

## Gender differences in experiences of TAFE IT students: a work in progress

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### Abstract

In Australia, one of the sources of loss of females in the IT education pipeline occurs at the TAFE (college) level. Female students comprise the majority of early TAFE IT courses and female completion rates for these courses are similar to males. Despite this early success, most females choose to not continue to Diploma level, and through articulation pathways into university IT courses. A survey was conducted to determine possible differences in experiences between male and female TAFE IT students. It was found that more females than males lived alone or with dependents. Female students had higher employment status, higher previous education, and comparable computer literacy and interest in IT to the male cohort. Despite these advantages, the female students had lower confidence in their ability to study, and their abilities in IT, and many female students did not intend to study or work in IT. Possible reasons are discussed.

**Keywords:** Women in Technology, attrition, self-efficacy, survey, TAFE, college.

### 1 Introduction

Since 2008 the Women in Technology (WIT) program at Southern Cross University has been conducting events such as games nights, robotics workshops, and social events to attract female students to study IT, and to support and retain these students throughout their course. The WIT program's purpose is to address the low proportion of females in IT courses and the IT industry - currently around 15% in tertiary educational institutions and around 22% in the IT workforce (Australian Computer Society 2011). The narrowing of the educational pipeline of females studying IT is likely to lead to a greater gender imbalance in the future, and the lack of participation by females in the production of technology has an ongoing impact on the shaping and content of that technology (Logan & Crump 2007).

A recent WIT think-tank - involving university staff, students, TAFE NSW staff, and representatives of local

IT industries and employment agencies - identified that one of the sources of loss of females in the IT education pipeline occurred at the TAFE (technical college) level. Specifically, TAFE NSW North Coast Institute (NCTAFE) offers various Certificate, Diploma and Advanced Diploma courses and other training packages in IT, some of which were articulation programs into undergraduate computing degrees at Southern Cross University. NCTAFE comprises campuses in Northern NSW, with approximately 1650 students studying IT courses (Certificate 1 through to Advanced Diploma) each year.

Within the TAFE IT courses, a substantial number of female students who start IT Certificates do not progress to Diploma or Advanced Diploma courses. For example, in 2012, across all campuses and study modes, 134 female students (vs 81 male students) enrolled in Certificate 1 IT courses but this number declined to just 1 female (and 22 male students) in the Advanced Diploma courses. Surprisingly, there are actually more females than males in Certificate 1 IT courses but for the Advanced Diplomas the proportion drops to less than 5% females (Figure 1).

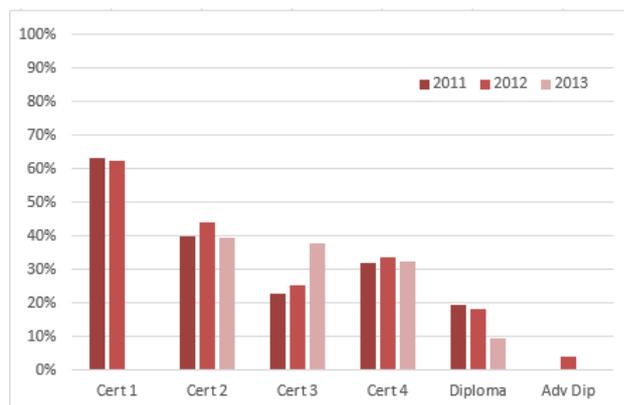


Figure 1: Percentage of female students in NCTAFE IT courses (Data provided by NCTAFE 2013)

Females are not leaving further study at TAFE in the same proportions in other courses. In fact, in certification levels across all courses in TAFE NSW, females comprise over 45%, and higher than 50% in Certificate 4 and Diploma (TAFE NSW 2013). This is illustrated in Figure 2 with the enrolment data for 2012.

