VET pathways into science, technology, engineering and maths occupations

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Abstract

The Federal Government has spent considerable effort to meet the perceived shortage of skilled workers with Science, Technology, Engineering or Mathematics (STEM) qualifications.

While many of these qualifications are undertaken in the Higher education Sector, there are a number of STEM qualifications in the Vocational Education and Training (VET) sector, particularly in the health, agriculture and trade areas of study.

The Longitudinal Surveys of Australian Youth (LSAY) provides an opportunity to investigate the pathways young people (aged 15 – 25) take from compulsory schooling through post-school education, and finally into the labour force. Information is also collected on factors influencing career choices.

This paper uses LSAY data to explore the pathways young people take from VET into STEM occupations, where the leakages occur, and the factors that influence young people to pursue STEM careers. Where relevant, comparisons are made with young people who study STEM qualifications at University.

This research points to areas of policy development which may help to increase the number of people pursuing STEM qualifications in the VET sector and going on to pursue STEM occupations.

Introduction

There is a declining participation in post-compulsory Science, Technology, Engineering or Mathematics (STEM) subjects. This is a concern for government, industry and educators in Australia and internationally. Despite a labour market increasingly driven by, and reliant on, technology, many contend that Australia's workforce is now facing general skills shortages in these areas which will only get worse over time. Underlying shortages of suitably qualified teachers of science and maths are also concerning. National and state governments are keen to understand the reasons behind this apparent broad decline in interest, with considerable attention focused on how to encourage more students to study STEM in school and post-school studies.

This paper is based on a project NCVER undertook on behalf of The Department of Education, Employment and Workplace Relations (DEEWR) investigating pathways of individuals entering Science, Technology, Engineering and Mathematics (STEM) careers, and those undertaking STEM study both at school and in post-school education.

The research used data from the Longitudinal Surveys of Australian Youth (LSAY) from 3 different (Y95, Y98 and Y03) cohorts. LSAY is a longitudinal survey which interviews respondents each year until the reach the age of 25. In the first waves of the survey for the Y95 and Y98 surveys, respondents also undertake some testing to determine their mathematics and reading ability. The first wave of the Y03 cohort is obtained from the Programme of International Student Assessment (PISA) in which students are tested on various aspects of mathematics, reading, and science. The Y95 cohort were interviewed in 1995 when they were in Year 9, Y98 were first interviewed in 1998 when they were also in Year 9, and the Y03 cohort were first interviewed in 2003 when they were aged 15 years.

Our original paper, Anlezark *et al.* (2008) was focussed on those post-school, and occupations in STEM which were generally at Bachelor degree level or higher (Higher education.). For this paper, we have broadened the scope of STEM to include courses and occupations with qualifications from Certificate I to Advanced Diploma (VET). This enables us to compare and contrast movement in and out of the different levels of STEM courses, and allows us to determine differences between the two education sectors (VET and Higher educationucation).

The report is in four key areas. In the first section we use the Y95 LSAY cohort to investigate the level of STEM study while in Year 12 and the pathways from school into post-school courses in STEM.

In the second, we briefly use the Y98 LSAY cohort to determine the factors influencing the decision to undertake Year 12 STEM. In the third, we then use the Y03 LSAY cohort to determine what motivates young people to study STEM while at school and in post-school study. We also look at the reasons people don’t study STEM, and discuss the factors which would need to be changed to influence young people to undertake STEM study post-school.

Finally, we use the data from the Y05 cohort to investigate the pathways from post-school STEM into STEM occupations at age 25 and the background characteristics of who are working in a STEM career.

We end with some conclusions and highlight some further areas that could warrant further research.

What is STEM?

The definition of what is a STEM subject in school, STEM course and STEM occupation are based on several different classification code frames.

In Year 12, LSAY respondents are asked what subjects they are doing. The national subject lists is comprehensive and NCVER in consultation with DEEWR determined which of these subjects were to be classified as STEM subjects. An individual is classified as studying STEM in Year 12 if they were studying two or more subjects in broad categories of science, maths and computing/information technology in Year 12.

For post-schooling courses, LSAY asks questions on their field of study. These are then coded by the data collection agency to the Australian Standard Classification of Education (ASCED), codes 01 to 06 (ABS 2001). Some examples of the types of fields of education coded as STEM include: mathematics, automotive electrics and electronics, engineering, agricultural science, etc. A full listing of STEM courses classified as STEM (by ASCED code) can be found in Appendix A

LSAY asks questions about current and intended occupations. These are coded to standard occupation classifications (ASCO), from which they are categorised in STEM occupations (refer to Appendix A for a detailed list)

