Policy note

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GROUP OF EIGHT

Key Messages

There was only limited change in shares of Year 12 course completions by subject between 2005 and 2010. Fears of a collapse in participation in science and advanced maths appear to be exaggerated.

Nevertheless, the most basic level of maths is now the most commonly completed maths course at Year 12. Intermediate maths has declined.

Demand for university study has shifted markedly towards fields which require a solid grounding in quantitative skills (Science, Engineering, Health). Patterns of Year 12 participation by field are not consistent with tertiary demand. Many new students entering university may be under-prepared for study in quantitative fields.

There has been very little improvement in female participation in advanced maths, physics and chemistry.

National trends in Year 12 course completions

Current Year 12 students form the largest single group of Australian university admissions, comprising approximately half of all admissions at Australian universities. For those Year 12 students who continue to tertiary study at Australian universities, the courses studied in Year 12 play an important role in preparing them for that further education. Information regarding Year 12 course participation is therefore of serious interest to Australian universities. Unfortunately, reliable, detailed and consistent data in this area are not readily available at the national level. Data that are available based on Year 12 enrolments have recently been shown to have issues with consistency.[1] Furthermore, these data often do not offer detailed information about the levels of difficulty or types of courses within key learning areas.

This paper addresses this lack of information by compiling data on Year 12 course completions from all Australian States and Territories into a single, national level data source. This data source allows an examination of Year 12 completions over the time period 2005 to 2010. Although these are not individual level data, the data can be compared to trends in undergraduate university applications and offers in a general sense, giving some indication as to whether or not changes in Year 12 course completions suggest corresponding changes in preparedness for university courses. It is important to explain here the difference between Year 12 student numbers and Year 12 course completions. The number of students is simply the number of students in Year 12 in a given year. Year 12 course completions is the number of individual courses completed by each of those students. Each Year 12 student is likely to complete around five courses, therefore the number of course completions each year will be roughly five times the number of Year 12 students. The examination of course completions data is useful because it allows us to see which learning areas are experiencing growth or decline in student participation over time.

1 The Australian Academy of Science 2011 report 'The Status and Quality of Year 11 and Year 12 Science in Australian Schools' utilised data on Year 12 enrolments which was subsequently shown to have serious errors in consistency.

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Data Sources

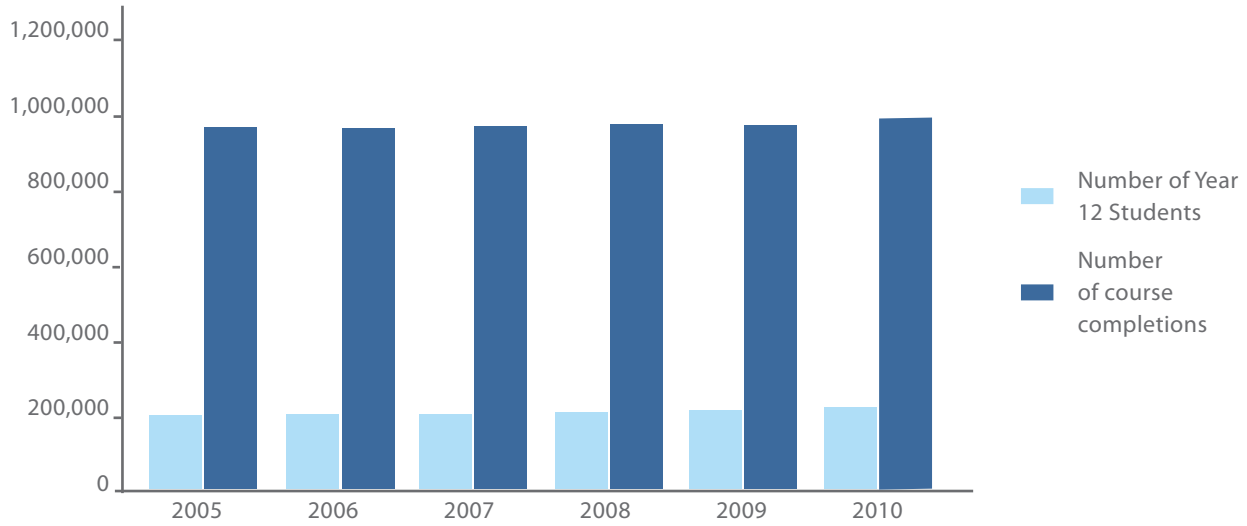
Although each Australian State and Territory has an assessment, curriculum or accreditation body which publishes some form of course completions data, compiling these data into nationally consistent and coherent information is difficult. Nomenclature is not consistent between jurisdictions, meaning that even subjects with very similar course content can have different titles and possibly be classified as belonging to different learning areas. Another serious impediment to nationally consistent data is the use of different systems of categorisation within each jurisdiction. Courses can be delivered with very different levels of difficulty, time or effort; these systematic differences may not be apparent from the course title.

