Actuaries Institute

2019 Presidential Address

Gender diversity in actuaries: The Good, the Ugly, the Good and the Bad

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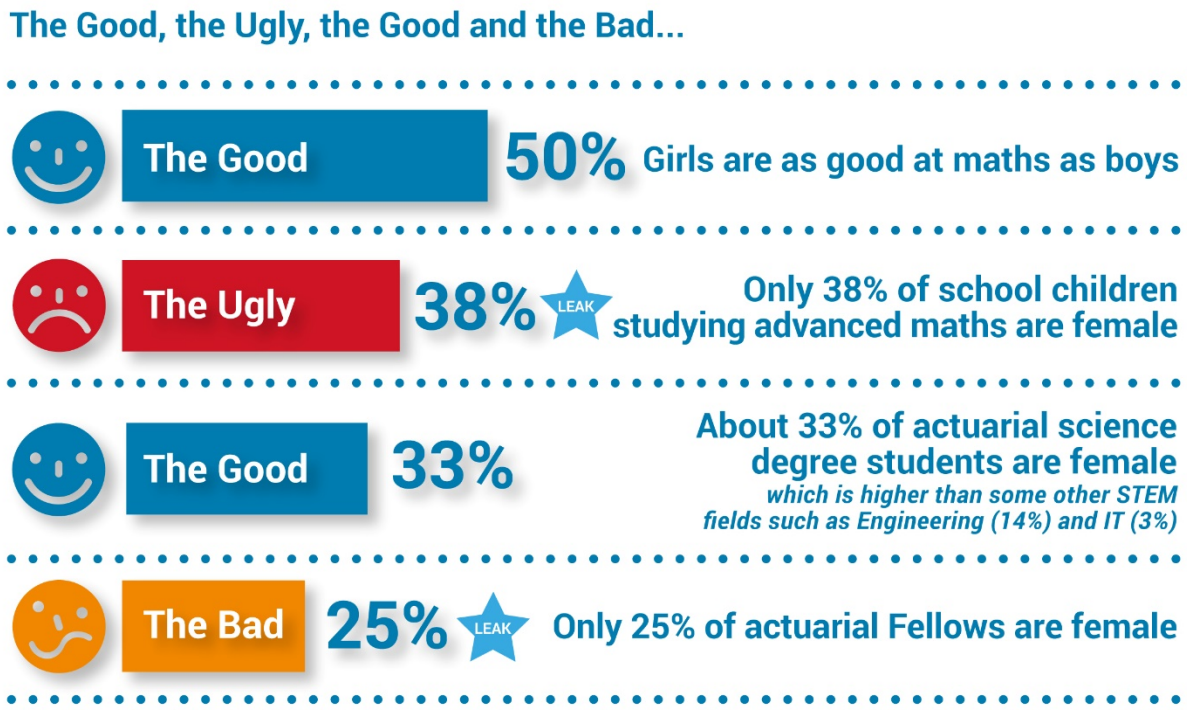
Executive Summary



Diversity in our profession is important for both economic and ethical reasons. The Actuaries Institute is committed to diversity and inclusiveness and has a strategic goal, 'Growth and Diversity', and a Diversity and Inclusion Working Group.

However, whilst girls are biologically as good at maths as boys, only 25% of Actuaries Institute Fellows are female. This paper analyses the education pipeline and identifies the major leaks. While the population of Actuaries Institute members in Australia is small (just under 5,000), the analysis has broader implications for Australia's future and how we ensure our children develop STEM (Science, Technology, Engineering, Maths) skills.

There are two major leaks:

1. **The Ugly:** Take-up of advanced maths by female students in school (only 38% of advanced maths students are female). Advanced maths is the traditional recruitment area for students seeking an actuarial career.
2. **The Bad:** Even though 33% of domestic actuarial university students are female, only 25% of actuarial Fellows are female.

The first leak is the most concerning. The research identifies two main drivers – a cultural gender stereo typing issue and a female lack of confidence issue.

It is alarming that there is deep-set gender stereotyping still happening in Australia, leading to girls not studying maths at the same rate as boys, despite equal ability. This is a cultural issue. It is even

more concerning because 75% of future careers will require STEM skills. Finally, it is apparent that other countries are doing much better than us.

I find this situation more troubling than data on the Australian gender pay gap or the percentage of female CEOs. I think this is because we are disadvantaging girls from a very young age. It's hard to envisage improvement in the latter metrics if we can't get this formative stage right.

Another key driver of the first leak is lack of confidence of girls in their maths ability. They are 25% less confident in their maths ability than boys. The good news is that some research shows that simple teaching interventions can address this. There is a significant role for parents and teachers.

The conclusions on gender stereotyping and confidence should be a huge wake-up call to all Australian parents of daughters.

The second leak is less concerning. Although it seems like a big drop, further analysis shows that for Fellows qualifying in the last 15 years, 31-33% are female. Hence, the 25% female Fellows figure is low because many of the older actuaries are predominantly male. This suggests that the main issue for gender diversity in actuaries is at the start of the pipeline, at school.

The 'one third' figure perpetuates throughout the pipeline – about one third of kids studying advanced maths at school in the last 10 years were female (38% in the latest year), one third of actuarial students at university were female and one third of actuaries recently qualifying as Fellows are female. This is why the first leak should be the focus – **until we increase the percentage of girls taking advanced maths at school, we will not be able to significantly improve the gender diversity of actuaries.**

Drilling down into the second leak:

- there seems to be evidence that women are staying at Associate Level and not progressing to the Fellow level.
- there is also evidence that women are not progressing to the most senior actuarial roles.

Hence, the Actuaries Institute needs to develop strategies to address these areas. This may be through our education system, partnering with other organisations or mentoring.