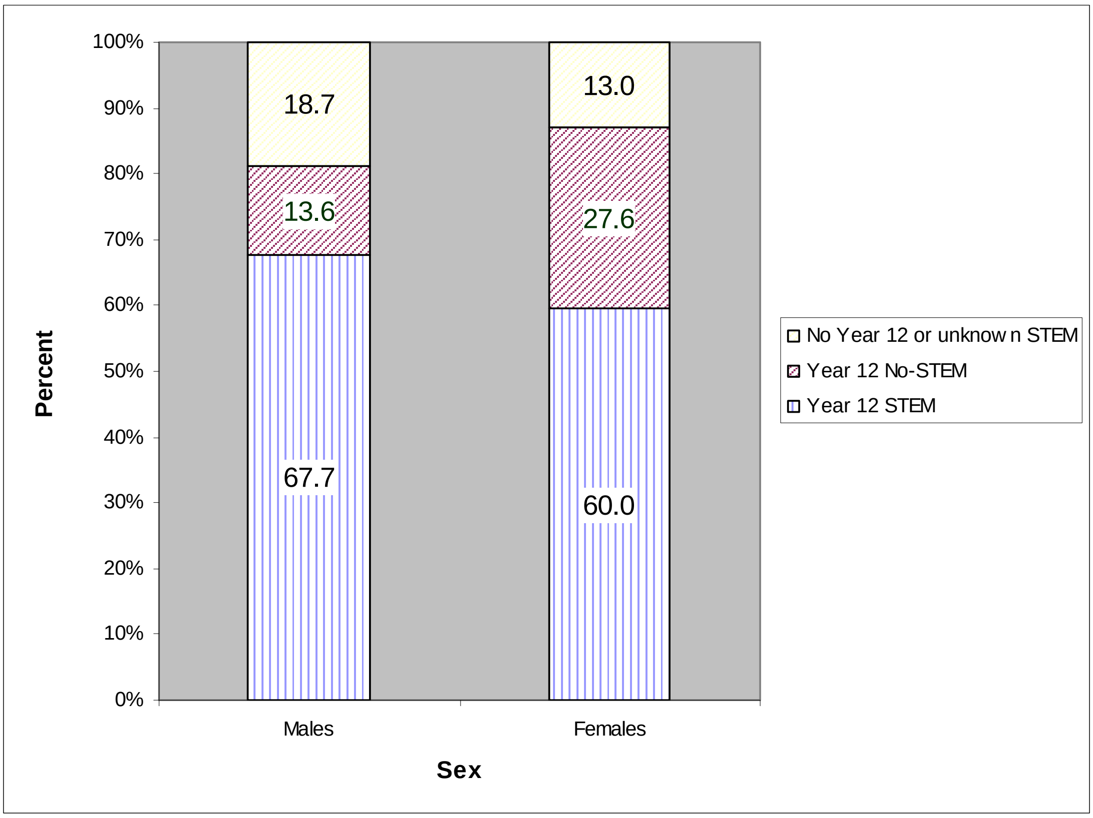
The level of study is not taken into consideration when coding a field of study or occupation as STEM. In this report, we classify VET study as anyone who has completed a Certificate I to Advanced Diploma and Higher education study as anyone who has completed a Bachelor’s degree or higher. These definitions are used for the remainder of the paper to differentiate VET from Higher education.

Pathways from school into post school STEM study

In this section we explore the pathways from secondary school into post-school study. In the first part, we identify the percentage of respondents who undertook a STEM course of study whilst at school (Figure 1) and in the second part we investigate the proportion of respondents who undertook STEM study post school (Figure 2). We then present the demographics of post-school STEM students by sector to determine if there are differences between those doing VET and Higher education STEM courses.

Those undertaking Year 12 STEM are the individuals that provide the supply into post-school STEM study and onto STEM occupations If we can get students interested and undertaking solid STEM subject while at school then we can move someway towards addressing future skills shortages. From the results, we observe that 60% of all respondents undertook two or more STEM subjects while in Year 12 (Figure 1). We note that males are more likely than females to undertake STEM subjects in Year 12.

Figure 1: Percentage of students undertaking STEM subjects in Year 12 by gender



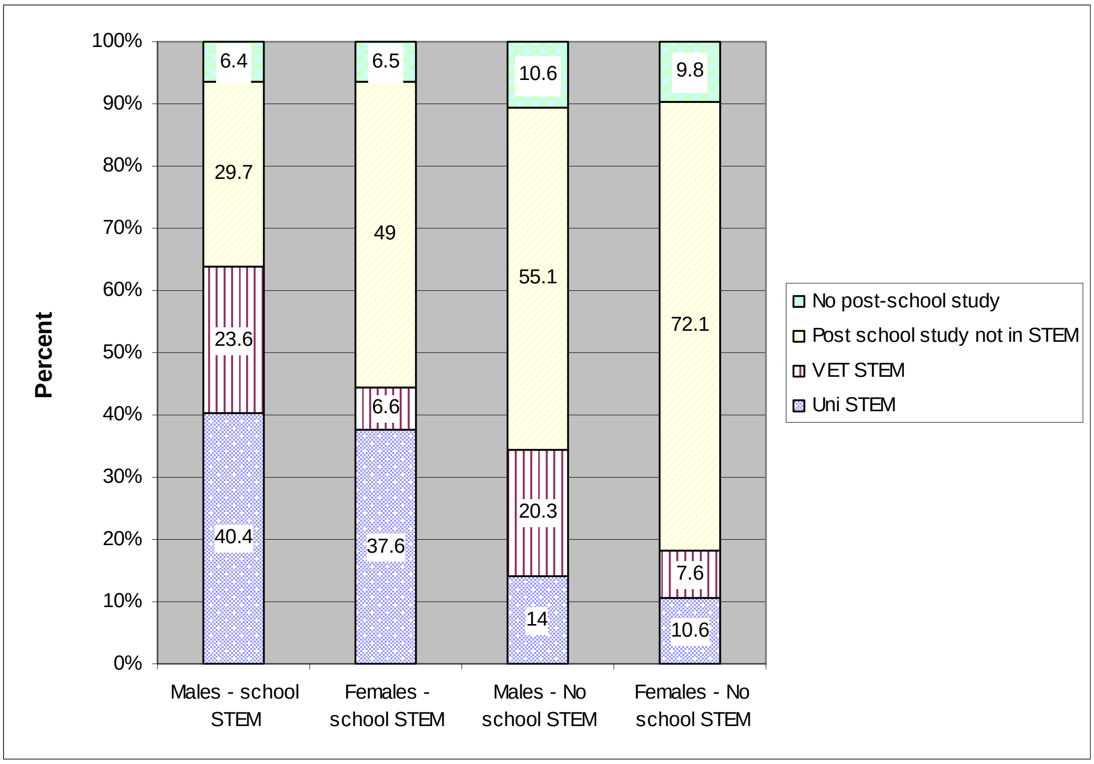
Given that we have a reasonable pool of students undertaking STEM in Year 12, it is important that we investigate the retention of these students into post-school STEM courses. Figure 2 presents the percentage of respondents undertaking VET STEM (Cert I – Adv. Diploma), Higher education STEM (Bachelor degree or higher), post-school study in STEM (all levels) and no post-school study by gender and their Year 12 STEM status (ie: did they do Year 12 STEM?).