This paper uses data compiled from a number of State and Territory education organisations that detail the number of Year 12 students either successfully completing a course, or sitting the final exam (or exam equivalent) for a course.[2] Because this paper is interested in preparedness for tertiary study, Vocational Education and Training (VET) courses and other apprenticeship courses are excluded. The data are referred to as Year 12 course completions, or simply completions. Raw overall numbers of completions will be discussed initially; however, the majority of this paper examines proportions of total completions. The proportion of total completions is calculated by dividing the sum of course completions in a given subject area by the total number of course completions. In other words, it demonstrates the relative share of course completions that each area makes up of all course completions over time. This approach is used because it eliminates the effects of overall increases in student numbers and allows real change between and within key learning areas to be examined. Although this approach may sometimes reduce ease of interpretation, it is the most appropriate approach for the data presented.

Overall Course Completions

Over the years 2005 to 2010 the number of Year 12 students in Australia increased by 10.5%, from 194,165 students in 2005 to 214,542 in 2010.[3] Predictably, the number of Year 12 course completions also increased over this time period; however, this increase was not as substantial as the increase in student numbers. Year 12 course completions rose from 954,937 in 2005 to 981,261 in 2010, an increase of 2.8%. The difference in magnitude of these increases suggests that some of the increase in Year 12 student numbers could be due to an increase of students undertaking VET or other apprenticeship courses, who would not have been included in the course completions figures. These increases in the number of students and course completions are illustrated in Figure 1.

Figure 1. Number of Year 12 students and course completions, 2005-2010



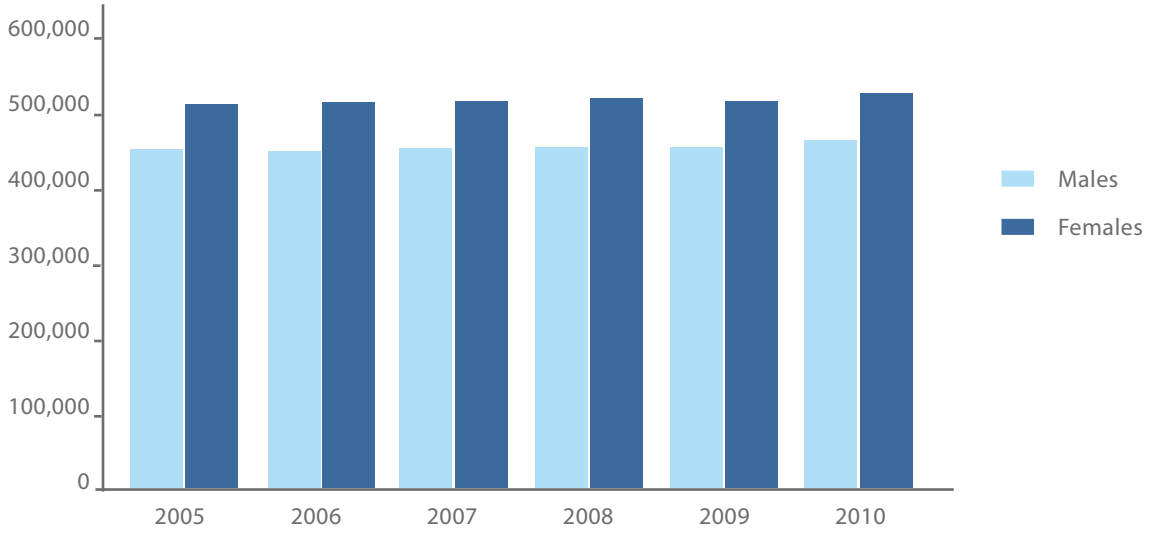
2 Data sources as follows; Australian Capital Territory Board of Senior Secondary Studies, Board of Studies New South Wales, Queensland Studies Authority, South Australia Certificate of Education (SACE) Board of South Australia (also provides data for Northern Territory completions), Tasmanian Qualifications Authority, Victorian Curriculum and Assessment Authority, and the Western Australia School Curriculum and Standards Authority.

