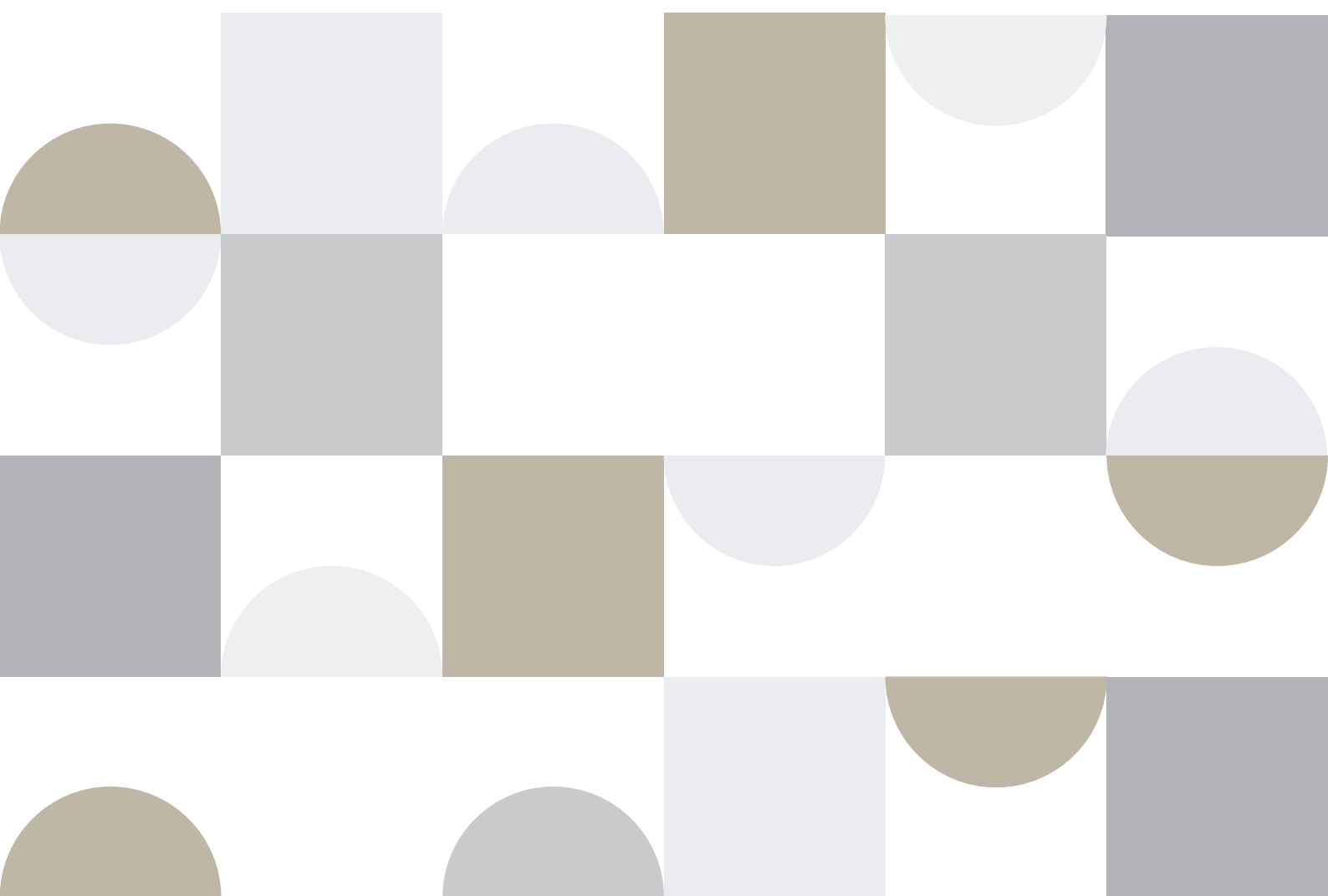




Australian Government

STEM EQUITY MONITOR

Summary Report 2020



industry.gov.au/stemequitymonitor

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STEM EQUITY MONITOR

Summary Report 2020

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- Australian Bureau of Statistics (ABS)
- Australian Curriculum, Assessment and Reporting Authority (ACARA)
- Australian Public Service Commission (APSC)
- Australian Research Council (ARC)
- Department of Education, Skills and Employment (DESE)
- National Centre for Vocational Education Research (NCVER)
- Organization for Economic Co-operation and Development (OECD)
- National Health and Medical Research Council (NHMRC)
- The Social Research Centre
- Youth Insight – Student Edge
- Workplace Gender Equality Agency (WGEA)

The department would also like to thank the Office of the Chief Scientist and the Office for Women for their support and advice in the development of the *Monitor*.

MINISTER'S FOREWORD

A workforce with strong science, technology, engineering and mathematics (STEM) skills is essential if we're to keep the Australian economy growing. Digital innovation alone can potentially deliver \$315 billion in gross economic value to Australia in the next 10 years.¹

However, Australian girls and women are still significantly underrepresented in STEM education and careers, particularly in fields like information technology and engineering. Australia must address this inequity if we are to take full advantage of future opportunities provided by STEM-driven industries and a more global and digital economy.

Increasing the participation of girls and women in STEM requires a system-level response with long-term strategic action from across all areas — government, industry, academia and education. We need to drive cultural change and remove systemic barriers that continue to prevent girls and women from fully participating in STEM education and workplaces.

The Australian Government is committed to action. In 2019 we released the *Advancing Women in STEM* strategy² and supported the development of the *Women in STEM Decadal Plan*.³ These documents set out a guiding framework for the government and the STEM sector to work together for sustained increases in women's STEM participation and retention — through early childhood, education and careers.

In the development of these frameworks, the STEM sector highlighted the need for better data to track the impacts of our collective efforts. The government has responded by committing to develop a consistent evidence base over the ten years of the *Women in STEM Decadal Plan*. This consolidation of data on girls' and women's participation in, and engagement with STEM will help policymakers and the STEM sector support programs that target ages, career stages and sectors where girls and women continue to remain underrepresented.

It is my pleasure to present the *STEM Equity Monitor* — an annual report on our progress towards achieving our vision of an Australian society that provides equal opportunity for all people to learn, work and engage in STEM.

KAREN ANDREWS

MINISTER FOR INDUSTRY, SCIENCE AND TECHNOLOGY



1 AlphaBeta 2018, *Digital Innovation Report: Australia's \$315b opportunity*, commissioned by the Commonwealth Scientific and Industrial Research Organisation's (CSIRO's) Data 61, CSIRO, Canberra, viewed on 29 January 2020, <https://data61.csiro.au/en/Our-Research/Our-Work/Future-Cities/Planning-sustainable-infrastructure/Digital-Innovation>.