From Figure 2, we observe that of those respondents that undertook school STEM, approximately 40% of both males and females go on to Higher education. STEM study. A further 22% of males undertake VET STEM study, whereas less than 10% of females undertook VET STEM. This may be because males are more likely to undertake apprenticeships (of which some) which are classified as STEM courses. Females are much more likely to be undertaking courses which are not STEM, such as clerical and administration type VET courses.

For those who do not undertake school STEM, approximately 35% of males undertake STEM post school (mostly at VET level) and less than 20% of females undertake STEM study post school (mostly at Higher education. level).

The results indicate that a pathway into Higher education post-school STEM may be pre-determined based on school subject choices, however a VET STEM post-school pathway is equally likely to be taken without studying school STEM. Females are unlikely to undertake VET STEM regardless of their school choices. This is consistent with post-school VET more generally:- NCVER's Student and Courses data (2007) show that the most common VET fields of study for females are management and commerce, society and culture, food and mixed field programmes (ie non-STEM courses) whereas for males, the most common fields are STEM type courses in engineering and related technologies, management and commerce and architecture and building.

Figure 2: Post-school study in STEM, Y95 cohort



We now look at the demographics of those who undertake VET and Higher education. STEM (Table 1) using the Y95 cohort. It is clear that there is even split of males and females who undertake Higher education STEM. However, males (73%) are more likely than females (27%) to be undertaking VET STEM.

If we consider a respondent's country of birth (if outside of Australia), we notice that those born in a non-English speaking country are more likely to be undertaking STEM at Higher education level than undertaking VET. Respondents from metropolitan areas are more likely to undertake Higher education STEM whereas there is more VET STEM in the rural/remote localities (most likely due to proximity of TAFEs and other VET service providers). Those from government schools are more likely to undertake VET STEM than those who went to catholic or independent schools.

In terms of Year 9 achievement in mathematics, those in the top two achievement quartiles are more likely to undertake Higher education. STEM whereas those in the bottom two quartiles are more likely to undertake VET STEM.

Table 1: Demographics of those who undertake STEM study in VET or Higher education, Y95 cohort.

	All	
Demographics	**Higher education. STEM (%)**	**VET STEM (%)**
Gender		
Male	50	73
Female	50	27
Aboriginal and Torres Strait Islander		
No	99	97
Yes	1	3
Respondent's Country of Birth		
Born in Australia	86	93
Overseas – English speaking country	2	3
Overseas – Non-English speaking country	12	4
Size of residential location in 1995		
Metropolitan Area (> 100,000)	60	47
Regional Area (1,000 to 99,999)	25	25
Rural/Remote (< 1,000)	15	28
School Type		
Government	58	77
Catholic	22	15
Independent	19	8
Maths Achievement Quartile		
Lowest	7	24
Second	18	32
Third	34	25
Highest	42	19

In this section we have shown that VET STEM is dominated by males, primarily from regional and remote area, Australian born from government schools and not from the highest maths achievement quartiles. In contrast, entry in Higher education STEM is generally from those in the top half of the maths achievement quartiles, evenly split between males and females and comprises migrants whose country of birth is not English speaking.

These results appear consistent with VET compared with Higher education, and so may not restricted to study in STEM (Curtis 2008).

If we wish to address the perceived skills shortages of people who undertake STEM courses post-school then we need to concentrate on the two different pathways, Higher education and VET. Those on the Higher education. trajectory need to be targeted at the school level, so that they undertake some STEM subjects in Year 12. Our results show that a low proportion of respondents enter a Higher education. STEM course with no Year 12 STEM. In terms of the VET trajectory, Year 12 STEM does not seem so important as a post-school STEM study requirement and, and while there is a gain for males, it does not provide incentive for females. Given that females are more likely to use the advice of career guidance counsellors more than males ,one way to address this is could be to attract more females into post-school VET STEM through better careers advice at school (Anlezark *et al.* (2008)).

What motivates young people to undertake STEM in Year 12 and beyond?

