

Researcher supply and demand

To help inform the policy debate, the Group of Eight offers the following analysis of trends in the training of Australia's future researchers.

The role of research training

Research graduates are a source of new knowledge and know-how. They enable scholarly continuity and renewal and they serve as a conduit for the flow of new ideas and technologies to businesses, community organisations and government bodies. They make creative contributions to innovation, problem solving and understanding of social and environmental challenges.

The main Higher Degrees by Research are the doctorate by research (usually PhD) and the Master's by research.

The changing nature of research training

The PhD continues to be conceived of primarily as certification for academic practice, even though it has become a less than sufficient qualification to secure academic appointment and it is being used increasingly for entry and career advancement across a range of professional occupations.

Today, the PhD is taking new forms in responding to more diverse student characteristics:

- Part-time students now comprise 25% of candidates, with about 10% going 50/50 full-time and part-time;
- Women represent almost 50% of candidates;
- International students account for 19% of all PhD students;⁽ⁱ⁾
- The PhD is emerging in new fields of research such as in business and nursing, as well as in new cross-disciplinary areas;
- More than two thirds of PhD graduates in Australia are employed outside the university sector.⁽ⁱⁱ⁾

The career motivations of students as well as the expectations of employers are driving a greater emphasis on the formation of independent research skills alongside teamwork skills. Several universities are exploring ways of broadening the learning experiences of students:

- Coursework elements in research methods and other areas are being offered, within the framework of two-thirds of assessable activity being research;
- Collaborative research programs are being offered where students can work for a time in different universities and other places;
- Greater attention is being given to the quality of research supervision, through researcher training and monitoring, and supervisor panels for individual students;

(i) Department of Education, Science & Training, (2007), *Students 2005: Selected Higher Education Statistics*. Canberra.

(ii) Graduate Careers Australia (2006) *Postgraduate Destinations 2006*

- New forms of support are being offered to students across fields, through induction programs, web sites and conferences;
- Go8 universities are designing new methods of examining and verifying PhD standards.

The supply of research degree graduates

Chart 1: Higher Degree Research completions, Australia, 1996–2006

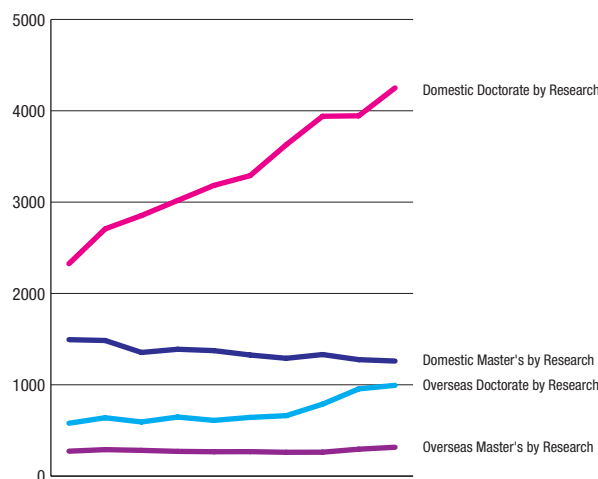
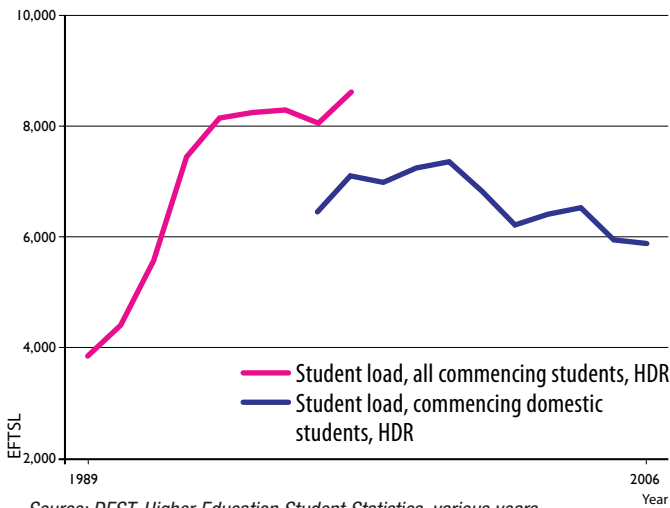


Chart 1 key points

- Total HDR graduate output has grown by 60% from 4,272 in 1995 to 6,820 in 2005.
- Master's by research graduates have declined relative to doctoral graduates over the period, perhaps reflecting the status accruing to the doctorate title.
- Domestic doctoral completions have risen over the decade, reflecting growth in commencements in two earlier periods: first, pre-1995 funded increases (including government grants for qualifications upgrading of staff of former colleges merged into universities) flowing through from a combination of part-time and full-time enrolments; second, a boost to completion rates post 2001, following the introduction of incentives to improve completion rates (through weights for completions in the formula allocating funding for research training places (RTS)).
- International doctoral completions were static for a lengthy period before rising post 2001 when the RTS formula included overseas student completions.
- Australia is producing only 2.3 new doctorates per 100 university graduates, compared with 3.9 in Canada, 10.1 in Switzerland and 11.2 in Germany.