A final conclusion of this paper is that more women can be attracted into the actuarial profession by reviewing how we market the profession. We need to make maths "cool" and we need to address women's need for 'social belongingness'. Women are more likely to be attracted to our profession by showing how they can make a difference to the world as an actuary, solve complex problems and work in a collaborative environment.

I very much welcome feedback on these conclusions and further dialogue with members on this important subject.

Preamble

I an incredibly honoured to serve as the Actuaries Institute President in 2019. I have greatly admired and respected the long list of past presidents. One of those was David Knox. In his presidential address, David questioned the purpose of the presidential address.

- "Is it a review of the profession's successes and failures or is it the new President's hopes and strategies for the next year?"
- "Does it lead, or does it reflect?"
- "Is there a single theme or is it a ramble through many actuarial topics?"
- "Does it represent the view of Council, the membership or perhaps, a very personal view?"

Having looked over all the past addresses, this very much captures their essence – they can be many things! This year I'm going to do things a bit differently. In the hope of having greater impact, I have chosen to focus on a single theme and to provide a personal view. However, consistent with David's musings, it does capture some of our 'successes and failures' and, also both 'reflects and leads'. This hasn't been an easy choice. There are a raft of strategic opportunities and challenges facing the Institute – the Royal Commission, data analytics, the role of Australia in the global actuarial profession and our education and CPD strategy.

However, there is a confluence of events this year - a 'perfect storm' - that means it makes sense to focus on the subject of gender diversity in the actuarial profession.

- Our 2018-2020 Strategy - one of our strategic goals is 'Growth & Diversity'. Another goal is 'Brand & Community'. The issue of gender diversity is important to both goals. I am particularly enthusiastic about building and nurturing our actuarial community.
- The subject of female take-up of STEM careers is getting widespread academic and media focus.
- For the first time, we have a female president, senior vice president (Hoa Bui, Partner at KPMG) and CEO (Elayne Grace). We also now have many senior female actuaries who are members (see Appendix 2 for examples).
- My own personal background – I am passionate about the subject of career mums and published a book on the subject a couple of years' ago[i]. I also have three daughters, so I have a vested interest in getting this right. I should admit that none of them appear to be showing any interest in an actuarial career at this stage!

I believe we have gold in the individuals who comprise our actuarial community. The strength in our community comes from the high intellect of our members, their willingness to be a 'force for good' and their generosity in dedicating their time to our profession.

Not only do we have appointed and approved actuaries, but we have members who are CEOs, regulators, people who have built large businesses, Fintech entrepreneurs, company directors and partners of big accounting firms. Actuaries are peppered throughout financial services and beyond.

In the year ahead, I intend to put energy into profiling these leaders, telling their stories and building our community. However, this paper will focus on the female contingent of our community.

Background

Many have described the progress of women in STEM careers as a 'leaky pipeline'. This paper will provide a case study on what this pipeline looks like in the actuarial profession. In the spirit of applying our actuarial skills to problems, it will draw on analysis to identify where the 'leaks' are. It will seek to explain how we go from girls being as good at maths as boys at school to only 25% of actuarial Fellows being female.

However, first we should address why this is important in the first place.

Why is diversity important?

At the Actuaries Institute, we are committed to promoting all types diversity. We want to be an inclusive profession. Our Diversity and Inclusion Working Group is committed to encouraging and supporting everyone to have a voice and feel that they are being treated equally irrespective of gender, ethnicity, age, disability and sexual orientation/identity.

But why is this important? For many, the answer to this question is obvious. However, for completeness, I have provided a summary on gender diversity below.

Gender diversity is important for economic and equity reasons. The most compelling studies come from McKinsey who have looked at both company performance and economic performance. In their latest study on company performance, they conclude:

"Leadership roles matter. Companies in the top-quartile for gender diversity on executive teams were 21% more likely to outperform on profitability and 27% more likely to have superior value creation."[iiii]

In their 2015 study on the economic impact of gender diversity, McKinsey showed what a significant impact improved gender diversity could have economically. A 'best in region' scenario in which all countries match the rate of improvement of the fastest-improving country in their region could add as much as $12 trillion, or 11 percent, in annual 2025 GDP."[iv]

In terms of impact on team performance, American social scientist and Professor at the University of Michigan, Scott Page, presents in 'The Diversity Bonus' overwhelming evidence that teams that include different kinds of thinkers outperform homogenous groups on complex tasks, producing what he calls 'diversity bonuses'. "These bonuses include improved problem solving, increased innovation, and more accurate predictions—all of which lead to better performance and results."[v]

It would be remiss of me not to point out that some of the academic research is more equivocal on the link between gender diversity on boards and company performance.

In addition to the economic argument, there is the equality argument – it's just the right thing to do. Then there's the enjoyment factor. To quote an old boss of mine, "it's just more fun working in an environment where there are men and women!"

The Actuarial Diversity Pipeline

Historically, the actuarial profession has drawn on school children studying advanced maths as the source of the pipeline. Hence, the actuarial gender pipeline looks like this:

% Female	
49%	Year 12 school children[vi]
38%	School children that study advanced maths[vii]
33%	University students studying actuarial science
40%	Actuarial Associates
25%	Actuarial Fellows

I would like to acknowledge the work of Associate Professor Adam Butt (ANU) and Professor Leonie Tickle (Macquarie University). Their paper[viii] Building a gender diverse profession was very much an inspiration for this paper.