2 Commonwealth of Australia 2019, *Advancing Women in STEM*, Department of Industry, Innovation and Science, Canberra, viewed on 29 January 2020, <https://www.industry.gov.au/data-and-publications/advancing-women-in-stem>.

3 Australian Academy of Science 2019, *Women in STEM: Decadal Plan*, Australian Academy of Science, Canberra, viewed on 29 January 2020, <https://www.science.org.au/support/analysis/decadal-plans-science/women-in-stem-decadal-plan>.

INTRODUCTION

ABOUT THE MONITOR

The *STEM Equity Monitor* (the *Monitor*) is a national data report on girls' and women's participation in science, technology, engineering and mathematics (STEM). It presents the current state of STEM gender equity in Australia. It also provides a baseline for measuring change and trends over time in key sectors and career phases of girls' and women's engagement with STEM.

The *Monitor* follows the pathway of girls' and women's participation in STEM through:

- primary and secondary school
- higher education
- graduate outcomes
- the workforce.

The *Monitor* collects and integrates data from a range of sources and places them into a single website. Each section highlights particular questions of interest and some high-level observations from the data. As the relevant issues are different for each stage of the pathway, data examined in each section is not comparable to other sections.

DEFINING STEM

The *Monitor* considers STEM to include the fields of science, technology, engineering and mathematics, consistent with the approach taken in the [Australia's STEM Workforce](#) report published by Australia's Chief Scientist.⁴ The *Monitor* takes the Chief Scientist's definition of STEM education fields, sourced from the Australian Standard Classification of Education (ASCED), and matches these to research fields from the Australian and New Zealand Standard Research Classification (ANZSRC).

The *Monitor* also uses qualifications in STEM education fields to define STEM-qualified occupations and STEM-qualified industries. The *Monitor* considers an occupation or industry to be STEM-qualified if the majority of people in the occupation or industry reported a qualification in a STEM field of education in the 2016 Census of Population and Housing. However, the *Monitor* also recognises that STEM-qualified graduates work in wide range of sectors across the workforce.

This *Monitor* does not include health in the definition of STEM. However, health is recognised as a closely related field that people with STEM qualifications may enter and is often included in broader definitions of STEM. The full web version of the *Monitor* allows users to view health data in addition to STEM, so they can see the results for STEM – science, technology, engineering, mathematics and medicine.

The full methodology and definition list for this report is described at <https://www.industry.gov.au/data-and-publications/stem-equity-monitor/methodology>.

DATA LABELS – GENDER, WOMEN AND MEN

There may be instances of data which have been collected and recorded by sex. However, consistent with the Australian Government Guidelines on the Recognition of Sex and Gender,⁵ and for consistency, the terms **gender**, **women** and **men** will be used throughout.

These terms (and 'girls' and 'boys' for minors) encompass cisgender (personal gender identity corresponding with sex assigned at birth), transgender, non-binary and intersex persons who identify as women (girls) or men (boys).

Further information is available in the full methodology at <https://www.industry.gov.au/data-and-publications/stem-equity-monitor/methodology>.

SOURCES OF DATA AND NOTES

This summary lists the specific sources used for the data reported at the end of each section. A more comprehensive list of sources used for the data report can be viewed at <https://www.industry.gov.au/data-and-publications/stem-equity-monitor/methodology>.

When interpreting data reported in the *Monitor* it should be noted that significance testing has not been carried out.

⁴ Office of the Chief Scientist 2016, *Australia's STEM Workforce*, Office of the Chief Scientist, Canberra, viewed 29 January 2020, https://www.chiefscientist.gov.au/sites/default/files/Australias-STEM-workforce_full-report.pdf.

⁵ Attorney General's Department, 2015, *Australian Government Guidelines on the Recognition of Sex and Gender*, AGD, Canberra, viewed 24 September 2019, <https://www.ag.gov.au/Publications/Pages/AustralianGovernmentGuidelinesontheRecognitionofSexandGender.aspx>.

PRIMARY AND SECONDARY SCHOOL

Development of confidence, interest and skills in STEM begins at a young age and can be influenced by many factors.

Understanding girls' perceptions and attitudes to STEM can assist families, educators and policy makers to support girls to persist in STEM and consider future STEM-related career options.

KEY DATA ON GIRLS' PARTICIPATION IN STEM AT SCHOOL

Do girls and boys have different levels of STEM skills?

National Assessment Program – Literacy and Numeracy (NAPLAN) numeracy results showed girls consistently achieved lower mean scores than boys in years 3, 5, 7 and 9 from 2008 to 2018.

In the 2018 NAPLAN test results, in each year group, 96% of girls and 95% of boys achieved scores at or above the minimum standard expected in numeracy. However, across all year groups, a lower percentage of girls than boys achieved scores at or above the highest band usually achieved for their respective year group.⁶

Australian students' science and mathematics mean score results in the Organization for Economic Cooperation and Development's (OECD) Programme for International Student Assessment (PISA) declined between 2006 and 2018 for both girls and boys.

Between these years, the OECD PISA mean score results also showed:

- Australian boys consistently achieved higher mean scores than Australian girls in mathematics.
- Australian girls consistently achieved higher mean scores than the OECD average for girls in mathematics, but the gap narrowed over this time period.⁷
- Australian girls and boys consistently achieved higher mean scores than the OECD average for science.⁸

Do girls think STEM skills are important for future careers?

Findings from the 2019–20 *Youth in STEM Research* survey indicated that 90% of school-age girls (12 to 17 years old) considered STEM skills important when considering future employment. Of the four STEM knowledge areas (science, technology, engineering, mathematics), the highest proportion of both girls and boys cited technology as important. The smallest proportion of both girls and boys cited engineering as important.⁹

Do girls' and boys' aspirations to work in STEM-related careers differ?