Chart 2: Commencing student load for Higher Degree Research students, 1989–2006

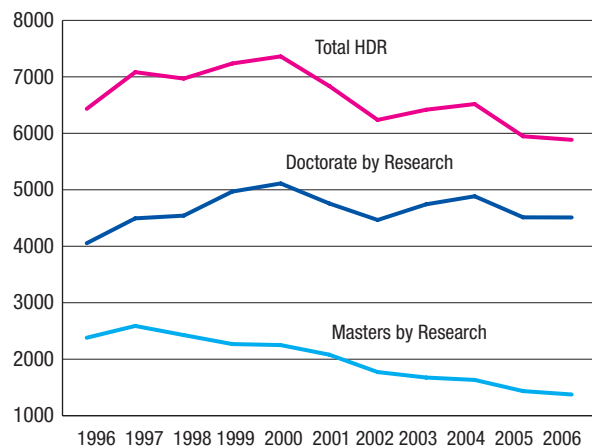


Source: DEST, Higher Education Student Statistics, various years

Chart 2 key points:

- Chart 2 presents trends in commencements of all domestic students on a full-time equivalent basis, including the period pre-1996 when disaggregated data were not available.
- A growth spurt is apparent from 1989 through to 1993, then some plateauing before a drop after 1995, followed by a long-term trend decline.
- Total HDR domestic commencements declined from 7,362 in 2000 to 5,885 in 2006, representing a 20% reduction.

Chart 3: Commencing student load for domestic Higher Degree Research students, 1996–2006



Source: DEST, Higher Education Student Statistics, various years

Chart 3 key points:

- Since 1999 the reduction of domestic HDR opportunities has accelerated.
- Domestic commencements into Master’s by research have continued to decline from 1997.

Table 1: Commencing domestic PhD student load by discipline group, 2006

Discipline group	Domestic PhD commencements
Natural & Physical Sciences	1,130
Information Technology	189
Engineering & Related Technologies	349
Architecture & Building	56
Agriculture, Environment & Related Studies	152
Health	672
Education	271
Management & Commerce	273
Society & Culture	1,192
Creative Arts	228
Total	4,510

Table 2: Commencing domestic PhD student load (EFTSL), 2006 (selected fields of study)

Field of study	Student commencements
Mathematics	81
Earth Sciences	65
Information Systems	38
Manufacturing Engineering	21
Process & Resources Engineering	64
Geomatic Engineering	10
Dental Studies	18
Optical Science	3
Radiography	4
Accounting	25
Banking, Finance & Related Fields	16
Forestry Studies	4
Fisheries Studies	3
Environmental Studies	53

Tables 1 & 2 key points:

- Australian PhD student commencements are precariously low in a number of fields that are critical for Australia’s sustainability and competitiveness.
- For an economy heavily based on minerals and energy exports, and seeking to establish itself as a world financial centre, there are insufficient commencements in earth sciences and mining-related engineering, accounting, banking & finance.
- At a time when the world is facing unprecedented environmental stresses, there is a surprisingly low number of new PhD students undertaking environmental studies.
- There are very few Australians commencing doctoral work in key areas of health sciences, notably dental, optical and radiography studies.

Labour market demand for research degree graduates

Table 3: Main occupations of Higher Degree by Research graduates in full-time employment, all fields of education, 2006

Occupation	HDR graduates (%)
Education professional	27.6
Science professional	23.2
Manager/Administrator	9.8
Business/Computing professional	7.7
Social/Legal professional	7.4
Health professional	7.3
Building & Engineering professional	5.2
Other Associate professional	2.0
Medical, Science Associate professional	1.7
Artist/Related professional	1.4
All Others	2.1
Total	100

Source: Graduate Careers Australia, Postgraduate Destinations 2006

Table 4: Destinations of Higher Degree by Research graduates by selected fields of education, 2006