Year 12 STEM

In the original report, we used a series of logistic regressions to investigate the factors that influenced young people's pursuit of STEM in Year 12. The results of these regressions (results not presented) show that a young person's own future career aspiration, their self-concept of ability in STEM subjects, and their achievement in mathematics testing in Year 9 were important indicators of motivating a young person to undertake STEM in Year 12. The implication here is to ensure that young people receive good quality careers advice well before (ie: Year 8/9) choosing their senior school subjects. It is also important that career advisors are familiar with what a STEM career is and what the pathways into them might be.

The Y98 cohort was used to investigate the career aspirations of those students who were and were not undertaking STEM in Year 12. Those respondents who did two or more STEM subjects in Year 12 were more likely to want to work in a STEM career when asked in Year 10 than those who did not undertake any STEM in Year 12 (Table 2), but this isn't high. Of interest are the 42% of those who studied STEM in Year 12 but did not want to pursue a STEM occupation.

Table 2: Career aspirations of STEM and non-STEM school students by gender, Y98 in 2000 (%)

Y98	STEM in Year 12			Did not do STEM in Year 12		
	Males	Females	Total	Males	Females	Total
	%	%	%	%	%	%
STEM career	29	27	28	10	6	7
Non-STEM career	38	46	42	60	64	63
Don't know	30	22	26	27	24	25
Missing	3	4	4	3	6	5
All (%)	**100**	**100**	**100**	**100**	**100**	**100**
Total (N)	**283**	**244**	**527**	**330**	**609**	**938**

We observe that while wanting to undertake a STEM career may influence a person's desire to undertake Year 12 STEM, not wanting to have a STEM career has a strong influence on the decision not to do STEM in Year 12. Around 60% of both males and females who did not do STEM in Year 12 indicated that they did not want a STEM career.

Table 2 indicates a low proportion (28%) motivated by a STEM career even amongst those doing STEM subjects at school (and even less for those not doing STEM).

The following section used data from the Y03 cohort which contained an additional series of questions asked in 2007 at age 19 about factors which influence decisions on whether or not to study STEM subjects post-school.

Factors which influence decisions about post-school study in STEM

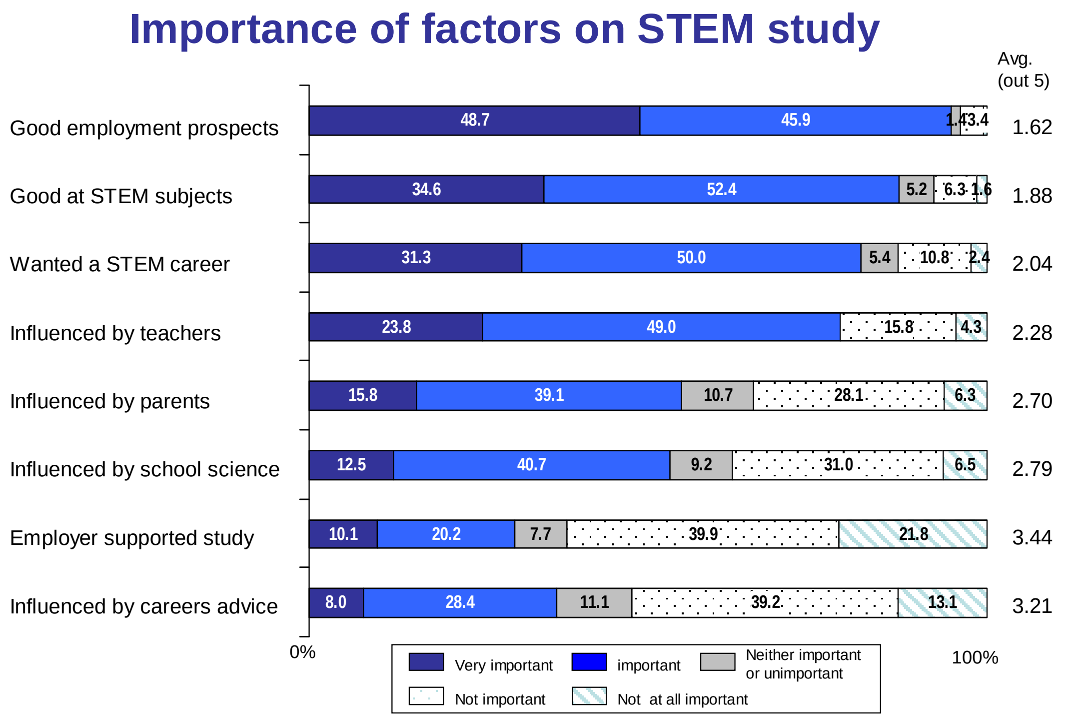
Of the 6657 young Australians who were in the Y03 LSAY cohort in 2007, a third indicated they studied STEM subjects in Year 12 and had gone on to post-school study[1]. Of this group, just over half (55%) indicated that they were studying a science, engineering, mathematics or IT- related post-school course. Most of this self-

[1] This is relatively consistent with the Y95 cohort (Figures 1 and 2) despite it being from the Y03 cohort.

identified post-school STEM study was in natural and physical sciences and health related courses.

Students studying these post-school STEM courses were asked about the importance of a range of factors on their decision to study science, engineering, maths or IT, the results of which are contained in the figure below.