The Good

Girls are as good at maths as boys. As Australia's Chief Scientist Alan Finkel points out, "a meta-analysis of more than 240 studies published between 1990 and 2007 shows no statistically significant gender difference in mathematics performance. In short, maths ability is not determined biologically by sex."[ix]

He goes on to make a very compelling point. If mathematical ability were biologically determined then gender differences would be consistent among countries, and over time. However, this is not the case. In the 2011 Trends in International Mathematics and Science Study (TIMSS), there were no significant differences in the mathematics scores of Australian boys and girls in Year 4 or Year 8. Of particular note, Year 8 girls outperformed boys in mathematics in 13 countries, compared to only seven countries where boys outperformed girls.

If we are looking for a shining example, it is Singapore:

"Singapore is one of the top five countries in PISA[x] mathematics; and their female and male students perform equally. The Singaporean system is proof that the girls can be world leaders in mathematics when placed in the right education environment."[xi]

However, in Australia, boys have outperformed girls in every year group and over time for numeracy in the NAPLAN tests[xii]. Why is this?

Alan Finkel goes on to say, "the answer lies both in social norms and the confidence of students. PISA studies find that gender disparities in drive, motivation, and self-belief play a significant role in determining differences in male versus female mathematics performance."[xiii]

A recent study has shown that gender stereotypes about intellectual ability emerge early. "Five-year-old girls are just as likely to say that girls can be "really, really smart" but from six years up they

think brilliance is much more likely in boys. From this age girls are also much more likely to be attracted to a game if it is described as being for children who "work really hard" than if it is described as being for children who are "really smart."[xiv]

Lack of confidence in girls and women is a subject that I have been interested in for a while, largely because I feel like it has been a significant theme in my own life. I wrote about it in an *Actuaries Digital* article, "Are women less confident than men?"[xv] There is an excellent book that explores this exact issue, *The Confidence Code*, by Katty Kay and Claire Shipman.

However, there is cause for hope in relation to girls' confidence in maths. A paper from a partnership between the Australian Mathematical Sciences Institute (AMSI) and the BHP Billiton Foundation, the *Choose Maths* project, firstly articulates the difference in confidence:

"About 7 out of 10 boys and 5 out of 10 girls in Year 5 were confident in their self-perceived ability to learn mathematics. That is, **girls are at least 25 % less confident in their mathematical ability than boys**."

This begs the question, "can we do anything to address this?". The paper goes on to demonstrate some pleasing results on the impact of some simple interventions. The interventions[xvi] involved two modules that taught:

- the idea that the human brain and its ability to learn mathematics can grow; and
- the usefulness of, and need for, mathematics in daily life.

"In the pilot intervention of 300 students in each of Year 5 and Year 8, the proportion of students who were confident in learning mathematics increased by more than 80 % for girls and more than 30% for boys as a result of the intervention."

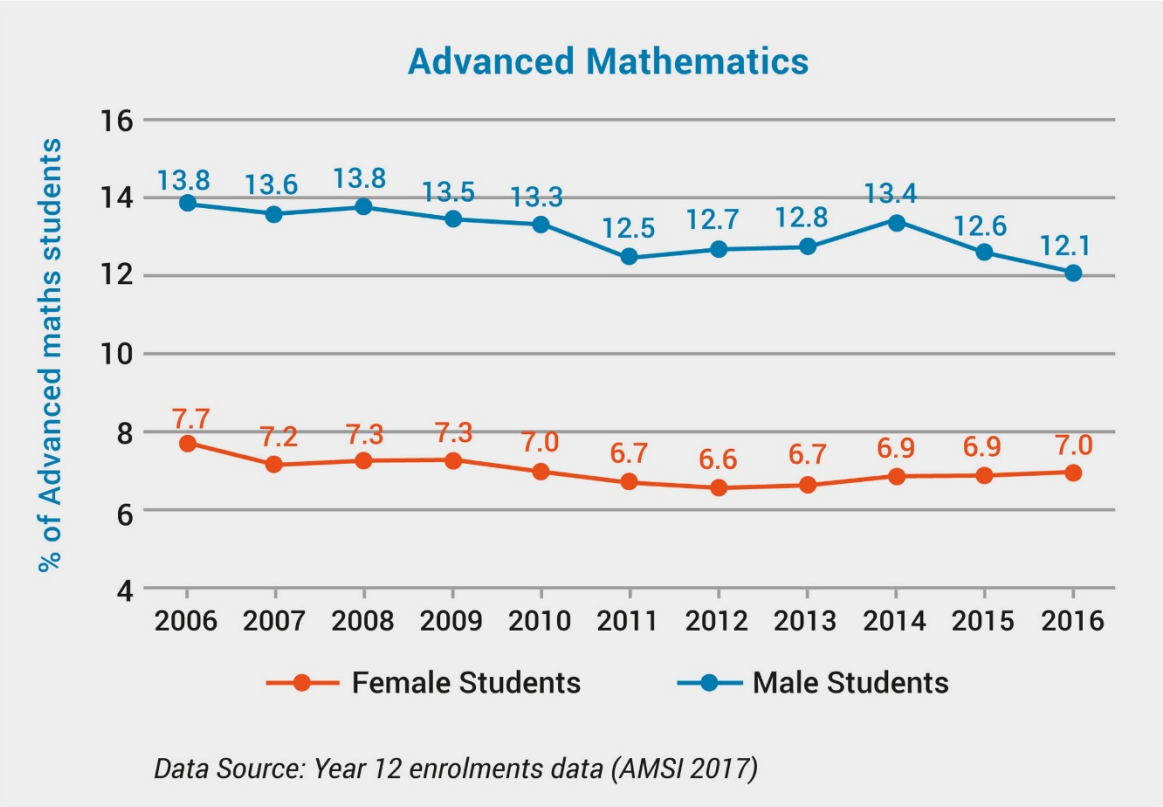
"After the intervention, at least 9 out of 10 students reported being confident, regardless of gender. These results are very encouraging and indicate that focussed intervention can make a difference in attitude with an expected flow-on effect on engagement and participation in mathematics."[xvii]

The recommendations from the report are shown in Appendix 1. In summary, the report recommends a very comprehensive and multi-layered response.