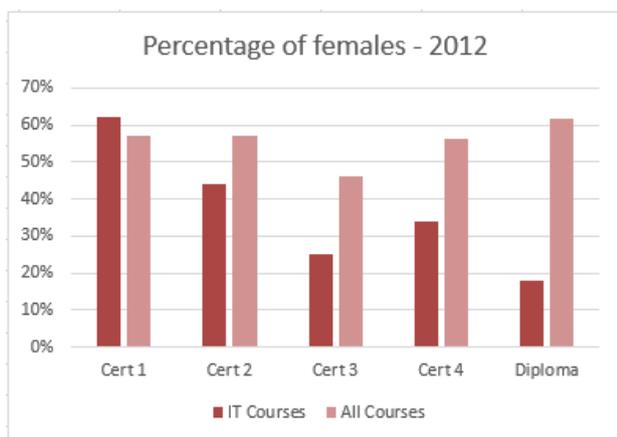


Figure 2: Percentages of female students in IT courses vs All courses (TAFE NSW)

This decrease in number of female students between Certificate 1 IT courses and Advanced Diplomas should not be seen as an indication that female students are less able than males at IT. Completion rates for each course are similar for males and females (Hellou 2013). At the end of each course, students are required to make a conscious decision to pursue further study, and to enrol in the next course. Fewer female students are making the choice to continue in IT than are male students.

If this decrease in female students between initial enrolment and final qualification was happening in a university undergraduate course, it would present as withdrawals or failures and would be subject to scrutiny to find out what was happening to these female students. The TAFE course configuration allows many exit points and so this 'choose not to progress' attrition has not been previously identified. The direct result is that the pipeline of female IT students entering universities through articulation pathways from TAFE is narrowed. In 2012 at Southern Cross University, for example, females comprised merely 9% of the TAFE IT articulation pathway intake compared to 13.5% in the normal educational intake (school-leavers and mature-age students). The reasons for this decrease in female enrolment percentages from TAFE IT Certificate courses to Diploma courses are not currently known. Before programs can be put in place that aim to boost the numbers of females continuing to study IT at TAFE or University, the reasons why female IT students choose not to continue need to be determined.

Many reasons have been proposed for the low numbers of female IT students, including external factors such as family obligations and obtaining employment, and other factors such as lower self-confidence, lower initial computer literacy, lack of availability of desired choice of Diploma programs and societal gender expectations (Cohoon 2001; Katz et al. 2006; Roberts et al. 2012; West & Ross 2002). A survey was proposed as a starting point to determine the differences, if any, between male and female IT students' experiences, life circumstances and attitudes.

## 2 Methodology

In early 2014, all NCTAFE Information Technology students were invited to participate in an online survey,

with the objective of determining if there were differences in the profile of male and female students in IT courses that could impact on their progression. A wide range of questions were asked in the survey, to identify any possible differences between male and female experiences and attitudes.

Some of the areas examined were:

- age group;
- living circumstances (living alone, with family, share house etc.);
- primary caregiver status (of children or others);
- number of dependents;
- employment status;
- financial pressure experienced;
- current level of emotional well-being;
- prior educational level;
- use of computers;
- previous study in IT;
- reasons for the choice of course;
- attitudes towards study and the course, including self-efficacy; and
- future intentions in study and employment.

The full set of questions may be accessed at <http://bit.ly/NCITSurveyQuestions>.

NCTAFE offers courses in on-campus, distance/online and 'mixed' mode. Online students can commence a course at any time during the year. For this reason, the invitation to participate was sent to all new students with their enrolment package, as well as invitations and information disseminated to all current IT students.

## 3 Results

### 3.1 Responses

The survey was open for 2 weeks, and collected 78 responses in total, which is about 10% of the Semester 1 IT course enrolments. One of these respondents was under 18 years of age, and this response was discarded, as approval was not obtained from a parent or guardian. Several participants did not progress past the first two questions of the survey - age and gender - and these responses were not included in the data set.

There were a total of 65 complete or mostly-complete responses included in the analyses below. Where not all participants chose to answer a question, this has been indicated in the results.

### 3.2 Demographics

**Gender:** Thirty-seven males (57%) and twenty-eight females (43%) participated in the survey. It should be noted that while there were more male than female participants, the purpose of the survey was to examine the differences in circumstances and attitudes between genders, and for this purpose the proportion of male to female participants is suitable.

**Age:** The age groups of the survey participants are shown below in Table 1.

Approximately 66% of the participants were over 40 years of age. Although NCTAFE is a regional institution which does have a large amount of mature-age students, the proportion of older students in this sample is higher

than expected compared to the general population of NCTAFE students (NSW Dept of Education and Communities 2012).