3 Australian Bureau of Statistics, 'Schools Australia', cat no. 4221.0, 2005 and 2010

In addition to illustrating the trends in student numbers and course completions over time, Figure 1 shows the relationship between the number of Year 12 students and the number of Year 12 course completions. It is apparent that the number of course completions is always roughly five times higher than the number of students. This is because most Year 12 students would complete around four or five courses each.

As well as examining the overall trend in Year 12 course completions, it is worthwhile to examine whether the increases in course completions are different for male and female students. Although the Australian Bureau of Statistics does not provide the number of Year 12 students broken down by gender, course completions data suggest that the increases are roughly equal between male and female students. Figure 2 demonstrates that the gender breakdown of Year 12 completions remained constant from 2005 to 2010, with 53% of completions belonging to female students, and 47% to male students consistently.

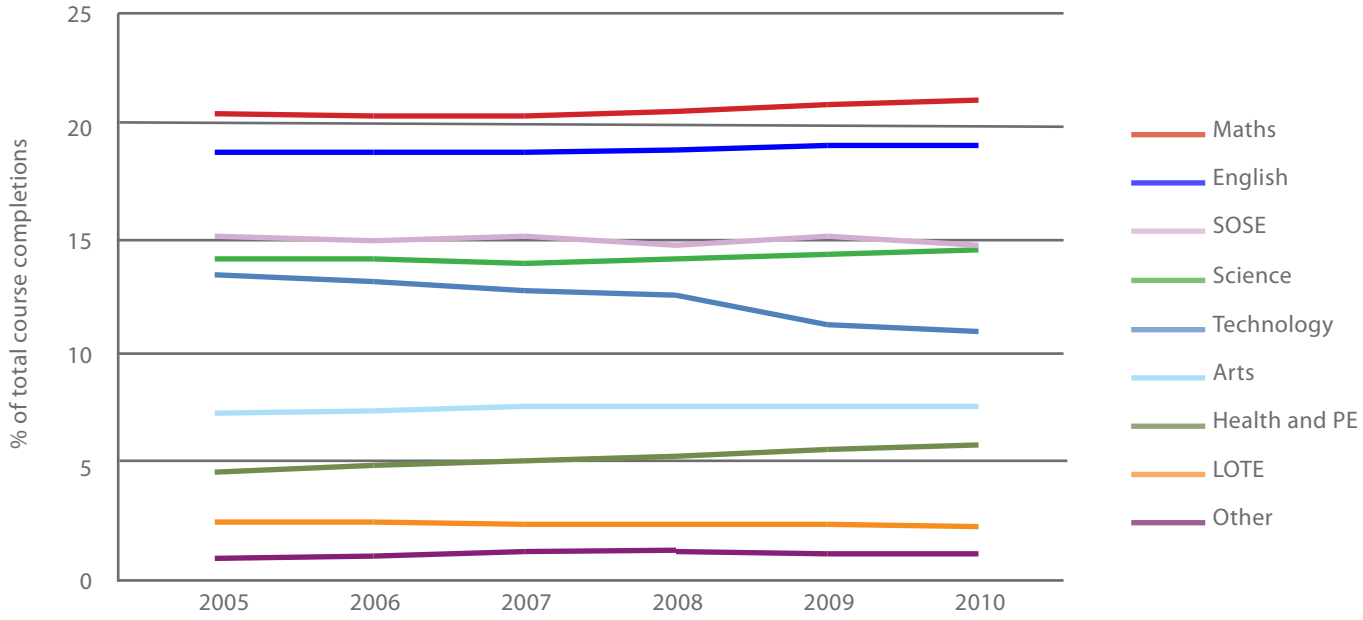
Figure 2. Number of course completions by gender, 2005-2010



Course completions by key learning area

Examination of Year 12 course completions by key learning area allows us to determine whether there has been growth or decline in the popularity of specific types of courses. These trends have been calculated by dividing the number of course completions in a given key learning area by the total number of course completions for each year. Because students generally study five courses each, each key learning area is unlikely to account for more than 25% of the total course completions, even if all Year 12 students completed a course in that learning area. Figure 3 presents each key learning area's share of the total number of Year 12 course completions, for each year from 2005 to 2010.