In order to improve the confidence of girls in their maths ability, so that their maths results reflect their ability, support is needed at three levels – the students themselves, the teachers and the parents.

The Ugly

The actuarial profession has typically drawn on school children doing advanced maths at school as the feeder for our pipeline. It turns out, that this is where the biggest 'leak' occurs. Over the last decade, boys have outnumbered girls doing advanced maths by a ratio of close to 2:1. While the ratio has improved slightly in recent years, this is mostly because a lower percentage of boys are studying advanced (another worrying societal trend). The percentage of female students studying advanced maths has been fairly constant for the last decade as the graph illustrates.



Data Source: Year 12 enrolments data (AMSI 2017)

This is a very worrying situation for two reasons. Firstly, Australia has the lowest percentage among countries in the APAC region for girls electing to take STEM subjects in school (27%)[xviii]. Secondly, in the next decade, 75 % of all jobs will need skills in STEM[xix].

Interestingly, the take-up of advanced maths varies considerably by state, with only 20% of girls doing advanced maths in the Northern Territory, but 50% in ACT[xx]. This is intriguing but also gives cause for hope.

If girls are as good at maths, why is the take-up of advanced maths so low for girls?

Again, a key reason is confidence. Helen Watt, Professor of education psychology at the University of Sydney, said:

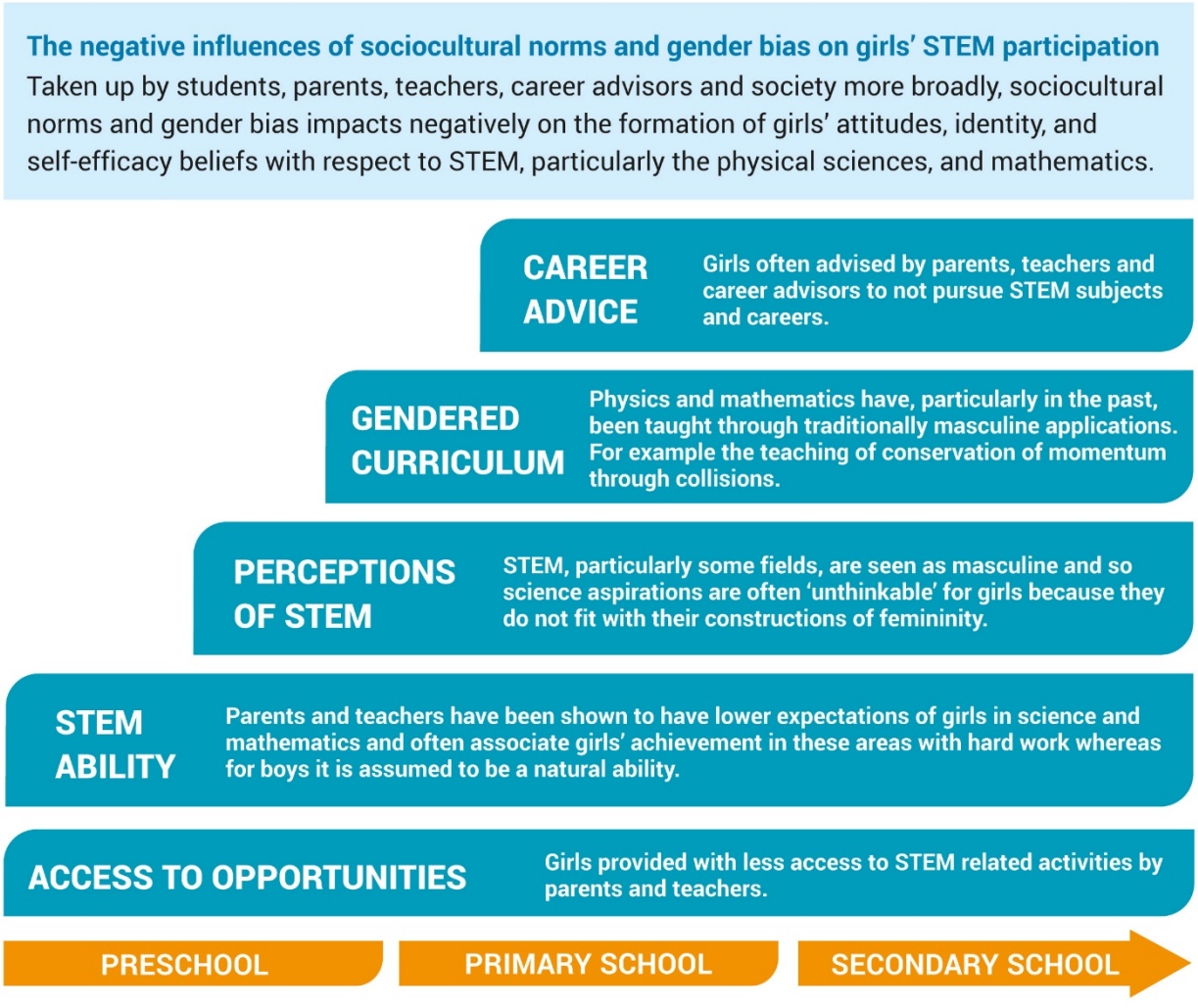
"Boys also have this slightly overestimated self-concept that spirals into benefits, they actually do rate their self-concept in maths higher than girls despite similar levels of achievement.

"For girls, choosing a subject is much more about what they think is important, worthwhile and useful."[xxi]

However, another important reason is cultural. Whilst we may think of ourselves as a gender-neutral country, the evidence suggests otherwise.