Figure 3: Factors influencing decisions to study post-school STEM courses



Source: LSAY Y03, 2007 interviews, those who self-identified studying a STEM-related qualification post-school in 2007 n=1221.
*excludes don't know responses, 1 = very important, 5 = not at all important

The most important factors for young people in their decision to study STEM post-school were the employment prospects offered by STEM careers, a personal motivation to work in a career in this field, and school performance in STEM subjects. The influence of others was seen as being of relatively lesser importance, but having good science or maths teachers in high school was seen as influential for almost two-thirds of those who went on to post-school STEM study. Teachers were perceived as being more influential than parents, and more important as an influencing element than science-related experiences at high school. The influence of careers advice was seen as relatively unimportant. This suggests that factors which influence choices for post-school STEM study are well developed long before students leave school.

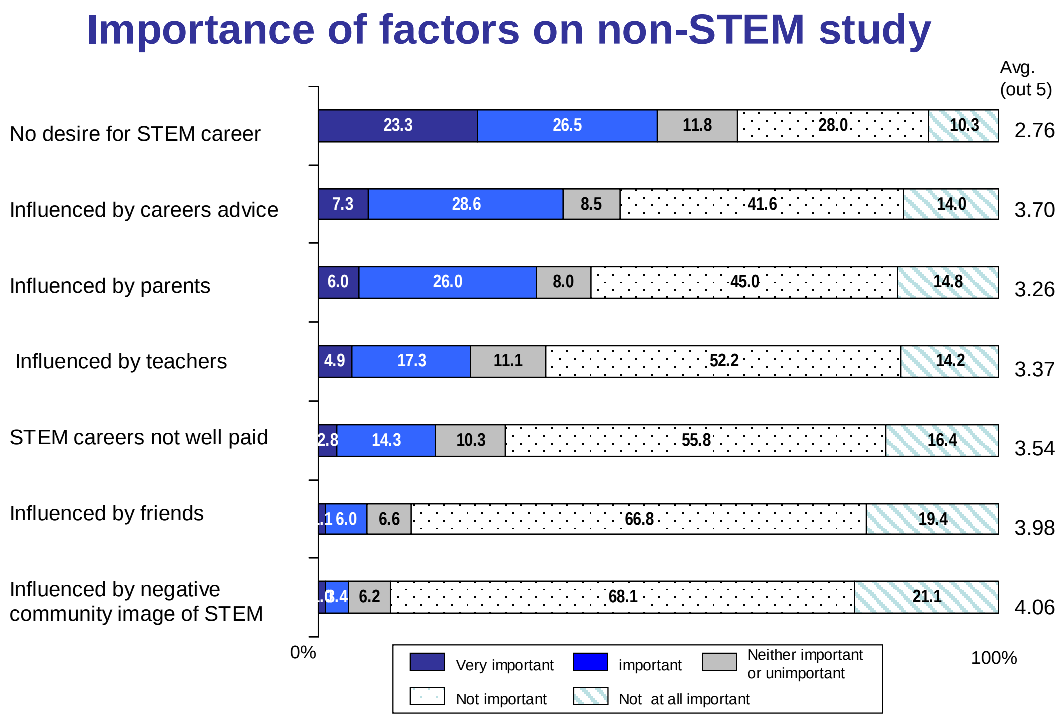
Factors which influence decisions about post-school study in areas other than STEM

Some 45% of 19 year olds in the Y03 cohort who had studied STEM subjects in Year 12 indicated that, although they were currently studying, it was in a non-STEM related field.

A third of this non-STEM study was in the field of management and commerce courses and a further 28% in society and culture courses. For females studying non-STEM courses, these fields were equally popular; however, for males, there was a preference for management and commerce, accounting for 35% of their non-STEM study.

These students were then asked about the importance of a range of factors on their decision to study in a non-STEM related field, the results of which are contained in Figure 4.

Figure 4: Factors influencing decisions to study non-STEM post-school courses, Y03



Source: LSAY Y03, 2007 interviews, those who were studying, but not in a STEM-related qualification post-school in 2007 n=1013.
*excludes don't know responses, 1 = very important, 5 = not at all important

Here, we find the converse for decisions not to study STEM, namely a lack of personal motivation which drives the desire not to work in a STEM career. However, unlike motivators of post-school STEM study, the influence of others appears more important (% same, ranking higher) in influencing non-STEM study, particularly from careers advisors. Negative community perceptions and the influence of friends have a negligible influence on choices not to study STEM subjects.

Factors which would need to be changed to consider studying post-school STEM

The majority (60%) of those who were studying non-STEM courses indicated that nothing could have influenced them to study science, engineering, or maths. Of those who indicated that they might have been influenced to study STEM, factors cited as potentially influential included better performance in STEM subjects at school, more STEM careers information, financial incentives to study STEM or higher perceived future remuneration, a more positive image for STEM careers, and better STEM teachers and teaching methods in school.

Table 3: Factors which would need to change to consider STEM study by gender, Y03

Factor	% who mentioned (verbatim)	
	Males (n=631)	Females (n=590)
Nothing	60.8	60.3
Better marks	9.1	10.3
More STEM careers information	8.6	6.8
Financial study incentives or future remuneration	4.8	3.4
Improved image of STEM career	2.8	3.2
Better teachers or teaching methods	1.5	2.8

* Source: Y03 students studying in 2007, but in non-STEM study areas, who suggested other factors.