Figure 3. Course completions by key learning area, 2005-2010



Overall, it is clear that there has not been much variance in the relative popularity of each key learning area. For the entire time period examined, Mathematics had the highest proportion of course completions, followed closely by English. Studies of Society and Environment (SOSE) and science courses held the third and fourth highest proportions of completions respectively. Technology was ranked fifth in terms of popularity. Art, Health and Physical Education (PE), Languages Other Than English (LOTE) and 'other' courses had the four lowest shares of total completions consistently from 2005 to 2010.

Similar rankings of the popularity of key learning areas have been compiled by previous reports using Year 12 enrolment data.[4] The findings of these reports generally differ to the findings presented here in the top three key learning areas. Studies based on enrolments tend to report that SOSE courses hold the highest relative share of enrolments, followed by English and then Mathematics courses. These differences could be caused by two factors. Firstly, studies that use enrolments rather than completions include students who may not actually finish the courses in question. English and Mathematics courses could possibly have lower drop-out rates than SOSE courses which would result in them appearing relatively more popular when using completions as opposed to enrolments. The second factor that could potentially cause differences is the classification of courses into different key learning areas. This is unavoidable given the lack of a nationally consistent classification system for Year 12 courses.

Although the order of popularity of key learning areas was consistent from 2005 to 2010, some of the areas still experienced minor fluctuations in their shares of completions. Technology, SOSE and LOTE completions all experienced decreases in popularity. SOSE and LOTE completions both experienced small drops of less than

4 Ainley et al, 'Participation in Science, Mathematics and Technology in Australian Education' 2008. MCEETYA National Reports on Schooling, 2000 – 2008.

one percentage point from 2005 to 2010, while Technology completions decreased by 2.4 percentage points. Mathematics, English, Science, Art and other courses all saw modest increases of less than one percentage point. Health and PE completions experienced the most growth, with 1.3 percentage point gain in popularity from 2005 to 2010.

Overall, gendered patterns of participation have remained constant over the time period examined. Table 1 presents Year 12 course completions for each key learning area broken down by gender from 2005 to 2010. English, Science, LOTE, SOSE, Art, and Health and PE subjects all have consistently higher levels of female participation, while the majority of completions in Mathematics and Technology subjects reliably belong to male students. Gendered patterns of participation in Mathematics and Science subjects will be explored in more detail later in this paper.

Table 1. Gender distribution of Year 12 course completions by key learning area, 2005-2010 (%)

		2005	2006	2007	2008	2009	2010
English	Male	45.0	44.8	45.1	44.8	45.2	45.1
	Female	55.0	55.0	55.1	55.8	55.7	57.0
Mathematics	Male	51.0	50.8	51.0	51.0	51.3	51.3
	Female	49.0	49.2	49.0	49.0	48.7	48.7
Science	Male	47.2	46.9	47.9	47.4	47.1	47.5
	Female	52.8	53.1	52.1	52.6	52.9	52.5
LOTE	Male	36.3	35.6	36.4	36.4	37.5	36.4
	Female	63.7	64.4	63.6	63.6	62.5	64.0
SOSE	Male	43.3	44.0	42.9	42.7	43.0	42.9
	Female	56.7	57.4	57.1	57.3	57.0	57.1
Technology	Male	57.5	56.6	56.6	56.9	58.3	58.5
	~~Female~~	~~42.5~~	43.4	43.4	43.1	41.7	41.5
Art	Male	35.5	35.8	36.3	35.7	35.8	35.7
	Female	64.5	64.2	63.7	64.3	64.2	64.3
Health and PE	Male	44.9	44.3	45.0	45.2	45.3	46.0
	Female	55.1	55.7	55.0	54.8	54.7	54.0
Other	Male	29.9	32.4	34.2	34.1	31.5	31.4
	Female	70.1	67.6	65.8	65.9	68.5	68.6

University Applications and Offers

Data on university applications and offers suggest an overall increase in both supply and demand for undergraduate study over the time period 2006 to 2011. The time period 2006 to 2011 has been presented here because it represents applications and offers for the previous year's Year 12 cohort. The data collected on Year 12 completions is for the period 2005 to 2010, which means that the applications and offers for those Year 12 students are contained in the period 2006 to 2011.