	Total	Male	Female
18-21	6	6	0
22-25	6	4	2
26-30	4	1	3
31-40	6	5	1
41-50	23	11	12
51-60	10	5	5
over 60	10	5	5

Table 1: Age of survey participants

The age distributions for the participants in this sample, compared to the general NCTAFE population, should be kept in mind when considering the results of this survey.

### 3.3 Current Course of Study

Students may enter a TAFE pathway of study at any level, if they have satisfied the entry requirements. For example, some students may be studying a Certificate 4 as their first TAFE IT course, or they may be in Certificate 2 as their second IT course at TAFE. The numbers in our sample in each course are shown below in Table 2. Participation rates are dominated by Certificate 4 students, followed by Diploma students, and these two combined account for a total of 45 out of the 65 participants (69%) that answered this question.

Current Course	Total	Male	Female
Cert 1	1	0	1
Cert 2	6	4	2
Cert 3	11	7	4
Cert 4	28	15	13
Diploma	17	10	7
Adv. Dip.	0	0	0

Table 2: Current TAFE IT course level

Approximately 45% of our sample (50% of males and 41% of females) were enrolled in their first TAFE IT course. There were 29 students (46%) studying in online/distance mode, 32 (51%) studying on-campus and the remainder studying in mixed-mode.

### 3.4 Living Arrangements

Participants were asked to indicate their current living arrangements, by selecting from a list of options. The results are given below in Figure 3. More than one choice could apply to each student (for example, living with a partner and living with dependents), so percentages do not total 100%. Most students live with a partner, dependents, or with other family, with only 11% living alone.

Proportionally more females were living alone, and more females than males lived with dependents. More males lived with other family - for example they lived with their parents or siblings.

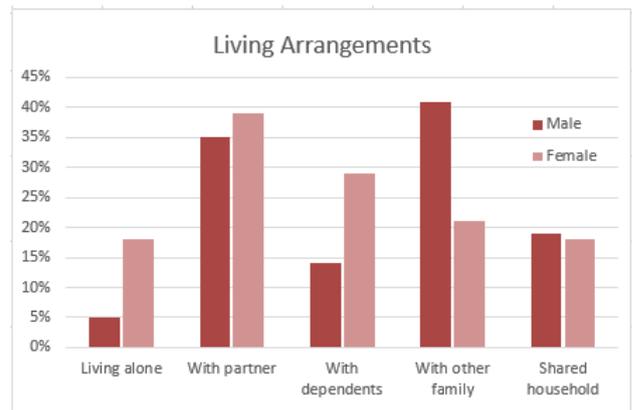


Figure 3: Living arrangements of male/female students.

The living arrangements of the women who live alone or with dependents without a partner or other family could adversely impact on the level of support these students receive during study, in contrast to the male students who would presumably be supported by family.

**Primary Caregiver Status:** 11% of males and 25% of females indicated that they were the primary caregiver for between 1 and 4 dependents.

### 3.5 Employment

Participants were asked if they had paid employment, and if so, whether this was full-time, part-time, casual or if they were self-employed. The differences between men and women were significant (Figure 4). More women had employment, inclusive of full-time, part-time or other (Chi Square:  $p = 0.01$ ; a significance level of 0.05 is used throughout this paper). Both men and women, if they were employed part-time or casually or self-employed, worked an average of 21 hours per week.

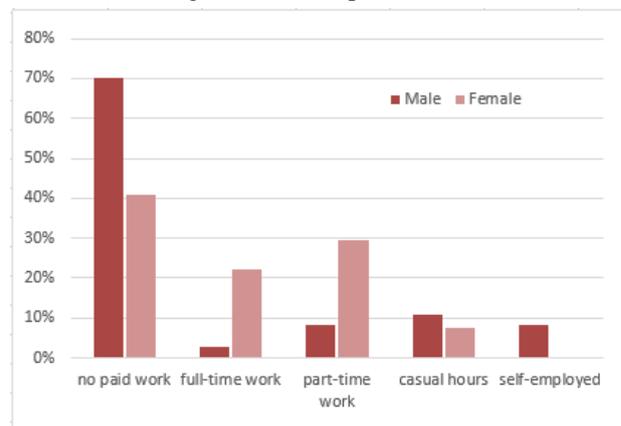


Figure 4: Employment of males and females.

We asked those who had indicated they were not working full-time, whether they were actively seeking employment. As a proportion of those who were not employed full-time, significantly more males (39%) than females (14%) were actively seeking employment whilst studying (Fisher Exact Probability Test:  $p = 0.04$ ).

