework, university work or research.

### Research question 3

What are the motivations of women compared to men for taking up a career in IT?

The review of the literature showed that little has been written regarding the motivations of men and women when deciding to study a career in IT. Motivations that were identified in the literature were financial aspects, job security, love/enjoyment and a desire for challenging work. The motivations listed by participants in this survey followed this pattern. This study found that women studying IT in New Zealand were motivated by the job opportunities available in the industry, followed by their interest in the field and their enjoyment of computers. The good pay available and the individual's ability to use a computer were also listed as motivations.

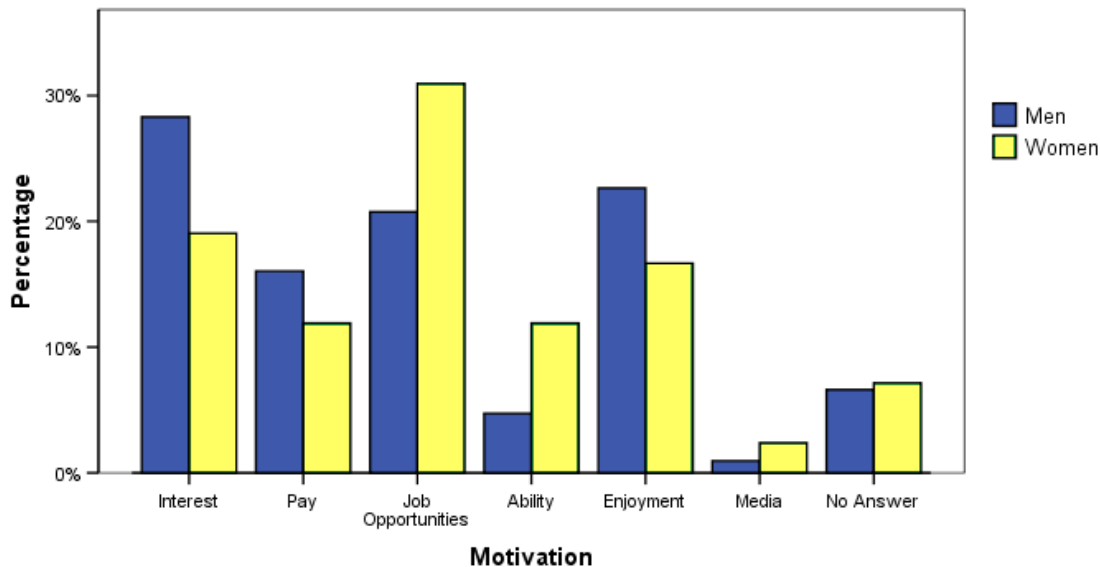


Figure 6: Main motivation for studying a career in IT

The men in the study also listed similar motivations however there was a difference in order between the genders. Interest and enjoyment were the two most common motivations for men to study IT, followed by job opportunities, pay and ability. This shows that men have more intrinsic motivations for studying IT, such as interest and enjoyment of the field. Women on the other hand identify extrinsic motivations such as job opportunities as their main motivation for studying IT.

### Recommendation 3

Identifying the main motivations that influence men and women studying IT in New Zealand can help parents and teachers, especially guidance counsellors to understand the different reasons men and women have for pursuing a career in IT. When encouraging women to study IT, parents and guidance counsellors should discuss the job opportunities that are available in the IT industry. When discussing career options with men the emphasis needs to be placed more on what they are interested in and what they enjoy rather than the job opportunities. If these different approaches for discussing career options in the IT industry with both genders are utilised the result could be an increase in the number of students especially women studying IT in New Zealand.

## CONCLUSION

This study aimed at investigating the different factors that influence men and women to study IT in New Zealand. A comparison of the social and structural influences and motivations were made between men and women studying IT in New Zealand. The findings conclude that there are specific people namely friends, fathers, brothers, teachers and partners in women's lives and friends and fathers in men's lives that influence their decision to study IT.

The access men and women had to computers was found to be largely the same across genders. The majority of men and women were introduced to computers at home between the ages of 6 and 12 and both reported having high access at home and university and limited access at primary and secondary school. The nature of their access differed between genders and age groups. Playing games was the primary activity for both men and women aged between 5 and 12. Playing games for men was still the primary activity between ages 13 and 17, whereas women focused more on homework. Aged 18 and over men and women primarily used the computer for university work.

Finally, in terms of motivation, men and women were found to have different weightings of motivation for studying a career in IT. Men tended to have more intrinsic motivations, for example interest and enjoyment, whereas women had more extrinsic motivations, for example job opportunities, for wanting to pursue a career in IT.

The results of this study showed a differentiation between the factors that influence men and those that influence women to study IT. This study also provided some insight into what people in men and particularly women's lives can do to encourage them to study IT and as a result help increase the participation rates of women in the IT industry.

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