Findings from the 2019–20 *Youth in STEM Research* survey indicate 27% of school-age girls (12 to 17 years old) aspired to have a STEM-related career in the future, compared to 42% of school-age boys.⁹

Primary and secondary school data sources

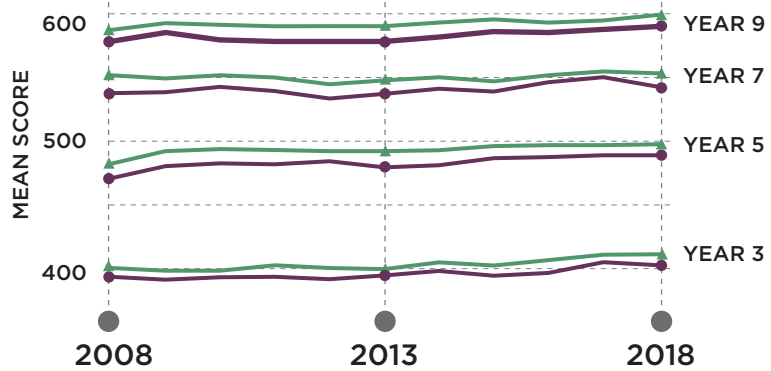
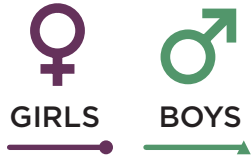
6 Australian Curriculum, Assessment and Reporting Authority (ACARA) 2018, *National Assessment Program – Literacy and Numeracy (NAPLAN) Achievement in Reading Writing, Language Conventions and Numeracy: National Report for 2018*, ACARA, Sydney, viewed 24 September 2019, <https://nap.edu.au/docs/default-source/resources/2018-naplan-national-report.pdf?sfvrsn=2>.

7 OECD 2020, Mathematics performance (PISA) (indicator), doi: 10.1787/04711c74-en, viewed on 30 January 2020, <https://data.oecd.org/pisa/mathematics-performance-pisa.htm#indicator-chart>.

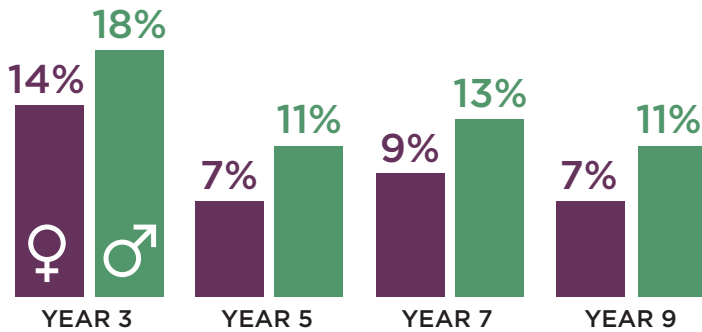
8 OECD 2020, Science performance (PISA) (indicator), doi: 10.1787/91952204-en, viewed on 30 January 2020, <https://data.oecd.org/pisa/science-performance-pisa.htm#indicator-chart>.

9 Student Edge 2019–20, *Youth in STEM Research*, commissioned by the Department of Industry, Science, Energy and Resources (DISER), DISER, Canberra, <https://www.industry.gov.au/data-and-publications/youth-in-stem-research-2019-20>.

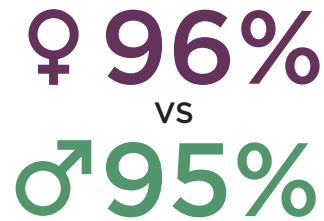
Between 2008 and 2018, girls consistently achieved lower mean NAPLAN scores in numeracy than boys⁶



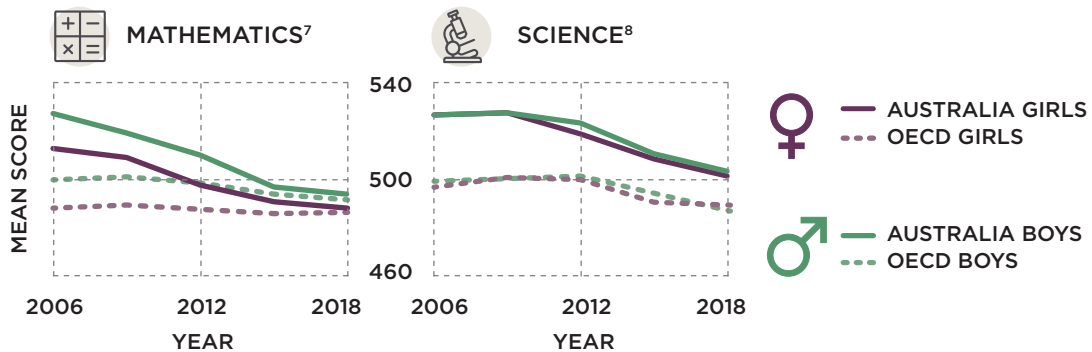
A lower percentage of girls achieved at or above the highest NAPLAN band in 2018⁶



A similar percentage of girls and boys achieved at or above the NAPLAN minimum standard in 2018 across all year groups⁶



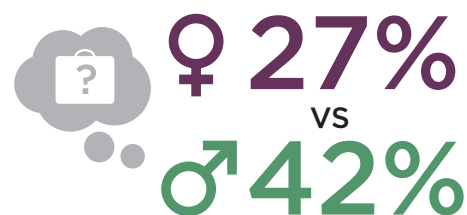
Results in mathematics and science amongst girls and boys declined from 2006 to 2018



In 2019, 12-17 year old girls were less likely than boys to see engineering skills as important to getting a good job in the future⁹

	GIRLS	BOYS
Science	72%	70%
Technology	79%	78%
Engineering	55%	68%
Mathematics	79%	75%

In 2019, girls aged 12-17 years were less likely to aspire to a STEM-related career than boys⁹



HIGHER EDUCATION

Many students who study STEM at primary and secondary school choose to continue developing their skills in higher education. They may enrol and complete their STEM studies through university or through vocational education and training (VET).

Understanding how women participate in STEM higher education can assist the government and other sectors in providing better targeted support for women as they progress through the STEM pathway — from schooling through to the workforce. In addition, it can help focus support on particular fields and education types.

KEY DATA ON WOMEN'S PARTICIPATION IN STEM IN HIGHER EDUCATION

What proportion of women in higher education study STEM courses?

Women are enrolling in STEM higher education at much lower levels than men, in both university¹⁰ and VET¹¹ studies. When considering university and VET enrolments together, only 9% of women participating in higher education enrolled in a STEM course in 2018. This proportion has remained largely consistent since 2015.

How do STEM and non-STEM enrolments and completions in university and VET courses compare?

When considering university and VET together, in 2018 women comprised only 21% of total STEM course enrolments and 23% of total STEM course completions. In comparison, women comprised 60% of total non-STEM course enrolments and 61% of total non-STEM course completions in 2018.