Half (50%) of these job-seeking males expected employment (if gained) to impact on their further study, while 66% of job-seeking females expected an impact on their study if they gained employment. This indicates no difference between genders for anticipated impact on

further study if employment was gained (Fisher Exact Probability Test:  $p = 0.54$ ).

### 3.6 Financial Pressure

To determine the level of financial pressure students may be facing, we asked “If you had to do so in an emergency, could you find \$2000 within 48 hours?” This question is included on Australian Bureau of Statistics surveys (for example the ABS General Social Survey - (Australian Bureau of Statistics 2012a)) as a measure of financial stress for individuals and households.

As 60% of female students are working full-time, compared to 30% of males, we may expect that more males than females would answer “no” - that is, more males would be experiencing financial pressure. This was not the case. Around 50% of both males and females identified that they were experiencing financial pressure, despite the higher employment status of female students. The reasons for females experiencing similar levels of financial stress despite higher levels of employment may be associated with female students reporting higher numbers of dependants than male students.

### 3.7 Kessler 10 (Level of Psychological Distress)

The Kessler 10 (K10) is a standard test of 10 questions designed to identify levels of psychological distress in participants (Kessler & Mroczek 1994). The test asks participants to indicate how often they have felt various feelings over the past 30 days. Each measure is then scored, with “none of the time” = 1, “a little of the time” = 2, “some of the time” = 3, “most of the time” = 4 and “all of the time” = 5. For the 10 questions, a minimum score of 10 and maximum score of 50 is possible (Andrews & Slade 2001). Scores are then grouped into four levels of psychological distress (Table 3).

K10 score	Categorisation
10 to 15	Low distress
16 to 21	Moderate distress
22 to 29	High distress
30 to 50	Very high distress

Table 3: ABS K10 categories (Australian Bureau of Statistics 2012b)

Not all of the participants chose to answer this section of the survey. The results of the 35 males and 24 females who answered this question are shown below in Figure 5.

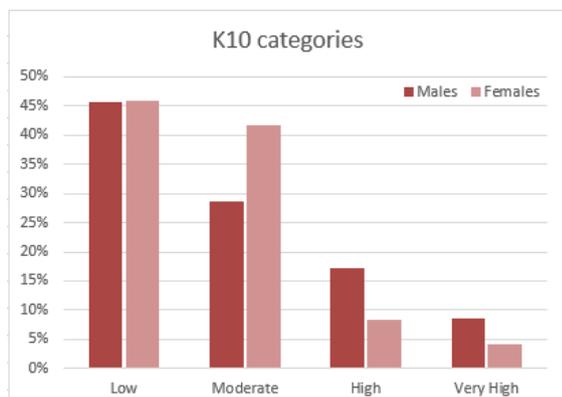


Figure 5: Male and Female K10 scores

There was no difference in psychological distress scores between males and females (Mann-Whitney U Test:  $p = 0.3192$ ,  $U_A = 389$ ,  $z = 0.47$ ).

Of particular interest in these results is that for both males and females, over half of the participants reported at least a moderate level of psychological distress. More research is needed to determine whether this is a phenomenon particular to IT students, or older IT students, or whether TAFE students in general are experiencing significant levels of stress.

### 3.8 Previous Level of Education

Students were asked to identify the highest level of education they had completed prior to their current course. The results of this question for males and females are shown in Figure 6.

Significantly more females than males had previous tertiary qualifications, either at TAFE or University (Chi-Square test,  $p = 0.016$ ).

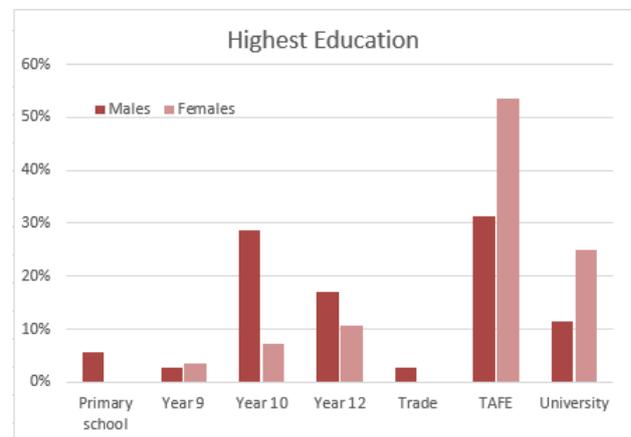


Figure 6: Highest level of previous education

### 3.9 Reasons for choosing to study in this course

It was proposed that as few females were choosing to continue with higher level TAFE courses, that perhaps their reasons for studying in IT courses in the first place were that their preferred course was not available, or that they were pushed into the course by close friends, parents, or to satisfy other external agents such as being a requirement for continuation of receiving unemployment benefits.