In a report developed by Deakin University and the University of Melbourne, "Girls Future- Our Future", co-author of the report, Deakin Chair in Science Education, Professor Russell Tytler says that, "how girls are encouraged to be part of the world is constrained and directed by cultural stereotyping and experiences from an early age".

This diagram from the report shows the multiple levels of negative influence on girls' STEM participation.



Source: p13 http://www.invergowrie.org.au/wp-content/uploads/2017/11/Girls-Future-Our-Future-TIF-STEM-Report.pdf

Another co-author of the report, Dr Linda Hobbs, Senior Lecturer at Deakin School of Education researcher, says "a concerted effort from parents, teachers, guardians and carers is needed to create a positive and gender-neutral view of STEM.

The promotion of female role models making strides in the field of STEM will also show girls that success is achievable and build confidence in their ability to succeed".[xxii]

There is a growing body of evidence that shows there is a strong cultural driver on STEM participation by females. The evidence also shows how some countries are doing much better than Australia. These are some of the figures on cultural influence that surprised me:

- In the UK roughly equal numbers of women and men are entering the actuarial profession.[xxiii]
- At ANU and Macquarie universities, the percentage of female *international* actuarial students (mainly from China) is significantly higher than for *domestic* students (by more than 10%).[xxiv]
- Using engineering as an example, women account for 40% of engineers in China, 44% of engineering graduates in Malaysia, and 58% of engineers in the former USSR. In contrast, women are poorly represented in engineering in Australia (14%) and in other Western countries.[xxv]
- Surprisingly, take up of STEM subjects is inversely correlated to gender equality in a country. The chart is shown in Appendix 3. It shows the higher take-up of STEM by women in countries such as Algeria, Turkey and United Arab Emirates. A paper published in Psychological Science suggests that this is because women in countries with higher gender inequality are simply seeking the clearest possible path to financial freedom, which is through STEM subjects.[xxvi] However, personally I believe it goes further than this. I think some cultures attach more importance to the study of maths.

A survey of Australian girls aged 12-14 by Mastercard provides further insight on where the issues lie in Australia:

- Reasons for not studying STEM include perceptions of male dominance (52%), lack of interest (48%) and lack of encouragement from society (39%).
- 70% of Australian girls believe parents are the most influential factor in studying STEM.[xxvii]

As a parent of a teenage girl, I have a heightened awareness of the role of parents in this process. I like to think of it as "sliding door moments". I had one about a year ago when my eldest daughter came home with the view that maths was getting too hard and she wanted to drop to a lower class. Another sliding door moment is when you discuss career options with them. How the parents react during these sliding door moments is critical and can significantly influence their future path.

I remember my own sliding door moment when I was about 16 and I told my mum that I was thinking of doing a personal assistant course after I finished school as a "back-up plan". My mum reacted quite negatively to that suggestion and I ended up dropping it as an idea. I remember being quite surprised by my mum's reaction because my mum had a career as a personal assistant herself!

The Good

When it comes to girls choosing a career path, the actuarial profession stacks up well compared to some other STEM areas. As Adam Butt and Leonie Tickle say "actuarial studies programs at Australian universities are attracting more females than other mathematical degrees such as Engineering and IT. At ANU between 30% and 40% of domestic undergraduates are female and at Macquarie, between 22% and 32%, with no discernible trend over time… The proportion of females among domestic undergraduate students is roughly in line with what we might expect based on numbers of final year school students who take advanced mathematics.

Percentage of domestic completing graduates who were female (2015)[xxviii]

STEM Field	**Bachelor level**
Agriculture and Environment	51%
Engineering	14%
Physics and Astronomy	22%
Information Technology	13%
Earth Sciences	36%
Chemistry	42%
Actuarial[xxix]	33%

This begs the question, why are women choosing an actuarial career and how can we increase it?

Why do women choose the actuarial career path?

Many women are probably choosing actuarial for the same reasons as men. A number of career studies rank actuarial as a highly attractive career. One of those comparisons, 'US News Best Jobs', a US career comparison site, ranks actuarial as the sixth best business career, with a score of 6.8 out of 10. They use five ranking criteria: salary, job market, future growth, stress and work life balance[xxx].

In relation to the 'salary' criterion, actuaries have ranked well for pay for a long time. The average graduate salary is $77,000 (base plus super)[xxxi] compared to $56,000[xxxii] for the average graduate salary. For an actuary with approximately 10 years' experience, the average salary is $185,000 (includes base and super) plus a 15-20% bonus.

This particular survey ranks the job market for actuaries highly, but puzzlingly ranks "future growth" quite low.

However, it is the last two criteria that are particularly interesting for women. The actuarial career is ranked about average for stress and work life balance. Whilst average doesn't sound that good, it is probably appealing relative to some careers that are ranked high for salary but don't rank well for stress and work life balance (e.g. surgeon).

I think it is worth thinking about another criterion that women seem to be using which I will label 'work environment'.

A study of 1,327 Swedish secondary school students explored why more boys than girls are attracted to STEM subjects at university and more girls are attracted to subjects in the HEED (health, elementary education and domestic) spheres. The difference was partly explained by **'social belongingness'**: teenagers felt they would fit in better in subjects that had more of their own gender.[xxxiii]

It is interesting that these findings come from one of the most gender-neutral countries in the world. I think the good take-up that the Australian actuarial profession has had by women reflects the fact that actuaries typically work in collaborative environments, where promotion is based on merit and there are some visible female role models. This can be contrasted to work environments that lower rates of women are choosing like politics, investment banking and construction sites.

Some further insight can be gained from an Australian piece of work called 'Future Impact'[xxxiv] which is looking at how the funds management industry can attract a more diverse talent pool. I think there are interesting parallels for the actuarial profession.