At university, women comprised 35% of STEM course enrolments and 37% of STEM course completions in 2018. In contrast, women comprised 64% of students in non-STEM university course enrolments and completions.¹⁰

In 2018, participation of women in STEM VET courses was particularly low — only 15% of enrolments and 19% of completions. Similar to non-STEM university participation, women comprised more than half of students in non-STEM VET course enrolments and completions in the same year.¹¹

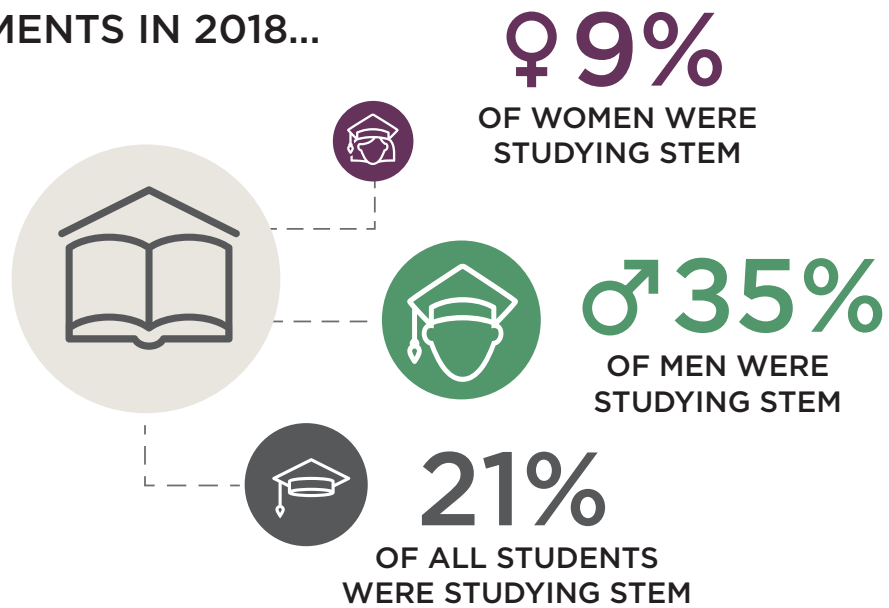
Higher education data sources

¹⁰ Department of Education and Training (DET), Higher Education Statistics Data (uCube), DET, Canberra, extracted on 5 December 2019, <http://highereducationstatistics.education.gov.au/>.

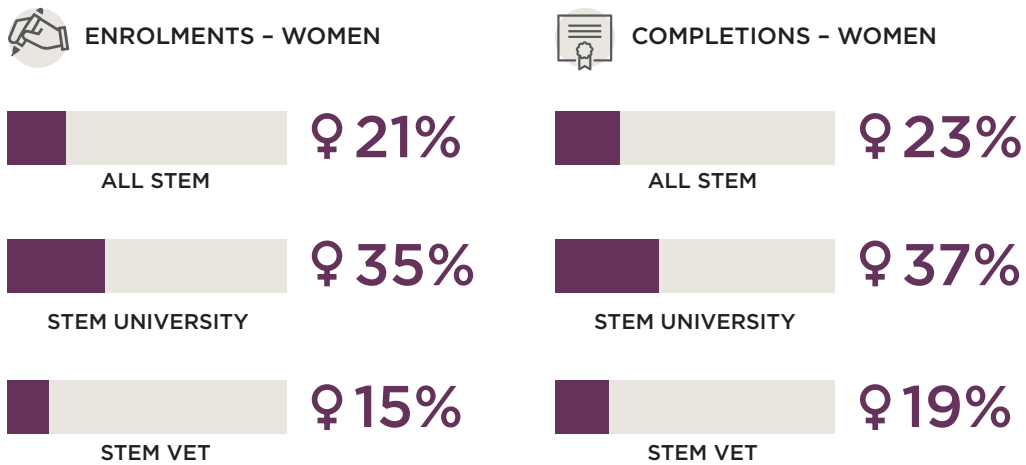
¹¹ National Centre for Vocational Education Research (NCVER) 2020, VOCSTATS, NCVER, Adelaide, extracted on 24 November 2019, <https://www.ncver.edu.au/research-and-statistics/vocstats>.

Women in higher education in 2018 studied STEM at much lower rates than men^{10, 11}

OF ALL HIGHER EDUCATION ENROLMENTS IN 2018...



Women were underrepresented as a proportion of total STEM enrolments and completions in 2018^{10, 11}



GRADUATE OUTCOMES

Successful transition into the workforce can be impacted by job availability and working and pay conditions.

Understanding graduate employment outcomes for STEM-qualified women can provide valuable insights into factors that continue to affect women's progression and retention in STEM.

KEY DATA ON WOMEN GRADUATING FROM STEM HIGHER EDUCATION

Is there a gender pay gap for STEM VET graduates entering the workforce?

In 2019, women who graduated from STEM VET courses and entered the workforce as full-time employees earned a lower median income than men in all STEM fields. Women's full-time median incomes were:

- Agriculture, environmental and related studies – \$47,000 (\$8000 less than men)
- Engineering and related technologies – \$57,000 (\$11,000 less than men)
- Information technology – \$52,000 (\$1000 less than men)
- Natural and physical sciences – \$44,000 (\$15,000 less than men)

Of people entering the workforce from all VET fields of education, the median full-time annual income was \$51,000 for women and \$65,000 for men.¹²

Is there a gender pay gap for STEM university graduates entering the workforce?

In 2018, the median income was the same for both women and men who graduated from 'Engineering' and 'Computing and information systems' undergraduate university courses, entered the workforce and were working full-time. However, the median income was less for women than men who graduated from undergraduate courses in the fields of:

- Agriculture and environmental studies – \$55,000 (\$8000 less than men)
- Science and mathematics – \$60,000 (\$3000 less than men)

In the same year, women who completed postgraduate coursework in STEM fields earned less median income than men:

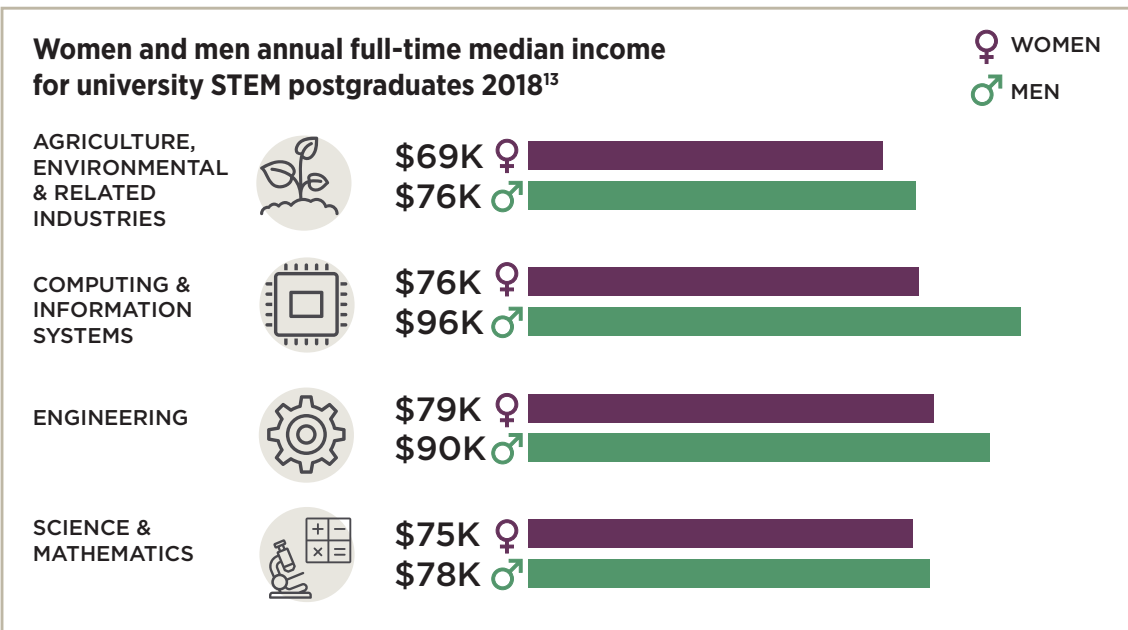
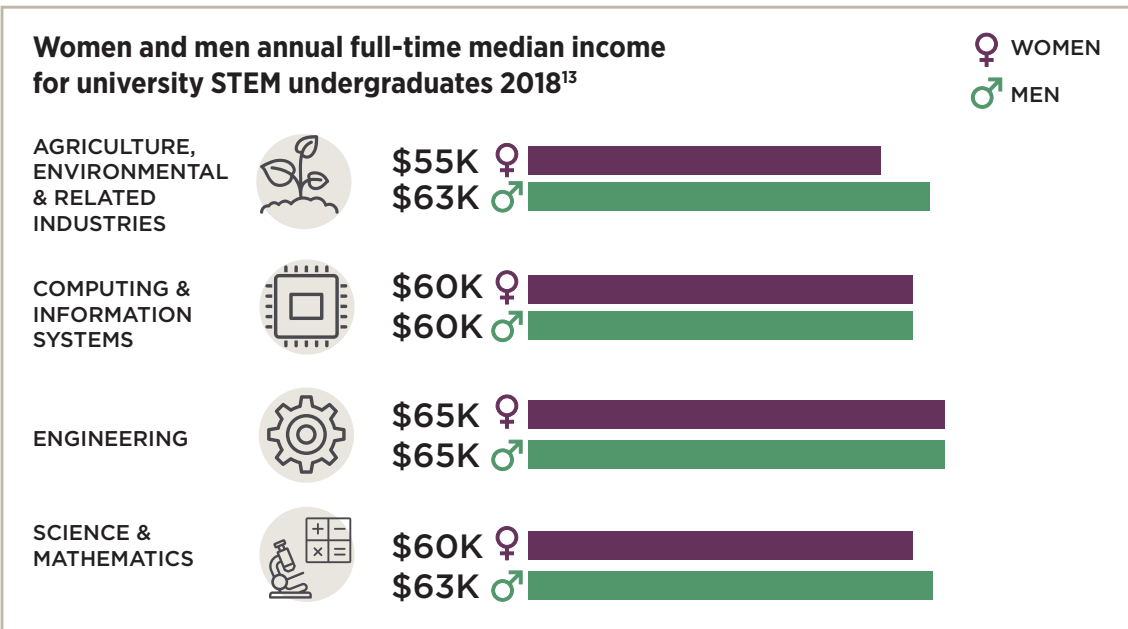
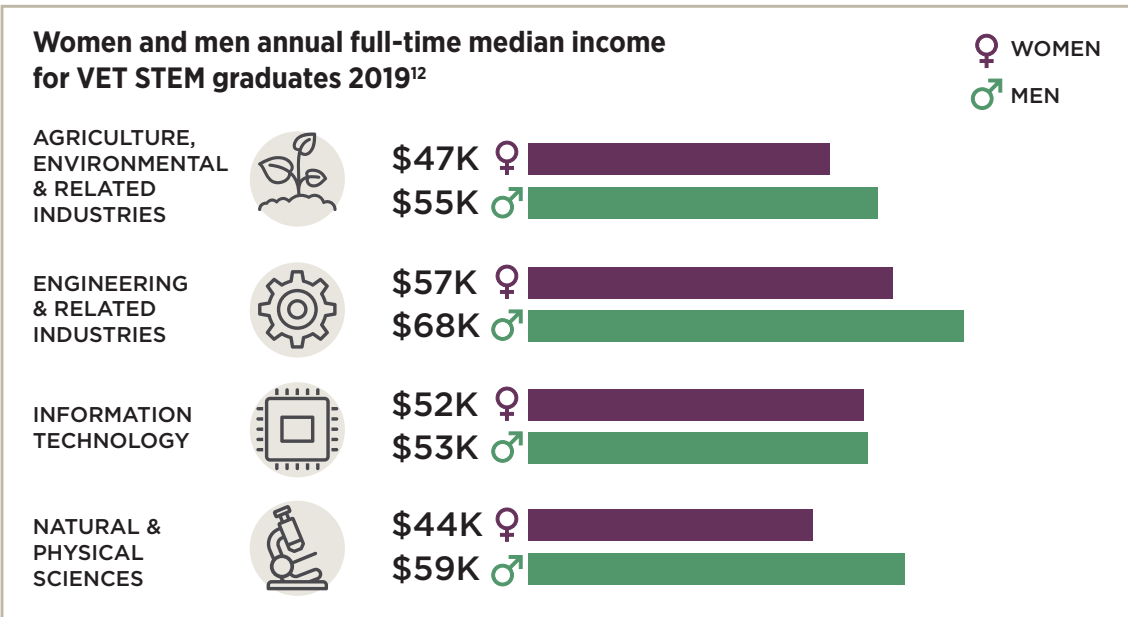
- Agriculture and environmental studies – \$69,000 (\$7000 less than men)
- Computing and information systems – \$76,000 (\$20,000 less than men)
- Engineering – \$79,000 (\$11,000 less than men)
- Science and mathematics – \$75,000 (\$3000 less than men)¹³

This data does not reveal the occupation the graduate enters into or include part-time annual income information.^{12, 13}

Graduate outcomes data sources

12 National Centre for Vocational Education Research (NCVER) 2020, *VET student outcomes*, NCVER, Adelaide, by data request provided on 26 November 2019, publicly available data can be found at <https://www.ncver.edu.au/research-and-statistics/collections/student-outcomes/vet-student-outcomes>.