To examine the possible differences in reasons for choice of course, we provided a list of common reasons and asked participants to indicate any that applied to their reasoning for studying their current course. Participants could choose more than one reason. A range of reasons were given, and space was also given for other reasons. The results are displayed for males and females in Figure 7.

There were no significant differences between males and females for any of these reasons (based upon Fisher Exact Probability Tests). It is notable that the most prevalent reason for both males and females was “I have always been personally interested in IT” with about two thirds of all students indicating this as a reason. Other reasons offered for undertaking the course included a desire for formal recognition of existing skills, changing

industry and needing re-skilling, and recognition that IT skills were broadly applicable to a wide range of careers.

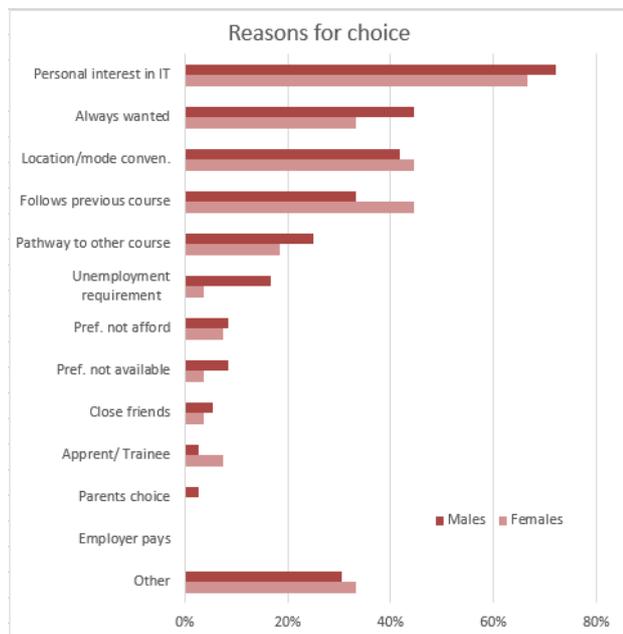


Figure 7: Reasons for choosing current course - males and females.

### 3.10 Computing Use and Skills

#### 3.10.1 Computer Literacy

Students were asked about their current skill level in using a computer as a tool. Values ranged from 1 (“new to using computers”) to 5 (“can use computers for advanced tasks and to format professional documents”). Both males and females generally had high computer literacy (Figure 8), and there was no difference between genders (Mann Whitney U Test,  $p = 0.4562$ ).

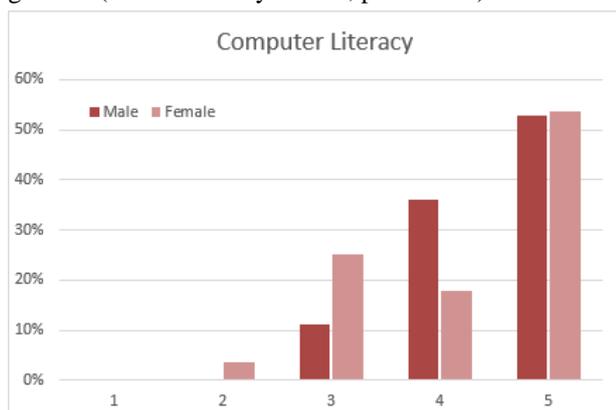


Figure 8: Computer literacy of male and female participants (1 = low, 5 = high).

#### 3.10.2 Computer Use

Time spent on the computer (“computer use”) has long been correlated with computing self-efficacy and positive attitudes towards computers (Gardner et al. 1993; Levin & Gordon 1989). The survey participants were asked how many hours (approximately) they spent on a computer at home and (for those who were employed) at work in a

week. Our definition of computer use included sending emails, socialising, playing games, studying and other activities.