In summary, this section has demonstrated that self-motivation in pursuing a career that has good employment prospects and a desire to study in an area of strong academic ability appear to be key motivators in post-school STEM study. The school environment also has a role to play in engaging students with science and other STEM subjects.

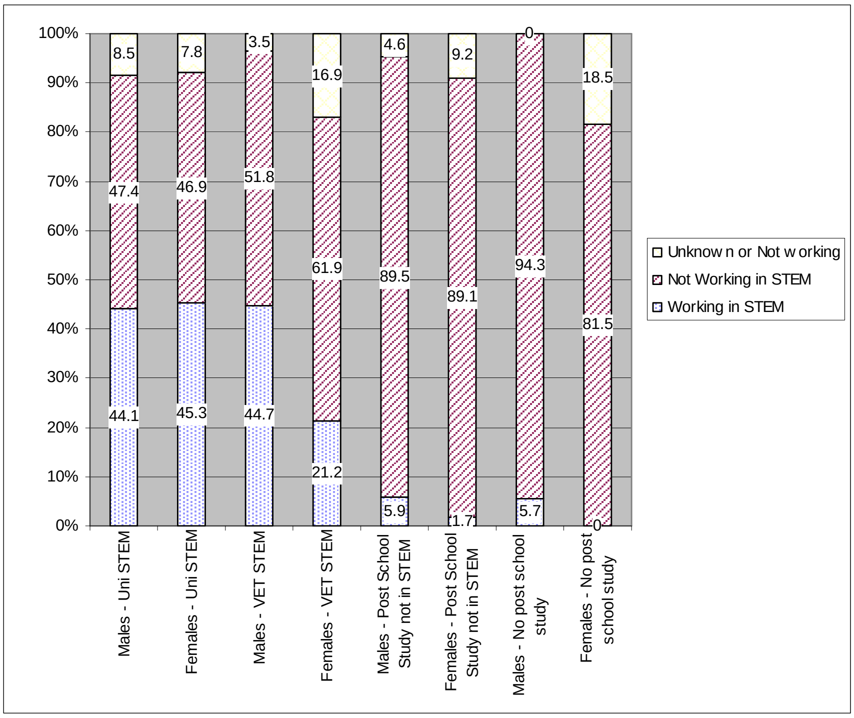
Having good science teachers in high school is seen as an important motivator for pursuing post-school STEM study for almost three-quarters of young people. Teachers are more influential on young people's decisions to undertake post-school STEM study than their actual science experiences in high school, and more influential than advice given by parents and careers advisors.

By comparing the importance given to careers advisors on decisions to study and not to study STEM subjects, we conclude that careers advisors are perceived to be more influential in steering young people away from, rather than into, STEM careers.

Pathways from post-school STEM into STEM occupations

Of those who undertook Year 12 STEM and post-school STEM study at the Bachelor degree or higher level, approximately 40% are working in a STEM career at age 25. This indicates that more than 50% of those who undertook STEM studies are not working in an area related to their study. This is an area of significant leakage out of STEM.

Figure 4: Whether in a STEM occupation for those that undertook STEM in Year 12 by post-school STEM status and gender, Y95 cohort

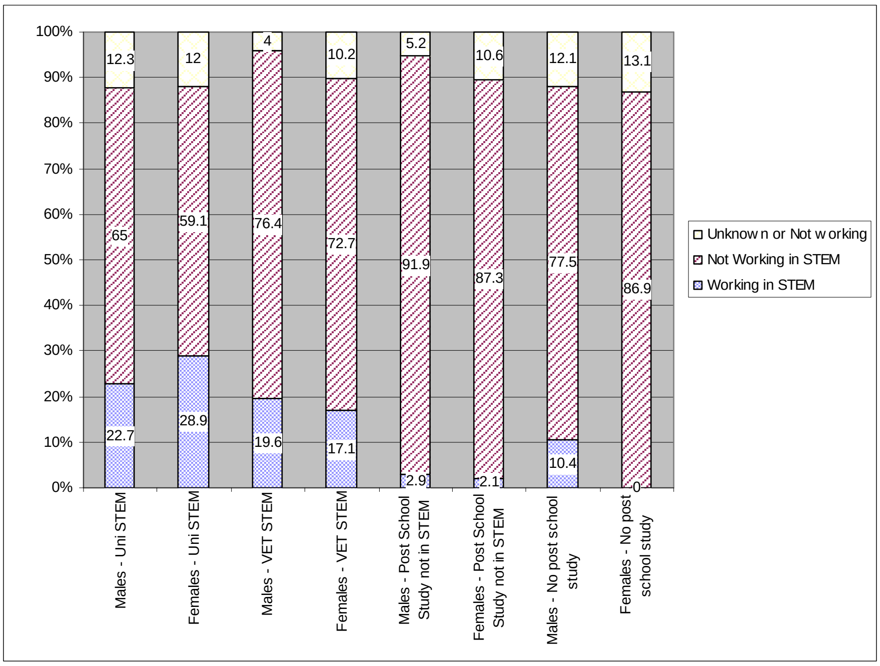


In terms of VET study in STEM, there is a marked difference in retention between males and females, approximately 40% of males who undertook VET studies in STEM remain in a STEM career at age 25, whereas only half this number of females remain in a STEM career, and given the low proportions of females entering VET STEM this could be an area of concern.