13 Social Research Centre 2019, *Quality Indicators for Learning and Teaching: Graduate Outcomes Survey National Tables 2019*, funded by the Department of Education, Skills and Employment, <https://www.qilt.edu.au/qilt-surveys/graduate-employment>.



WORKFORCE

STEM skills are widely valued and can be used in many different occupations and industries. STEM skills are also important for people working in the research workforce, including academic staff who perform research and have teaching responsibilities. In 2016, women made up 17% of all people in Australia with STEM qualifications.¹⁴

Understanding women's participation in STEM-qualified occupations and the STEM research workforce is critical to building an inclusive and diverse workforce that is positioned to take full advantage of the jobs of the future. Understanding how STEM-qualified industries are taking action to support women's participation can highlight industries that are driving change and where more effort still needs to occur.

KEY DATA ON WOMEN IN THE STEM WORKFORCE

What is the proportion of women working in STEM-qualified occupations?

STEM-qualified occupations are those where more than half the workforce reported a STEM qualification in the 2016 Census of Population and Housing.

Between 2009 and 2019, women's participation in STEM-qualified occupations increased by 3 percentage points, from 11% to 14%.

For comparison, women have comprised almost half of people in non-STEM occupations since 2009 and approximately three-quarters of those in defined Health occupations.¹⁵

What is the proportion of women working in STEM fields of research?

Women comprised 29% of the academic research workforce in STEM fields in 2017.

While some STEM fields had greater representation of women at junior levels, representation of women at senior levels was extremely low across STEM fields. In 2017, women comprised only 12% of the highest academic seniority level (Level E – Professor).¹⁶

Do research grant funding outcomes differ according to gender?

Women and men researchers in STEM fields had similar success rates in obtaining funding grants from the Australian Research Council (ARC)¹⁷ and the National Health and Medical Research Council (NHMRC)¹⁸ in 2018.

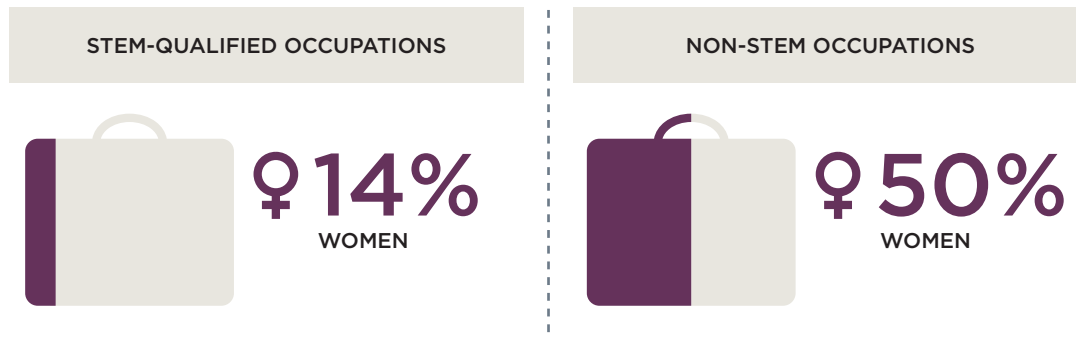
However, fewer women in STEM fields in 2018 submitted funding applications:

- 18% of all investigators on applications submitted for ARC funding were women.
- 28% of all investigators on applications submitted for NHMRC funding were women.

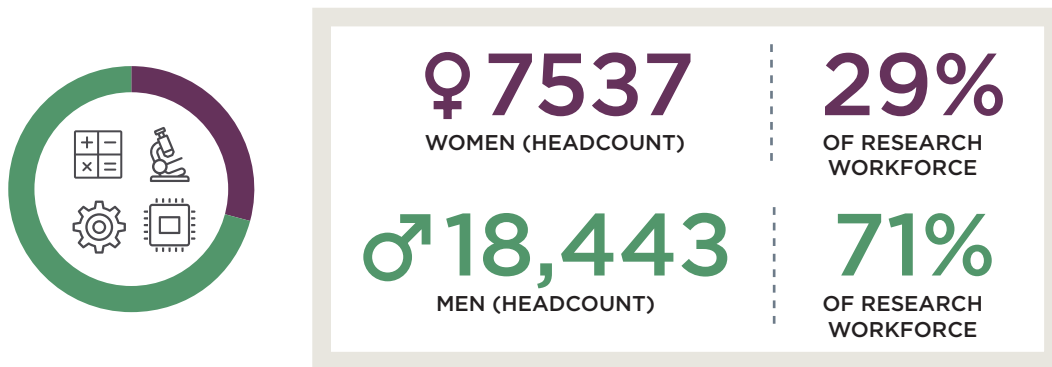
This resulted in an underrepresentation of women in successful research grants:

- 19% of all investigators on applications funded by ARC were women.
- 26% of all investigators on applications funded by NHMRC were women.