Table 2 details the number of university applications by field of education from 2006 to 2011. Overall the period saw an increase in applications of 13%. The fields of education experiencing the biggest increases were Architecture, Engineering, all areas of Health, Natural and Physical Sciences and mixed field programs. The remaining fields experienced decreases or stayed relatively constant.

Table 2. Eligible applications by field of education, 2006-2011

	2006	2007	2008	2009	2010	2011	% Difference
Agriculture	3,888	3,707	4,750	3,877	4,054	3,895	0.2
Architecture	7,157	7,375	7,443	8,125	8,537	8,610	20.3
Education	24,366	22,878	20,637	20,075	21,298	20,584	-15.5
Engineering	12,478	13,083	14,085	15,555	15,757	16,634	33.3
Health	47,411	52,158	50,504	52,358	60,253	62,714	32.3
Dental Studies	2,291	2,436	2,669	3,328	3,470	4,010	75.0
Medical Studies	9,097	11,151	10,274	9,093	11,230	12,425	36.6
Nursing	14,435	15,766	15,448	16,358	20,347	19,866	37.6
Veterinary Studies	1,860	1,907	2,112	2,283	1,970	2,067	11.1
Health Other	19,728	20,898	20,001	21,296	23,236	24,346	23.4
Information Technology	5,619	5,146	4,978	5,478	5,640	5,718	1.8
Management/Commerce	32,990	32,115	31,083	31,836	31,171	31,696	-3.9
Natural and Physical Sciences	14,273	13,618	13,795	16,157	18,271	19,661	37.7
Society/Culture/Creative Arts	70,165	68,244	68,452	73,922	76,972	75,991	8.3
Justice/Law Enforcement	1,229	1,134	966	1,309	1,374	1,270	3.3
Law	12,515	12,499	12,541	12,399	12,066	10,889	-13.0
Food/Hospitality/Personal	17	27	23	20	18	17	0.0
Mixed Field Programs	165	186	384	5	1,278	1,737	952.7
Total	**218,529**	**218,537**	**216,136**	**227,408**	**243,249**	**246987**	**13.0**

Source: Department of Education, Employment and Workplace Relations (DEEWR) 'Undergraduate Applications, Offers and Acceptances', 2011

Table 3 details the number of university offers by field of education from 2006 to 2011. Overall the period saw an increase in offers of approximately 10%. The fields of education experiencing the biggest increases in offers were Architecture, Engineering, selected areas of Health (such as Dental Studies and Nursing), Natural and Physical Sciences and mixed field programs. The remaining fields experienced small increases, decreases or stayed relatively constant.

Table 3. Offers to eligible applicants, by field of education, 2006-2011

	2006	2007	2008	2009	2010	2011	% Difference
Agriculture	4,073	3,855	4,991	3,796	4,148	3,945	-3.1
Architecture	5,357	5,781	5,912	5,722	6,060	6,156	14.9
Education	19,292	19,133	17,403	16,284	16,865	17,534	-9.1
Engineering	11,438	12,177	12,989	13,650	13,834	14,234	24.4
Health	32,106	34,997	34,305	34,104	37,361	38,990	21.4
Dental Studies	929	1,020	1,059	1,036	1,096	1,101	18.5
Medical Studies	2,640	3,036	2,827	2,016	2,454	2,649	0.3
Nursing	12,027	12,900	12,615	13,593	15,181	15,018	24.9
Veterinary Studies	583	659	799	667	586	588	0.9
Health Other	15,927	17,382	17,005	16,792	18,044	19,634	23.3
Information Technology	5,515	5,059	4,923	5,031	5,460	5,565	0.9
Management/Commerce	29,528	28,694	27,660	27,850	27,849	29,152	-1.3
Natural and Physical Sciences	16,538	16,061	15,089	17,542	19,817	21,045	27.3
Society/Culture/Creative Arts	60,762	59,816	59,231	61,802	64,346	65,739	8.2
Justice/Law Enforcement	1,167	1,049	914	1,127	1,292	1,261	8.1
Law	8,687	9,161	8,957	8,082	7,512	7,076	-18.5
Food/Hospitality/Personal	13	27	27	24	22	18	38.5
Mixed Field Programs	247	298	631	6	1,406	1,588	542.9
Total	**184,869**	**185,898**	**183,161**	**185,811**	**197,168**	**203,996**	**10.3**