There was a significant difference between the amount of computer use at home between males and females ((Mann-Whitney U Test:  $p = 0.0256$ ,  $U_A = 359.5$ ,  $z = 1.95$ ) with males using computers for longer times (Figure 9), but no difference between genders in the amount of computer use at work (Mann-Whitney U Test:  $p = 0.18$ ,  $U_A = 66.5$ ,  $z = 0.9$ ) (Figure 10). There were, however, more females employed than males (Section 3.5) and if each person’s total time per week spent on the computer is taken into account, then there is a trend towards females having more total time on the computer each week (Mann-Whitney U Test:  $p = 0.062$ ,  $U_A = 618.5$ ,  $Z = 1.54$ ).

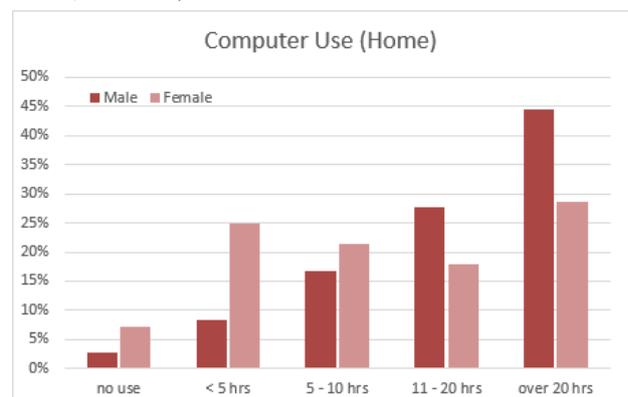


Figure 9: Computer Use at Home - Male and Female

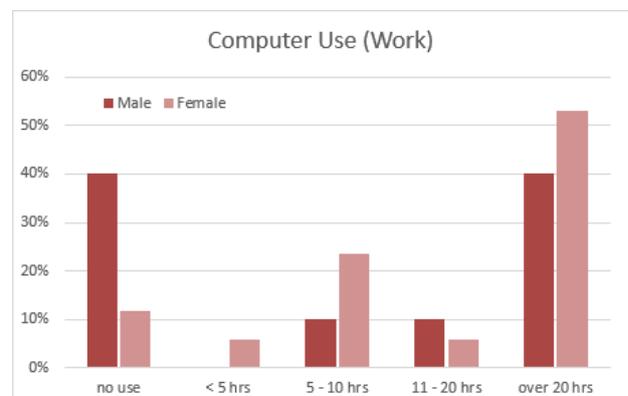


Figure 10: Computer Use at Work - Male and Female

### 3.11 Attitudes towards the course

Self-efficacy in computing and in study has previously been related to gender (Huffman et al. 2013; Saleem et al. 2011). We asked students to indicate their agreement on a five point Likert scale with the following statements:

- “I feel confident in my ability to study in this course.”
- “I feel confident in my ability in information technology.”
- “I feel excited about studying in my course.”
- “I feel fearful about what might be expected of me in my course.”
- “I feel confident that the skills I will learn will benefit me in the future.”

### 3.11.1 Self-efficacy in study

With respect to agreement with the statement “I feel confident in my ability to study in this course”, most students were reasonably confident in their ability to study (Table 4 and Figure 11). There was, however, a significant difference between males and females, with females reporting lower self-confidence (Mann-Whitney U Test -  $p = 0.0197$ ,  $U = 296$ ,  $z = 2.06$ ).

	Median	Mode	Min	Max
Male	4.5	5	2	5
Female	4	4	1	5
All	4	4	1	5

Table 4: Self-efficacy in study ability (1 = low, 5 = high)