Yolanda Beattie, formerly at Mercers, has been leading the initiative. Based on interviews, they concluded that the reasons for women not entering the funds management career path were:

- Lack of knowledge – they didn't know about it (note that this is also a challenge with actuarial, with more than 20% of Australians not really knowing anything about actuaries[xxxv]);
- Thinking they won't fit in (i.e. the "social belongingness" mentioned above); and
- Being negatively influenced by stereotypes (for example, movies like "The Wolf of Wall Street").

They have done some work on the value proposition that will appeal to women and concluded:

- Showing how their career can have an impact.
- Involves solving complex problems.
- Working in a collaborative environment.

Speaking to a number of actuaries, there is also a view that we need to make maths 'cool'. Felicity McVay and Greg Atwell (founders of FINCH) say that even 'STEM' has an image problem.[xxxvi] They think we need to inject the word 'creativity' into the proposition to make it more appealing.

Whilst we are doing quite well relative to some other STEM fields, these insights show how we can further improve the marketing of our profession to appeal more to women. This is very relevant for two pieces of work that are scheduled for the Actuaries Institute for 2019 - the development of our 'Social Purpose' and the review of our High School Program.

Research titled 'Engaging the Future of STEM' by Sarah Chapman & Dr Rebecca Vivian[xxxvii] supports a focus on marketing messaging. They point to the value of promoting STEM engagement through providing real world experiences, with links to industry and extension programs such as mentorships. They claim that effective messaging can attract girls to consider STEM and help them envision themselves at STEM professionals.

Why are 40% of Associates female when only 33% of domestic actuarial graduates are female?

Not only are 40% of Associates female, but the figure goes much higher for female Associates in certain age groups. This is a bit of an anomaly that I think should be examined.

Age of Associate	Total	% Female
Less than 30	109	39%
30-40	342	48%
40-50	139	38%
50-60	48	29%
60-70	27	19%
over 70	18	6%

The evidence from two Australian universities suggests that female actuarial students do as well as male students. Their marks are similar and dropout rates are similar. According to Adam Butt and Leonie Tickle, "There's no clear evidence of any significant difference in performance once in the actuarial studies degree, at either Macquarie University or ANU"[xxxviii] In other words, the reason is not to do with academic performance at university.

Hence, the possible reasons for the higher percentage of female Associates are:

- More women staying at Associate level and not continuing with studies to Fellow level.
- The overall Associates number includes international students, which have been shown to have a higher percentage of females.
- Higher female percentages in other Australian universities other than ANU and Macquarie Universities (where the gender splits have been taken from).

From looking at the data, it seems like the first reason is the most important one. Whilst the 48% Associate figure for the 30-40 age group looks good, it is actually a concern. It indicates that a disproportionately large proportion of women are choosing to stay at Associate level. Understandably, at this age, having children can compete for one's time with studying. Whilst the Actuaries Institute sees promotion of the Associate qualification as a priority, we need to look at ways we can support those women who do want to progress to the Fellowship qualification. I am optimistic that our new education strategy will assist here, by employing better and more modern education techniques that will support students through the process.

The Bad

Actuaries Institute figures show that 40% of our actuarial Associates are female, but only 25% of Fellows. Given those figures, you might question why I have labelled this section 'The Bad', rather than 'The Ugly'. The reason is that I have cause for optimism.

Firstly, when we look at the Fellows who have qualified in the last 15 years, we see that the female percentage is much higher, at 31-33%[xxxix]. In other words, the lower figure of 25% reflects the weight of older fellows who qualified at a time when it was a much more male dominated profession.

Years since qualifying as a Fellow	Total	% Female
Less than 5 years	520	31%
5-10 years	504	33%
10-15 years	299	31%
15-20 years	258	22%
20-25 years	252	22%
25-30 years	142	24%
30-35 years	82	10%
35-40 years	63	5%
Over 40 years	155	2%

The other striking conclusion from this table is that the percentage of female Fellows who have qualified in recent years is almost the same as the percentage of girls studying an actuarial degree (at ANU and Macquarie) which is almost the same as the percentage of girls taking advanced maths at school in the last decade. In other words, the biggest 'leak' we need to fix is take-up of advanced maths at school.

Another reason for optimism is that I am seeing so much positive change by many Australian companies in the area of gender diversity. This includes KPIs and targets around gender diversity, supportive HR policies (like flexible work policies), more vocal CEOs, programs like 'Male Champions for Change' and workplace training (such as unconscious bias).

As a result of publishing a book in this area, I have been invited to present at a large number of workplaces. I have seen a lot of positive momentum and much has changed in the last five years. I know this because some premises in my book are now out-of-date! A simple example is flexible work arrangements. When I wrote the book, flexible work arrangements were a privilege, something that had to be earned. Now, almost 70%[xl] of companies have a flexible work policy, with some companies having gone as far as saying that any job can be done flexibly.

However, I have also seen a wide spectrum of work situations. On entering a workplace, it is surprising how quickly the gender diversity situation becomes apparent. It can be judged from things like number of women in the leadership team, how prevalent part-time work is and level of CEO focus on diversity.

One of the most encouraging moments was when I asked a group of female Actuaries Institute members whether they thought they had had equal opportunity in the workplace. I'm happy to report that the majority thought they had. Although only anecdotal, this lends further support to the premise that actuarial workplaces are generally supportive environments for women.

Despite this optimism, there are two important questions to answer:

- How can we address the drop-off from 40-48% of Associates to 31-33% of Fellows?
- Are women progressing to the top of the actuarial career?

As a woman who has enjoyed the experience of a career and motherhood, I feel less emotion around the issue of women 'dropping out' and not progressing. It turns out that parenthood is an incredibly meaningful and amazing experience and choosing to dedicate time to this is very rewarding. More and more men are also realising this and choosing to split their time a bit differently. I have particularly witnessed this in the younger generation.