Source: Department of Education, Employment and Workplace Relations (DEEWR) 'Undergraduate Applications, Offers and Acceptances', 2011

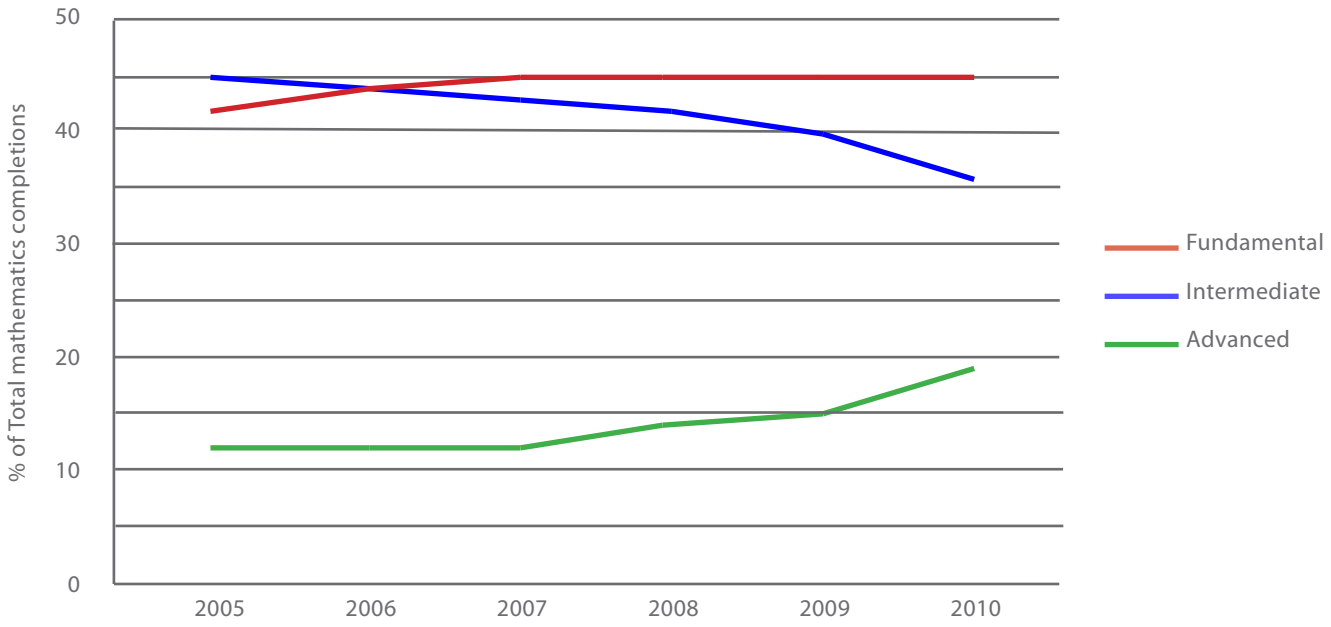
Increases in applications and offers in fields such as Engineering and Natural and Physical Sciences are currently of particular interest and importance to Australian universities. This is in part due to recent suggestions that Year 12 participation in Mathematics and Science is falling, potentially leaving students ill-prepared for tertiary studies in areas which require a solid grounding in Mathematics and Science. Although previous examination of completions by key learning area did not reveal any major changes in Mathematics or Science completions, a more detailed examination of completions in these learning areas is necessary.

Mathematics Completions

Overall Mathematics completions accounted for 20.8% of total completions in 2005; this increased slightly to 21.4% in 2010. Males held a slim majority of total Mathematics completions (51%) in 2005 and this gender gap had not shifted by 2010.

One of the reasons for compiling the data on Year 12 completions was to provide more detailed participation data. For Mathematics, the details of interest are levels of difficulty.[5] Mathematics courses were divided into three levels – fundamental, intermediate and advanced. Naturally, fundamental courses were the most basic, intermediate were mid-level and advanced courses present the highest level of difficulty. Figure 4 illustrates the changes in these three levels of Mathematics completions as a proportion of overall Mathematics course completions from 2005 to 2010. In other words, Figure 4 shows changes in the relative popularity of each level of Mathematics over time.