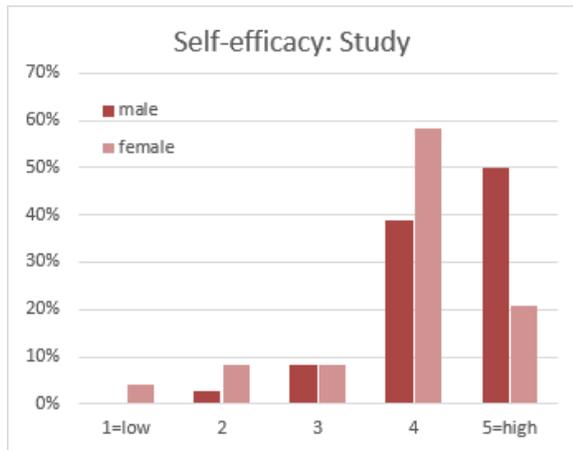


Figure 11: Self-efficacy in study in the course

### 3.11.2 Self-efficacy in IT

Most students were relatively confident in their abilities in IT as well (Table 5 and Figure 12), as presented by agreement with “I feel confident in my ability in information technology”. There was a trend towards females reporting lower self-confidence, compared to males (Mann-Whitney U Test:  $p = 0.0808$ ,  $U_A = 339$ ,  $z = 1.4$ ).

	Median	Mode	Min	Max
Male	5	5	2	5
Female	4	4	3	5
All	4	4	4	4

Table 5: Self-efficacy in IT (1 = low, 5 = high)



Figure 12: Self-efficacy in IT

### 3.11.3 General attitude towards course

There was no difference between males and females in their general feelings of excitement about studying in their course (Mann Whitney U Test:  $p = 0.2148$ ,  $U_A = 379$ ,  $z = 0.79$ ) - Table 6.

	Median	Mode	Min	Max
Male	4	5	2	5
Female	4	4	1	5
All	4	4	1	5

Table 6: Excitement about studying: male and female (5 = high)

### 3.11.4 Fear about expectations

There was no difference between males and females in their level of fear about what might be expected of them in the course (Table 7) (Mann Whitney U Test:  $p = 0.3192$ ,  $U_A = 463.5$ ,  $z = -0.47$ ).

	Median	Mode	Min	Max
Male	3	3	1	5
Female	3	4	1	5
All	3	3	1	5

Table 7: Fear about expectations (5 = high)

While there was no difference between genders, it should be noted that some students were very fearful about what might be expected of them, and most students had some level of apprehension.

### 3.11.5 Confidence in the course outcomes

There was no difference between males and females in confidence that the skills acquired in their course would benefit them in the future (Mann Whitney U Test:  $p = 0.1587$ ,  $U_A = 381.5$ ,  $z = 1$ ). Most participants rate highly on this measure, indicating generally positive views regarding their study, but there were also participants from both genders who rated this as “low” (Table 8).

	Median	Mode	Min	Max
Male	4.5	5	1	5
Female	4	4	1	5
All	4	5	1	5

Table 8: Perceived benefits (5 = high)

## 3.12 Future Intentions

Participants were asked what they intended to do when they completed their current course. Participants could choose any number of the provided options - seeking employment in IT, seeking employment in another field, study further in IT, study further in another field, or “other reason”. The results of this question are shown in Figure 13.

Proportionally more women than men were considering employment or study in a field other than IT, while all but 1 male intended to work and/or study in IT. This is clearer when looking at each participant and determining whether they were only interested in studying or working in IT (“IT only”), only interested in studying and working in another field (“Other only”), or

if they were more open and considering both (“both”). The results are in Figure 14 below.

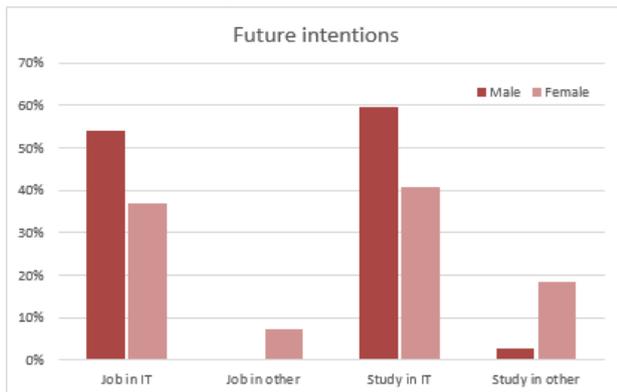


Figure 13: Future Intentions

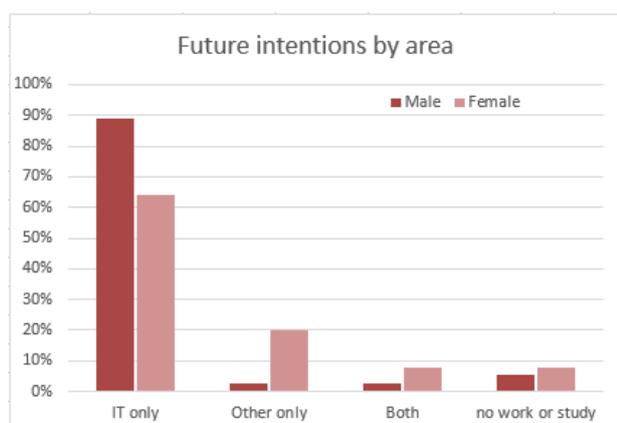


Figure 14: Future intentions by area (IT or other area).