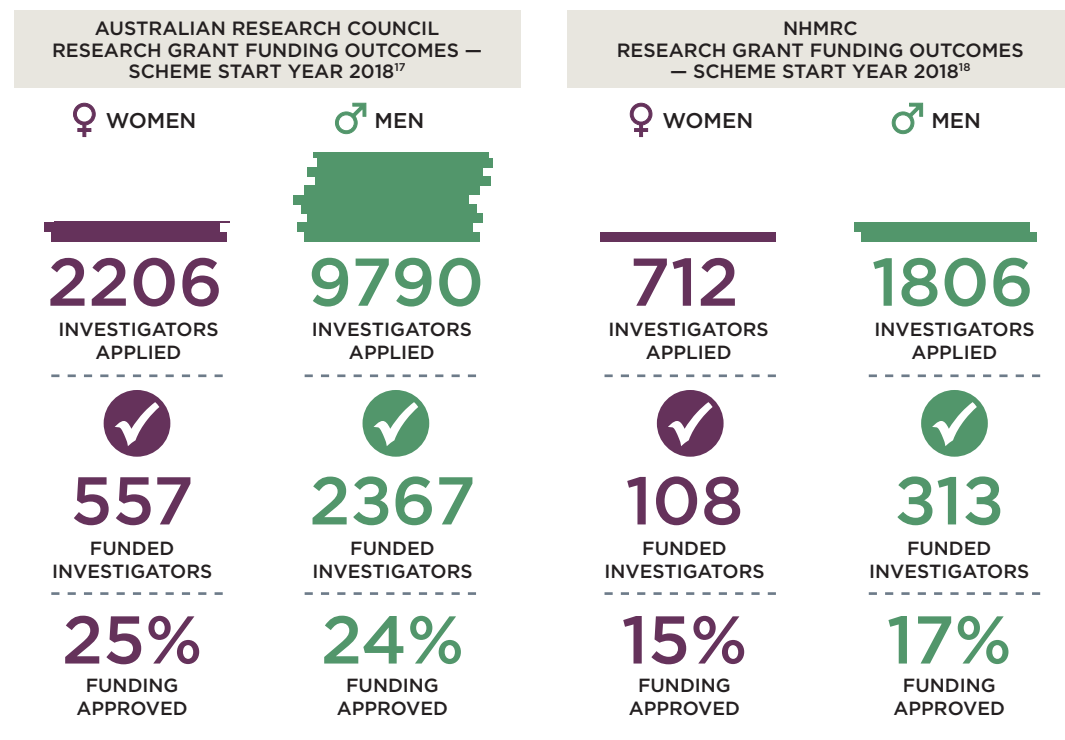
The percentage of women in STEM-qualified occupations was far less than in non-STEM occupations in 2019¹⁵



In STEM fields of research, women account for less than a third of the workforce in 2017¹⁶



Funding for research investigators in STEM was approved at similar rates regardless of gender, however women submitted fewer applications for 2018 funding



KEY DATA ON WOMEN IN THE STEM WORKFORCE (cont.)

What is the proportion of women working in STEM-qualified industries?

STEM-qualified industries are those where more than half the workforce reported a STEM qualification in the 2016 Census of Population and Housing.

In 2019, women comprised 27% of the people working in STEM-qualified industries.

Representation of women at senior levels in most STEM industries (with available data) was low in 2019. For all but one STEM industry, the proportion of women at senior levels was less than the proportion across all industries (36%). Only the 'Scientific research services' industry had a larger proportion of women (50%) in senior management.¹⁹

Is there a gender pay gap in STEM-qualified industries?

In 2019, women's average full-time remuneration was 19% less than men's in STEM-qualified industries, compared to 21% in all industries. This equates to an average pay gap of \$27,932 in STEM-qualified industries, compared to \$25,679 across all industries.

Only 5 of the 12 STEM-qualified industries (with available data) had a smaller pay gap percentage than the average pay gap across all industries.¹⁹

Workforce data sources

14 Office of the Chief Scientist, 2019 (unpublished calculations)

Refer to <https://www.chiefscientist.gov.au/2016/03/report-australias-stem-workforce/> for further information on STEM qualifications included in analysis.

15 Australian Bureau of Statistics (ABS) 2019, *Labour Force, Australia, Detailed, Quarterly*, November, data cube: EQ08, cat. no. 6291.0.55.003, ABS, Canberra, viewed 16 January 2020, <https://www.abs.gov.au/ausstats/abs@.nsf/mf/6291.0.55.003>.

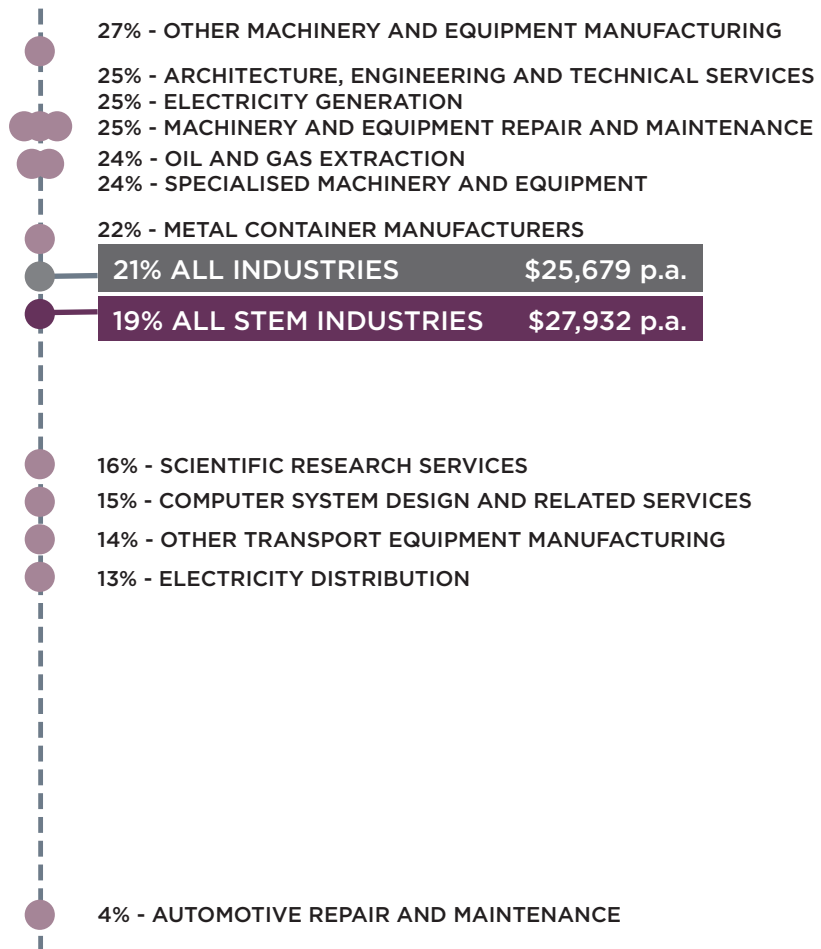
16 Australian Research Council (ARC) 2019, *Gender and the Research Workforce. Excellence in Research for Australia (ERA) 2018*, ARC, Canberra, by data request provided on 16 October 2019, publicly available data can be found at <https://dataportal.arc.gov.au/ERA/GenderWorkforceReport/2018/>.

17 Australian Research Council (ARC), 2019. *Gender Outcomes: NCGP Trend data*. ARC, Canberra, by data request provided on 9 January 2020, publicly available data can be found at <https://www.arc.gov.au/policies-strategies/strategy/gender-equality-research/gender-outcomes-ncgp-trend-data>.