If we consider those that do not undertake STEM in Year 12, we observe that the overall level of people working in a STEM career is low. The highest proportion of respondents working in a STEM occupation are females who undertook STEM studies at Bachelor degree or higher (30%). The occupations undertaken by this 30% include computing professionals and registered nurses. The gender differences of those working in STEM occupations for those who undertook VET STEM are no longer apparent for respondents who did not undertake STEM in Year 12.

The results show that it is uncommon for an individual to move into a STEM occupation without undertaking some form of STEM training (be it at Year 12 or post-school level).

Figure 5: Whether in a STEM occupation for those who did not undertake STEM in Year 12 by post-school STEM status and gender, Y95 cohort



The pathways into STEM occupations is linear with the majority undertaking STEM in Year 12 and then post-school STEM study either at VET or Bachelor or higher levels.

Table 4: Demographics of those working in STEM careers by Gender, Y95

	Males		Females	
Demographic	In STEM occupation (%)	Not in STEM occupation (%)	In STEM occupation (%)	Not in STEM occupation (%)
Aboriginal and Torres Strait Islander				
No	30	70	16	84
Yes	20	80	16	84
Respondent's Country of Birth				
Born in Australia	28	72	15	85
Overseas – English Speaking country	25	75	10	90
Overseas – Non-English speaking country	37	63	25	75
Size of residential location in 1995				
Metropolitan area (> 100,000)	27	73	15	85
Regional area (1,000 to 99,999)	31	69	17	83
Rural/Remote (< 1,000)	31	69	15	85
School Type				
Government	30	70	15	85
Catholic	28	72	15	85
Independent	25	75	22	78
Maths Achievement Quartile				
Lowest	19	81	10	90
Second	28	72	12	88
Third	29	71	17	83
Highest	33	67	22	78

Table 3 shows that those who are working in a STEM career at age 25 are not dissimilar to those who undertake STEM post-school study. Unlike post-school study however, we see that those from government schools are more likely to be in STEM occupations, and those from independent schools least likely was seen in terms of post-school STEM study). Those born overseas in a non-English speaking country, those from regional and rural/remote areas and those in the higher maths achievement quartiles are those most likely to be working in STEM occupations at age 25. There are no real differences between males and females, but males are more likely to be continue onto a STEM occupation if they have undertaken a VET STEM course than their female counterparts.

The number of individuals NOT working in a STEM occupation who have undertaken a STEM course suggests that undertaking a STEM course may provide a solid foundation to move into other occupational areas. This is particularly evident for females who undertake VET STEM. Alternatively, individuals may complete their course but struggle to find employment in their area, and may undertake further study, or any other possible scenarios. The results may in fact indicate that STEM occupations are indeed vocational. That is, the skills required to work in a STEM occupation must be learnt through a course of study, however, these courses may prepare individuals for a much broader range of occupations than the ones they train for.

Policy needs to be directed at the school level in ensuring that students undertake STEM subjects while at school. Further action also needs to be taken at the point of completion of post-school STEM courses as this is also an area of substantial leakage. Less than 50% of those who complete a STEM course are working in a STEM related occupation. Further research needs to be undertaken to investigate the reasons for this attrition.

Conclusions

The aim of this paper was to show the VET pathways taken by individuals into STEM occupations, and compare and contrast them with Higher educationucation pathways into STEM careers using the LSAY Y95 cohort. This paper examined the pathways into STEM study and occupations of a group of young people who were first interviewed in 1995. The paper also used the Y03 cohort to investigate the reasons why individuals do or do not study STEM courses in their post school education.

Undertaking Year 12 STEM is by no means a good indication of post-school STEM, particularly for females. We showed that for males who undertook Year 12 STEM, 40% went onto STEM study at the Bachelor degree or higher level and a further 20% undertook VET post-school STEM study. That is approximately 60% of males who did some at least 2 STEM school subjects in Year 12 undertook study in a STEM related area. For females, we showed that there was relatively little difference in the uptake of post school STEM at the Bachelor degree or higher level, but the undertaking of post-school VET in a STEM area is relatively low (less than 10%). This is most likely due to the nature of STEM courses in VET (licensed trades, engineering areas) which are typically male dominated.

Not doing Year 12 STEM does not exclude individuals from undertaking STEM post-school, however, this is more likely to be at the VET level. Of those who did not undertake at least 2 STEM related subjects in Year 12, only 10% of this group studied STEM at Bachelor or higher level. In terms of VET level courses in STEM, 20% of males and 10% of females (similar proportions to those who undertook Year 12 STEM) studied VET STEM post-school. This is one of the key differences between STEM study in the two education sectors. The entry into Higher educationucation is much more likely to be through a STEM pathway at school.

The next part of the paper identified who was undertaking the different forms of STEM study? There is an even split of males and females undertaking post-school study in STEM at the Higher education. level, however males are much more likely to be undertaking VET STEM (73% vs 27%). Australian born respondent's are much more likely to do both forms of STEM, but if we put them to the side, and consider migrants (place of birth when asked at age 15), overseas born respondent's from countries with a non-English speaking background were more likely to undertake STEM study at Higher education. level. This is not unsurprising given the nature of STEM courses (more technical than reliant of English prose) and is consistent with the higher percentage of non-esb preference for Higher education over VET more generally and is not just restricted to STEM post-school study (Curtis, 2008).