Significantly more males than females (Fisher Exact Test:  $p = 0.022$ ) were considering study or work in only IT, and had excluded all other possibilities. More females than males (Fisher Exact Probability Test:  $p = 0.0198$ ) considered working or studying in another field, whether or not they also considered IT. In fact, 20% of females intended to study or work in another field, and had excluded IT as a suitable target for work or further study.

#### 4 Discussion

For the Certificate 1 in IT offered by TAFE NSW - North Coast Institute there are as many female students as male. There are no apparent difference in completion rates for courses between men and women at NCTAFE, yet the proportion of women continuing with further studies in IT declines compared to males. The female students are choosing to *not* pursue further studies in IT at a greater rate than their male counterparts.

This study reports on an initial stage of research being undertaken with the objective of determining the reasons for the gender difference in continuation rates. Although the participants responding to this survey form a non-representational sample biased towards older students compared to the general NCTAFE student population, and biased towards “later courses” of Certificate 4 and Diploma compared to early courses of Certificate 1 and Certificate 2, there are some differences in gender present

that may represent differences in the general NCTAFE student population.

Despite holding higher levels of previous education and higher rates of current employment, each indicating a history of relative success, commencing female IT students reported lower levels of self-confidence than men in their capacity to study in their current course. At this stage we do not know whether this lack of confidence is due to an innate characteristic of females, discrimination (as suggested in Valenti 2014), or some other factor.

Women also reported a broader options-horizon than their male counterparts with respect to work opportunities beyond the area of IT. Of all the men studying IT in this study, only one indicated consideration of future study or work in an area other than IT, whereas seven (28%) of females indicated considerations of future employment or study outside of the IT discipline.

The fact that 20% of females indicated that they now *exclude* the possibility of future study or employment in IT is telling, and consistent with the backdrop to this study. Women begin their studies in IT with personal interest rates in the area that are similar to males. Female students are successful in their studies, with completion rates that are similar to males yet, for some reason, they perceive that they lack skills to study in their course, and, for whatever reason, come to the decision that their future career aspirations lie somewhere other than IT.

The IT discipline contains a gender bias demonstrating higher male participation and employment rates. Policies and programs intended to respond to this by intervening and supporting female students, for their life and activities both within and beyond educational institutions, need to better understand the reasons, rationales and perceptions that divide male and female students regarding study and career aspirations in IT. Further investigation in this area is warranted, and is currently in progress.

#### 5 Further Work

The current study has reported upon a participant pool that is skewed towards older students, and towards Certificate 4 and Diploma level courses compared to earlier entry courses. Future iterations of this study will seek a more representational sample with respect to age of students and course of current study.

A series of interviews is underway with some of the participants who completed the survey currently reported. These interviews seek deeper insight into some of the personal narratives, as case studies, with the intent of better understanding the dynamics involved in the decision making process regarding choice of further study, or employment, in IT and other content domains.

As observed by Abraham Wald (Samaniego & Francisco 1984) with respect to the location requirements for placement of armour on warplanes during World War 2, it is not the location of hits upon planes that survive and return that indicate the needed location for armour placement, but the absence of planes with certain areas demonstrating damage, as it is these areas, that indicate catastrophic vulnerabilities. Of the females participating in the current study 41% are undertaking their first course at NCTAFE, and so are presenting information regarding

their first experiences and perceptions of study in this area. Further research and analysis is required to drill into the experiences and perceptions of women who *fail* to return to study IT, rather than those who do.

It is important to note that harvesting participants through open invitations to current students, by definition, has excluded those past students who have already chosen, and acted upon, their intentions to not pursue further studies in IT. A strategy will need to be devised by which such people may be identified, and whose participation in completing both questionnaires and interviews, may be acquired, to enable determination as to the reasons why these students have become “missing in action”.

## 6 Acknowledgements

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