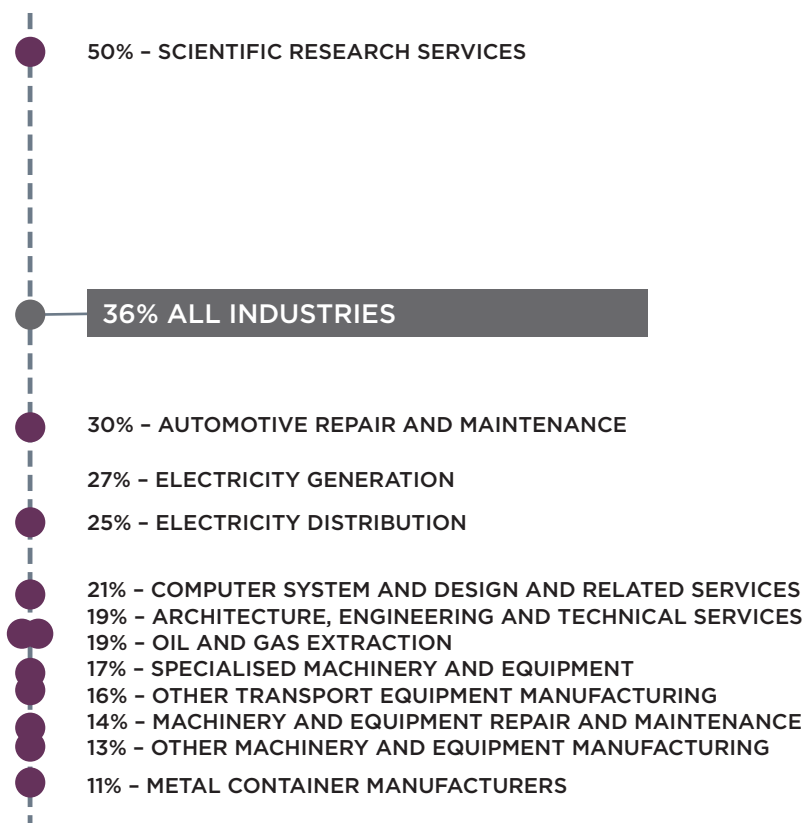
18 National Health and Medical Research Council (NHMRC) 2019, *Research funding statistics and data*, NHMRC, Canberra, by data request provided on 31 January 2020, publicly available data can be found at <https://www.nhmrc.gov.au/funding/data-research/research-funding-statistics-and-data#download>.

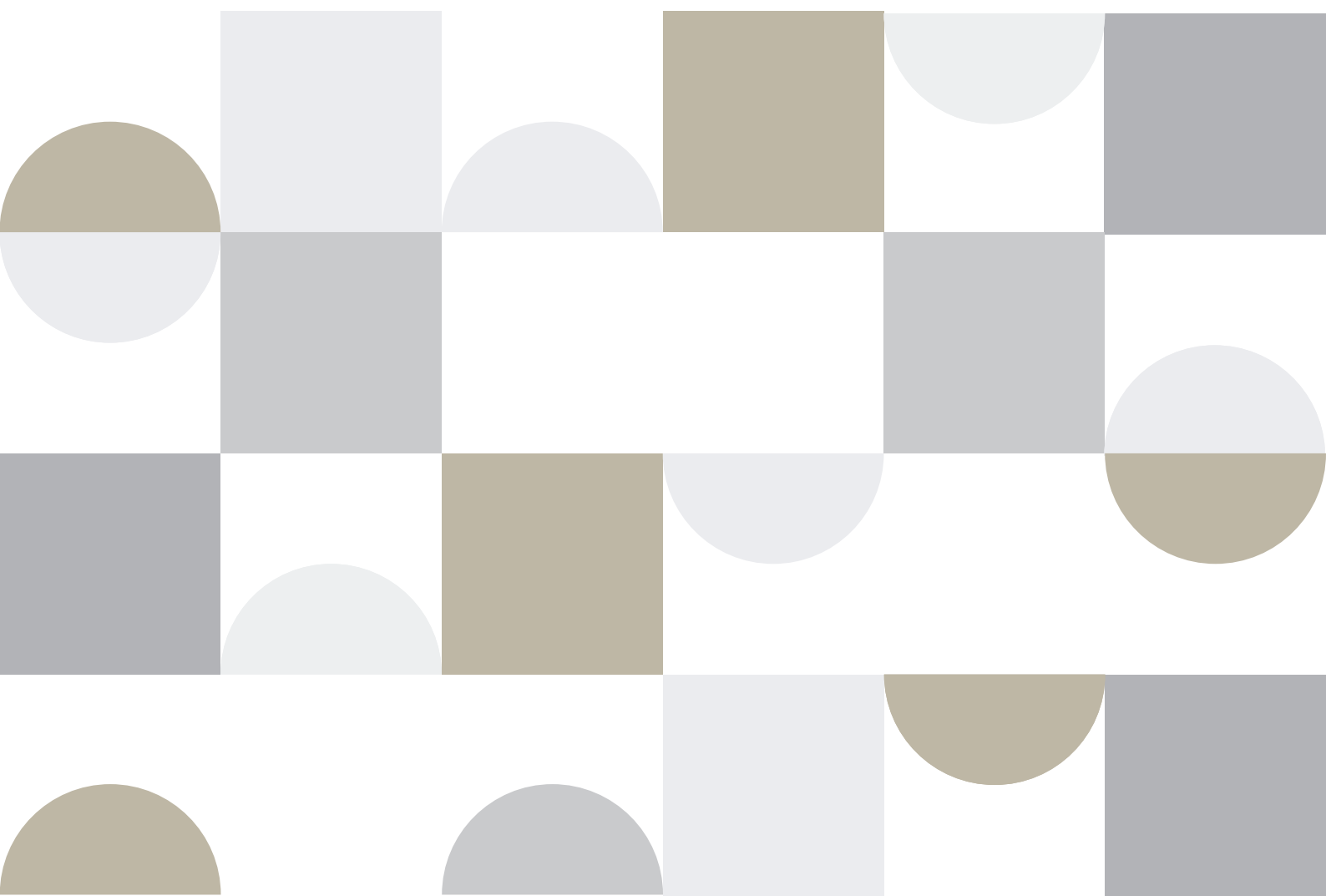
19 Workplace Gender Equality Agency (WGEA) 2019, WGEA Data Explorer, WGEA, Canberra, viewed on 12 December 2019, <https://data.wgea.gov.au/>.

The gender pay gap in STEM-qualified industries was 19% compared to 21% in all industries in 2019¹⁹



The percentage of women in senior management positions was low in most STEM industries in 2019¹⁹





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