Figure 4. Mathematics completions by level, 2005-2010



As demonstrated by Figure 4, completions in fundamental mathematics courses increased by 2.2 percentage points from 2005 to 2010, taking it from the second most common level of mathematics to the most prevalent. Completions in advanced mathematics were consistently the least common; however, they experienced an increase of 6.5 percentage points over the given time period. Intermediate mathematics completions fell correspondingly by 8.7 percentage points from 2005 to 2010. Essentially, the shares of both fundamental and advanced mathematics completions increased to the detriment of intermediate level mathematics. This could suggest that early specialisation is happening within Mathematics: Year 12 students could be opting for either fundamental or advanced mathematics because they have already decided whether or not they will continue in mathematically focused tertiary study. Although the rise in popularity of advanced Mathematics courses is positive it is still somewhat concerning that the proportion of students completing Year 12 with only a fundamental grounding in Mathematics is increasing.[6]

5 Data on Year 12 mathematics completions by level for the ACT were not available.

6 Note that these course completion data tell a different story from Year 12 enrolments data for maths presented on the website of the Australian Mathematical Sciences Institute (AMSI; see http://www.amsi.org.au/publications/amsi-publications/762-updated-year-12-mathematics-figures). Enrolment figures show the same increase in fundamental maths and decrease in intermediate maths as do the course completion data cited in this paper. However, enrolments in advanced maths as a proportion of all Year 12 enrolments are flat.

It is also important to note that the gendered patterns of mathematics participation have continued over the time period examined. Table 4 presents mathematics completions for each level of difficulty, broken down by gender from 2005 to 2010.

Table 4. Gender distribution of mathematics completions by level, 2005-2010 (%)

		2005	2006	2007	2008	2009	2010
Fundamental	Male	46.7	46.7	46.4	46.6	47.9	47.4
	Female	53.3	53.3	53.6	53.4	52.1	52.6
Intermediate	Male	52.1	52.1	52.6	52.5	51.9	51.6
	Female	47.9	47.9	47.4	47.5	48.1	48.4
Advanced	Male	61.7	61.2	62.6	61.4	60.2	60.2
	Female	38.3	38.8	37.4	38.6	39.8	39.8

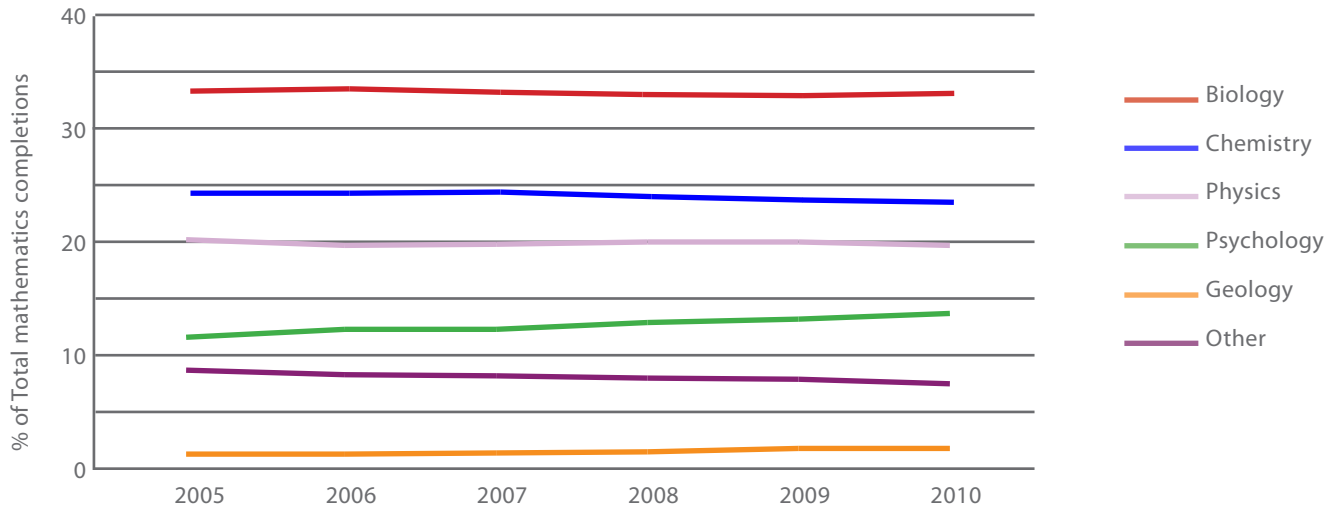
Fundamental mathematics completions were more frequently achieved by female students, at around 53% consistently. Intermediate mathematics completions showed the opposite bias, with approximately 52% of completions belonging to male students across the entire time period. Finally, advanced mathematics completions were dominated by male students: 62% of advanced mathematics completions in 2005 went to male students, however this imbalance did decrease slightly by 2010 to 60%.