While it would be easy to simply wait for the myriad of corporate policies to take effect and for the next generation to sweep in an improved level of gender equality in child rearing, there is still a need for vigilance.

This data isn't available specifically for the actuarial profession, but if you look at STEM graduate (bachelor and above) salaries for people aged over 30, 19% of women without children are in the top income bracket, compared with 12% of women with children, and 35% of men. The effects of motherhood don't explain why nearly twice as many men earn in the top income bracket compared with women without children.[xli]

In addition, if we use appointed and approved actuaries as a proxy for our most senior actuarial roles, we can see that pleasingly 23% are female[xlii]. However, if we look at the top 10 life and

general insurance companies, the figure is quite a bit lower. This crude measure suggests there is still a way to go and justifies the 'bad' label. The data also lends support to some anecdotal evidence that certain practice areas are more supportive of women (e.g. general insurance is better than life insurance).

One area the Actuaries Institute could investigate is how to encourage women to take more risk in their careers. There is an excellent TED talk called 'Teach girls bravery, not perfection' by Reshma Saujani.[xliii] I was very heartened to attend a KPMG session run by an actuary who is their Global Head of Insurance, Laura Hay, on 'Confidence and Risk Taking'. This goes to the heart of the issue.

However, having spoken to hundreds of women in the last two years, I am also convinced that the barriers to gender diversity in the workplace lie as much at home as they do at work. Until men take on a more equal sharing of the domestic workload and child rearing, we will not see women rise to the top in meaningful numbers. It is concerning that this observation mirrors the cultural factors evident in girls' take-up of maths at school. Australia has much progress to make on our culture and how it is impacting gender equality.

Conclusion: How do we increase the percentage of females in the actuarial profession?

Diversity is important and a significant part of the Actuaries Institute's strategy. The analysis of the 'leaky' pipeline for the actuarial profession has shown there are two main sources of leaks:

1. **The Ugly:** Take-up of advanced maths by female students in school (only 38% of advanced maths students are female)
2. **The Bad:** Drop off from Associate member (40%) to Fellow (31-33% for members qualifying in the last 15 years).

Of these two leaks, I worry most about the first. The female participation in advanced maths at school is a particularly deep-set issue. The research suggests that it is both a cultural problem and a female confidence issue.

There are two reasons to be positive about our ability to address the problem:

- Evidence from other countries suggests that it is possible to address our gender equity cultural issues as it relates to the take up of maths, and
- The 'Choose Maths' research suggests that simple interventions can lead to a significant uplift in girls' confidence in maths.

I echo the 'Choose Maths' and 'Girls Future- Our Future' research by concluding that the answer lies in the combined actions of parents and teachers to drive long-term change.

In addition, although it is not one of the major 'leaks', I believe that we can encourage more women to choose an actuarial career by changing how we market our profession. This would be by changing our marketing messaging to portray a more gender balanced workplace ('social

belongingness', changing the image of STEM, emphasising creativity and making it('cool'), showing how an individual can make a difference to the world as an actuary, illustrating the potential to solve complex problems and demonstrating how we work in collaborative and team-based environments.

Finally, the Actuaries Institute needs to look at how we can support women in their progression from Associate to Fellow and how we can support more women into senior actuarial roles.

I very much welcome feedback on these conclusions and further dialogue with members on this subject.

Appendix 1: Recommendations from Gender Report 2017: Participation, Performance and Attitudes Towards Mathematics

Supporting our Students

- Improve access to learning resources with a focus on growth mindset approaches to encourage self-confidence, particularly among girls.
- Incorporate careers awareness into classroom learning to strengthen understanding of the application and value of mathematics and the participation of women in STEM.
- Improve mentoring access, particularly for girls, to support learning outcomes and subject selection in Year 10.

Supporting our Teachers

- Equip all pre-service primary teachers with adequate mathematics knowledge and teaching strategies to improve capability and confidence and address maths anxiety in the classroom.
- For current primary teachers provide professional development in mathematics content and pedagogy to improve capability and confidence and address maths anxiety.
- Provide common training to primary and secondary pre-service and in-service teachers to support student transition from primary to secondary school, with a focus on the continuity of mathematical learning.
- Provide better access to growth mindset resources to pre-service and in-service teachers to support mathematics learning outcomes and engagement.
- Provide access to professional development for all teachers to improve understanding and implementation of emerging teaching strategies, in particular growth mindset approaches, for improving girls' confidence and self-perception.

Supporting our Parents

- Create positive home learning environments through better access to resources including those supporting growth mindset learning.
- Develop stronger engagement between school and home with access to better information for parents about the application and value of mathematics as an enabling discipline and career pathways, particularly for girls.

Appendix 2: *Some senior female members of the Actuaries Institute

***Ideally, we would have preferred to include ALL of our senior female actuaries in this stellar line-up!**

Leonie Tickle
Associate Dean
Learning and Teaching
Faculty of Bus & Economics
Macquarie University