Field of Education	University destination (%)	Other destination (%)
Agriculture	6.8	93.2
Architecture	37.0	63.0
Humanities	33.0	67.0
Social Sciences	13.3	86.7
Psychology	23.0	77.0
Social Work	40.0	60.0
Accounting	50.0	50.0
Economics	35.0	65.0
Education	37.6	62.4
Electronic/Computing Engineering	12.5	87.5
Mechanical Engineering	13.0	87.0
Mining Engineering	11.1	88.9
Medicine	6.9	93.1
Pharmacy	11.1	88.9
Dentistry	11.1	88.9
Law	57.7	42.3
Mathematics	41.7	58.3
Physical Science	8.5	91.5
Geology	2.9	97.1
Computer Science	32.2	67.7
Veterinary Science	17.6	82.4
Total	27.6	72.4

Source: Graduate Careers Australia (2006) Postgraduate Destinations 2006

Tables 3 & 4 key points:

- Just over one in four HDR graduates take up jobs in education and university research.
- Almost one in four find work in scientific organisations.
- Half the HDR graduates are distributed in professional jobs across the private and public sectors.
- The proportion of HDR graduates entering university jobs is highest for those fields that are most recently professionalising (e.g. Accounting, Law, Nursing, Social Work,) as well as for fields that underpin basic science (e.g. Mathematics).

Student demand for research training

Indications are that academic work has become less attractive than other occupations in terms of working conditions.

- Researcher autonomy is perceived to be more constrained, regulatory compliance obligations are more exacting, administrative tasks are more burdensome, expectations of self-generated income are more demanding.
- Private returns to PhD graduates are lower than those for graduates with a Master's by coursework. The median salary for Research Masters/PhD graduates in full-time employment in 2006 was \$60,900 compared with \$65,000 for coursework Masters graduates. PhD studies are generally four years full-time equivalent (or longer) and involve a higher opportunity cost than Coursework Masters which are generally up to two years full-time equivalent.
- Academic salaries for Academic Level A (Associate Lecturer) appointments range from \$45,000 at the entry step to \$65,000 at the top step. For Academic Level B (Lecturer) the range is from \$65,000 to \$80,000. Equivalent skills command much higher rates of remuneration in Government departments, publicly-funded agencies and professional service firms.
- Career options are uncertain for early and mid-career researchers who depend largely on grants for short-term research projects, typically three years in the case of ARC grants, three to four years for NHMRC grants, and even shorter grants for industry funded and contract research. Too many talented researchers, who could form the base for the next generation of Australia's research capability, are being lost to the system.
- The attraction of young people to academic careers will require improvement to conditions of employment.

Future research graduate supply requirements

Chart 4: Age structure of total academic staff (2006) relative to all employed persons, Australia 2005-06

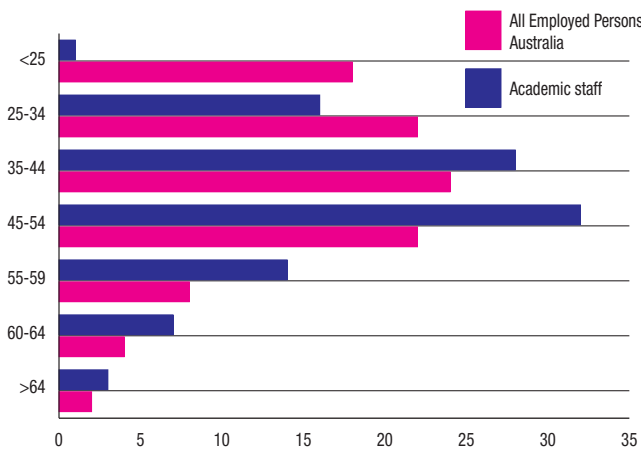
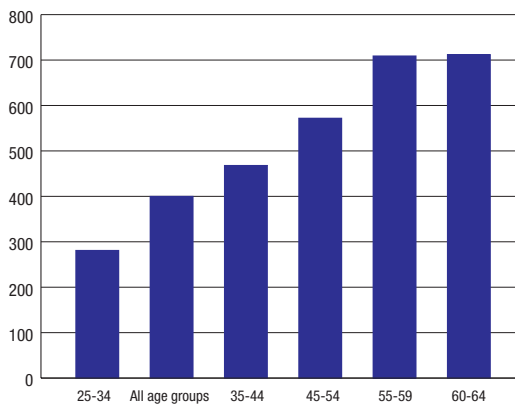


Chart 5: Academic staff per 10,000 employed persons, by age, Australia 2006



Charts 4 & 5 key points:

- The profile of Australia's academic staff is much older than for the employed workforce as a whole.
- Assuming over the next decade, that 25% of academic staff employed in universities in 2006 would leave the academic workforce for occupational mobility reasons, and that 85% of academic staff above the age of 55 years would retire, we estimate the net academic workforce replacement requirement to be of the order of 1,725 per annum over 2006–2016.
- The current rate of domestic PhD production is 4,250 per annum. However, that output flows from a commencing cohort in 2001 of 4,758, which was 5% higher than the 2006 commencing cohort. Thus, the trajectory for PhD output is 4,002 per year. Moreover, 72.6% of HDR graduates (3,086 per annum) currently enter non-university occupations. If there was no increase in general labour market demand for PhD graduates, the supply to the academic labour market would amount to 906 per year. Hence, there is a projected shortfall of 809 PhD graduates – 47% per annum on average – against the current level of the academic workforce with PhD qualifications.
- For Australia to be internationally competitive in an environment confronting complex challenges there will need to be a much greater expansion of high-end knowledge skills in the general workforce.

Chart 6: Ratio of PhD domestic commencing student load to academic staff, 2006

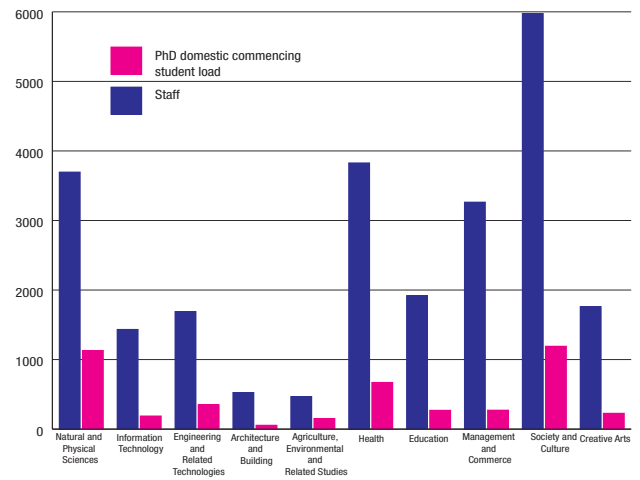
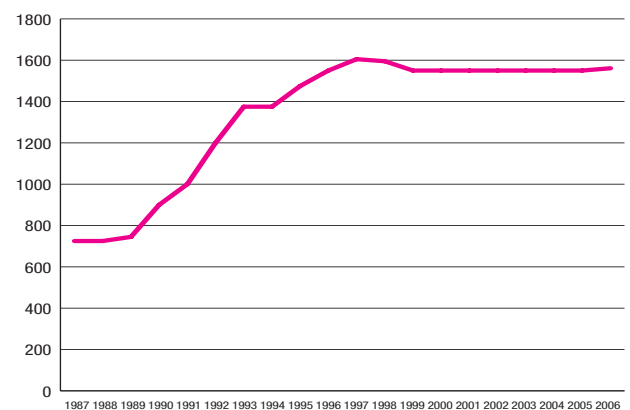


Chart 6 key points:

- The shortfall between supply and demand for the academic workforce varies across fields of education. The biggest shortfalls are in those fields with low ratios of commencing PhD students to academic staff and high rates of dispersal within the labour market, such as Geology, Mathematics and various fields of Engineering.
- To underpin further advances in national innovation, and help address environmental and social challenges, Australia should aim to increase the output of doctoral students in these and other areas.

Meeting future needs – attracting Australian research students

Chart 7: Australian Postgraduate Awards (APAs) 1987–2006



Source: Department of Education, Science and Training, 20 November 2006

Chart 7 key points

- Australian Postgraduate Awards (APA) are scholarships for students of exceptional research potential who undertake a higher degree by research. APAs are awarded to Australian citizens, New Zealand citizens or holders of permanent visas to assist them with their general living costs.
- The value of an Australian Postgraduate Award (APA) stipend over the full year in 2005 was:
 - full-time APA: \$18 837, indexed annually for subsequent years.
 - part-time APA: \$10 118, indexed annually for subsequent years.
- In 1996 there were 1,550 new Australian Postgraduate Awards (APA) available each year. The total number of new APAs available each year currently stands at 1,561.