Science Completions

In contrast to recent reports which found Year 12 science participation to be decreasing (based on enrolments), completions data showed that overall science completions have been relatively steady with a small increase from 14.5% of total completions in 2005 to 15% in 2010. Female students consistently provided a slight majority of science completions, around 53% over the entire time period.

As with Mathematics, it is useful to examine science completions in more detail than just overall completions. Science completions can be broken down into six different types of science: biology, chemistry, physics, psychology, geology and other. Figure 5 presents the shares that each type of science makes up of total science completions from 2005 to 2010.[7]

Figure 5. Science completions by type of science, 2005-2010



Biology is clearly the most popular type of science, consistently providing around 33% of all science completions. Chemistry is the second most popular at 24% of all science completions from 2005 to 2010, followed by physics which also remained consistent across the time period at around 20%. Psychology completions showed an increase in popularity of about 2 percentage points. Geology was consistently the least common type of science completion.

As was the case with mathematics completions, the gendered patterns of science participation remained consistent over the time period examined. Biology and psychology completions were dominated by female students, while the majority of physics and chemistry completions were achieved by male students. Geology and other sciences also saw slightly more male completions than female from 2005 to 2010. The breakdown of science completions by gender for each type of science is presented in Table 5.

Table 5. Gender distribution of science completions by type of science, 2005-2010 (%)

		2005	2006	2007	2008	2009	2010
Biology	Male	34.5	34.9	35.6	35.0	34.7	35.4
	Female	65.7	65.1	64.4	65.0	65.3	64.6
Chemistry	Male	51.2	50.8	52.2	52.1	51.4	51.3
	Female	48.8	49.2	47.8	48.3	48.6	48.7
Physics	Male	73.4	73.6	74.4	73.7	73.7	74.6
	Female	26.6	26.4	25.6	26.3	26.3	24.7
Psychology	Male	25.0	25.2	25.4	26.0	26.8	27.1
	Female	75.0	74.8	74.6	74.0	73.2	72.9
Geology	Male	55.8	57.9	56.1	56.9	53.9	52.4
	Female	44.2	42.1	43.9	43.1	44.2	47.5
Other	Male	53.7	52.2	53.0	52.0	51.4	51.8
	Female	46.3	47.8	47.0	48.0	48.6	48.2

It is important to emphasise here that although the data on Year 12 science completions do not support a drop in science participation, this does not mean that there could not have been a drop in the number of students participating in science. If the students participating in science courses were increasing the number of science courses they were each completing, this could potentially hide a decrease in the overall number of students participating in any science at all.

Conclusion

Changing trends in applications and offers for various undergraduate university courses illustrate that demand and supply fluctuate for different fields of education. This highlights the importance of examining trends in Year 12 participation to ensure that students are leaving secondary education with a solid grounding in the appropriate learning areas. Year 12 students who are unprepared for their tertiary studies will likely be a burden on the resources of universities which will have to supply bridging and remedial courses.

A lack of detailed, consistent, and reliable data on Year 12 participation at a national level means that it is difficult to ascertain whether or not trends in Year 12 participation are in line with trends in university applications and offers. This paper has addressed to some extent this lack of information by compiling data on Year 12 course completions. It found that mathematics and science completions experienced only very minor growth from 2005 to 2010. Given the growth in applications and offers of university courses requiring a solid background in these areas, an amplified policy focus on increasing Year 12 participation in Mathematics and Science would likely be beneficial. University admissions practices have a role to play. Universities could investigate how to modify the details of their entry requirements and procedures to influence participation and curriculum at the upper secondary level in a more systematic way. This could include more widespread use of bonus entry points, prerequisites, or matriculation-like arrangements to better align students' preparation at school with the demands of tertiary study. Universities could adopt practices that were consistent with their distinctive institutional missions.