Hoa Bui
Partner-in-charge
Actuarial & Financial Risk
KPMG

Jo-Anne Morgan
Program Director
Actuarial Science
Curtin University

Susan Looi
General Manager
Enterprise Risk
ANZ Banking Group Ltd

Kirsten Armstrong
Director of Knowledge
& Innovation
Fred Hollows Foundation

Bozenna Hinton
Head of
Portfolio Management,
Individual Life, TAL

Alissa Holz
Head of Business
Development
Australia and NZ, RGA

Andrea Gluyas
NZ Earthquake Commission
Past President NZSA

Melinda Howes
General Manager
Superannuation,
BT Financial Group

Lilian Ng
CEO Insurance
Prudential Corporation Asia

Elayne Grace
CEO, Actuaries Institute

Jennifer Lang
CFO & Chief Actuary,
CommInsure

Julia Lessing
Director, Guardian
Actuarial

Annie Tay
Managing Director
Cubic Risk Solutions

Zilinka Jiang
Executive Manager
ANZ Markets, Quantium

Jan Swinhoe
Non-Executive Director

Gloria Yu
Senior Manager, APRA

Bridget Browne
Partner, Advisory, EY

Win Li-Toh
Principal, Taylor Fry

Jenny Lyon
Director, SKL Actuarial

Estelle Pearson
Director, Finity Consulting

Corinne Glasby
CRO Insurance, Suncorp

Naomi Edwards
Non-Executive Director

Cathy Nance
Partner, PwC

Sarah Johnson
Scheme Actuary, NDIS

Carol Dolan
Non-Executive Director

Trang Duncanson
Partner, Deloitte

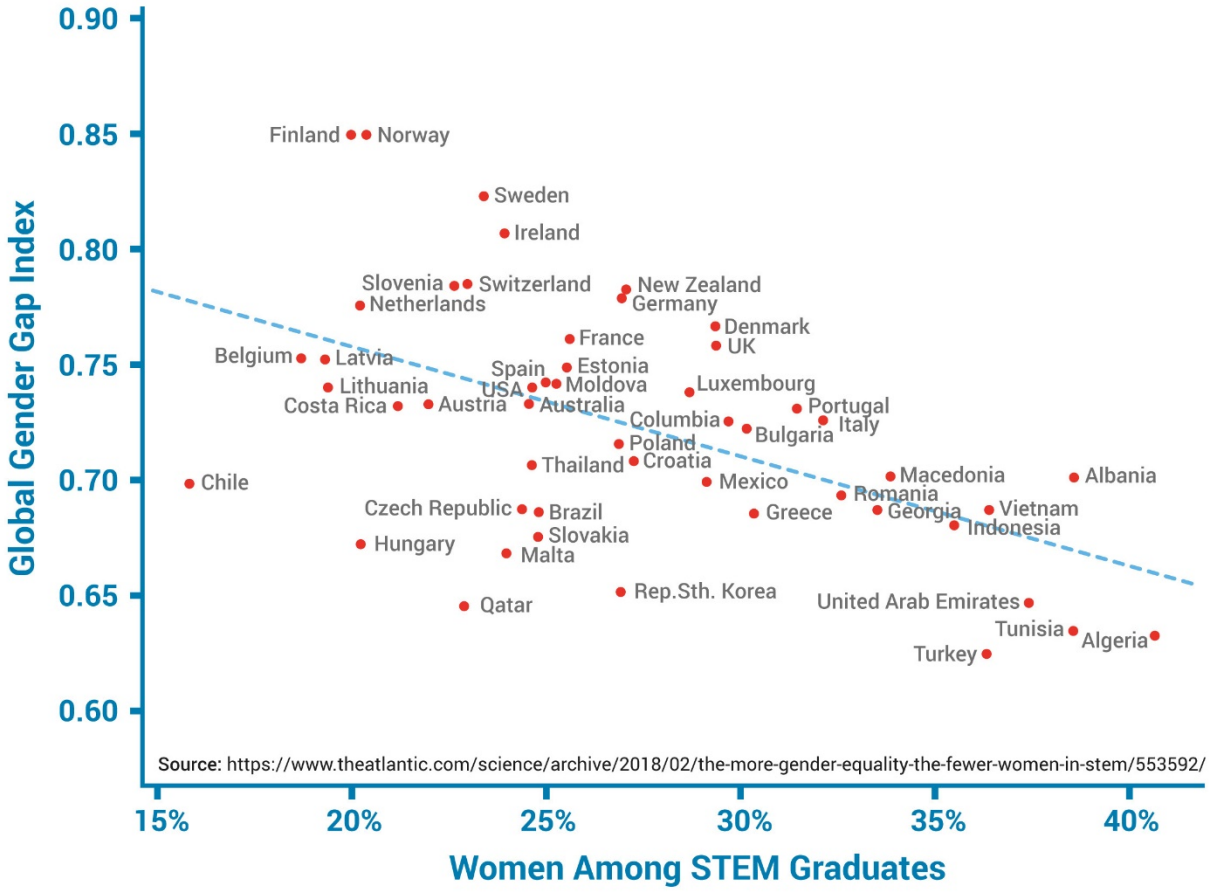
Annette King
Non-Executive Director

Helen Rowell
Deputy Chairman, APRA

Ann-Maree Cook
Non-Executive Director

Appendix 3

Scatterplot of countries based on their number of female STEM graduates and their Global Gender Gap Index[xliv]



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[viii] https://www.actuaries.digital/2018/07/18/building-a-gender-diverse-profession/
[ix] https://www.chiefscientist.gov.au/wp-content/uploads/OCS-paper-13.pdf
[x] PISA is the Programme for International Student Assessment, a worldwide study by the OECD designed to evaluate educational systems by measuring 15 year old school pupils scholastic performance on mathematics, science and reading
[xi] https://www.chiefscientist.gov.au/wp-content/uploads/OCS-paper-13.pdf
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[xiii] https://www.chiefscientist.gov.au/wp-content/uploads/OCS-paper-13.pdf
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[xv] https://www.actuaries.digital/2017/08/29/are-women-less-confident-than-men/
[xvi] The intervention consisted of two teaching modules. The first module explained how the human brain works and introduced students to the idea that the human brain and its ability to learn mathematics can grow. The second module reinforced students' awareness of the usefulness of and need for mathematics in daily life via a game of pairing 'title' and 'description' cards through collaborative work.
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