Chart 8: Ratio of Research Training Scheme (RTS) income to total research income, 2005

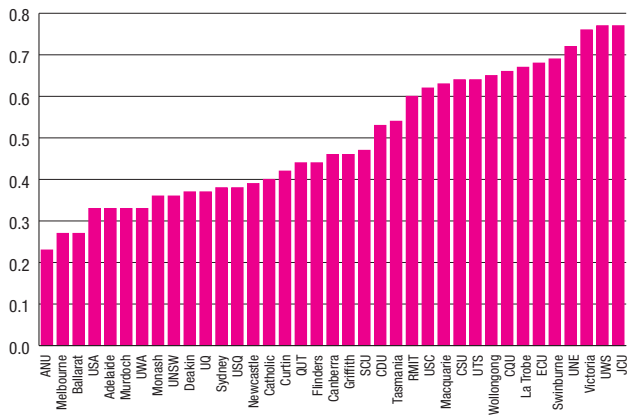
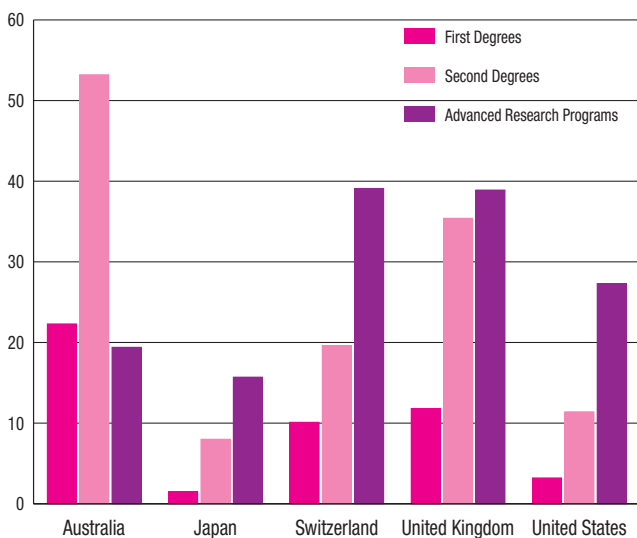


Chart 8 key points:

- There has been no growth in the number of HECS-exempt research training places since 1999, when there were some 21,500 places funded.
- Research training places are allocated by formula through the Research Training Scheme (RTS).
- There is an inverse relationship between RTS allocations and research performance, as measured by total research income, including nationally competitive research income and income from industry and other government sources.
- The flawed method of RTS allocation does not support growth of a quality system of research training in Australia.

Meeting future needs – attracting international research students to Australia

Chart 9: Proportion of international graduates in total graduate output by level of award, for selected countries, 2005



Source: OECD, Education at a Glance, 2007

Chart 9 key points:

- International graduates made up 22% of Australia’s Bachelor degree enrolments and 53% of Master’s degree enrolments in 2005 but only 19% of PhD enrolments. Australia’s share of the stock of PhD enrolments is well below that of major competitor countries.
- From 2007 onwards there will be approximately 2,288 scholarships offered by the Australian Government for international students to undertake study in Australia at the postgraduate level. This figure is made up of:
 - 1,150 Australian Development Scholarships (estimate based on 88% of 1320 total available)
 - 180 Australian Leadership Awards – Scholarships (150 Masters, 30 PhD) (AusAid estimate for 2007).
 - 370 Australian Leadership Awards – Fellowships
 - 330 Endeavour International Postgraduate Research Scholarships (Precise number to be offered from 2007 onwards will be substantially less than this due to clawback for overspending under the program in 2004 and 2005)
 - 40 Endeavour Postgraduate Awards (estimate only)
 - 30 Endeavour Asia Awards (funding for first year only) (estimate only)
 - 158 Endeavour Research Fellowships (four to six months only) (estimate only)
 - 30 Endeavour Cheung Kong Awards (four to six months only) (estimate only)
- The Endeavour International Postgraduate Research Scholarship (EIPRS) scheme, which provides financial support to assist outstanding international candidates to complete higher degree by research qualifications in Australia, has seen very limited increases in scholarship numbers over the last ten years. In 1996 there were 300 new scholarships per year available under this scheme. Thirty new places were made available in 2002, taking the total to the current level of 330 new awards a year. However, these are estimated to provide just 228 additional scholarships annually with the latter two programs providing financial support for one year and six months of study respectively.
- While numbers of international students undertaking postgraduate studies in Australia is four times higher than 1997 levels, EIPRS scholarships and total funding has remained relatively constant.
- The 2,281 scholarships represent 25% of international HDR students (8,981) in 2006. Universities variously provide internal scholarships, and some overseas students come here under sponsorship of their home governments or other benefactors. Some two-thirds of international graduate students in the US obtain income support from their host university or college.