We found that the biggest motivator for an individual to undertake post-school STEM related to the perceived ability to gain employment, being good in STEM subjects, wanted a STEM career and the influence of teachers. In terms of not studying a STEM course, no desire to undertake a STEM career was the single biggest influence for those studying non-STEM subjects post-school. When asked about what would need to change to undertake STEM study, apart from nothing, better marks, and more STEM careers information was highlighted. Education Review (March, 2009) suggests that there is a decline in quality mathematics educator's in Australia. If teachers themselves are failing to understand the concepts and don't have the necessary qualifications in STEM, then they may be ill equipped or unmotivated to teach their students, and inspire them into post-school STEM careers. This is one area where policy can be implemented to have teacher's with the necessary groundings and education in their own STEM fields prior to undertaking teacher training. We have seen some movements in this area recently with the Bradley review including some recommendations to improve the quality of STEM teachers. Further, the Federal Government has recently introduced some initiatives to encourage students to enrol in STEM courses (at Higher education level) and to work in teaching upon course completion, through HECS incentives.

Finally we investigated whether the pathways from STEM courses lead directly into STEM occupations. This is an area of substantial leakage with only 40% of those who undertake STEM at the Bachelor level remaining in a STEM career by the time they are 25. In terms of VET courses, 40% of males remain in a STEM career (which if VET is truly vocational we would expect to be higher), however for females, it is clear that VET courses in STEM are not vocational at all, with only 20% of those who undertake post-school STEM VET courses remaining in a STEM career at age 25. This matches with the results in Karmel (2009) which argues that VET is not vocational (except in a few small areas such as trades) but provides generic employability skills transferrable to a number of different occupations. Our results may also provide the same evidence for STEM courses at Bachelor or higher level. In a policy context, if we are to address the skills shortages of a quality supply of individuals in STEM careers, then the first obvious place is STEM students in school and post-school (both Higher education. and VET) with motivational talks, and information on post-school career options. This leads to further area of potential research: Investigating what the reasons are for not working in their STEM area (for those with STEM qualifications) and why some 50% of STEM graduates (or 80% for female VET STEM) are not working in the area they are trained in?

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Appendix A: STEM classifications

STEM post-school study

The Australian Standard Classification for Education (ASCED) (ABS 2001) was used for the classification of the post-school qualifications. Whilst not able to explicitly differentiate between qualification levels, it does provide a description of the nature of the course. ASCED is generally hierarchical, with the lower numbered codes within a category classification requiring higher levels of study. In our definitions we have tried to align the commencing post-school STEM study with the types of occupations which are in the STEM field (i.e. aligning ASCO and ASCED).

The following categories were included in our definition of commencing post-school STEM study:

ASCED 01 Natural and physical sciences
- All included

ASCED 02 Information technology
- All included

ASCED 03 Engineering and related technologies
- 030000
- 030101 and 030199
- 0303XX
- 0305XX – excludes 030507 and 030513
- 030701 and 030703
- 0309XX – all
- 0311XX – all
- 0313XX – all
- 0315XX – all
- 0317XX – all
- 0399XX – all except for 039909 cleaning

ASCED 04 Architecture and building
- 0401XX - all
- 0403XX – only 040301, 040303, 040305, 040311, 040313, 040327, 040399 included

ASCED 05 Natural and physical sciences
- 0501XX – excludes 050199
- 0503XX - all
- 0507XX – all
- 050999

ASCED 06 Health
- 0601XX – all
- 0603XX – all
- 0605XX – all
- 0607XX – all

- 0609XX – all
- 0611XX – all
- 061311 and 061399 only
- 0615XX – all
- 0617XX – excludes 061711 and 061799
- 0619XX – all
- 0699XX – excludes 069907 and 069999

The following ASCED classifications were excluded:

- 07 Education—not able to define specifically whether maths, science, technology or engineering teachers
- 08 Management and commerce—in keeping with not including business and information professionals in the ASCO classifications except of 081103 – Actuaries.
- 09 Society and culture—predominantly arts
- 10 Creative arts
- 11 Food, hospitality and personal services
- 12 Mixed field programs.

STEM occupation

The ABS standards for classifying occupations were used to define STEM occupations within the relevant year. Each LSAY cohort was asked about their occupational aspirations and destinations. These include the Australian Standard Classification of Occupations (ASCO first edition), Australian Standard Classification of Occupations (ASCO second edition), and the Australian and New Zealand Standard Classification of Occupations (ANZSCO first edition). The focus was on occupations requiring higher skill levels above certificate III level. As an example, the following categories were included in our definition of STEM occupations using the ASCO second edition:

ASCO 1 Manager and Administrator

- 12XX – included only 1221, 1222 and 1224
- 13XX – included only 1311, 1312, 1313 and 1314

ASCO 2 Professionals

- 21XX – all included
- 22XX – included 222, 223, and 2293
- 23XX – all included
- 24XX – all excluded
- 25XX – included only 2523, 2541 and 2542 Included urban and regional planners (e.g. ASCO 2523)

ASCO 3 Associate professionals

- 31XX - all
- 32XX – included 3294 only
- 33XX – included 3393 only
- 34XX – excluded 3421 and 3494

ASCO 4 Trades

- 41XX – all included
- 42XX – excluded 4214 and 4216
- 43XX – all included
- 44XX – included 4411 and 4431 only
- 46XX – included 4614 only
- 49XX – included 4981, 4987, 4988 only

Other Occupations included

- 6391, 6392