

David Glanz: We live in a world where technology is part of everything we do from keyless cars to mobile phones, from streaming movies on demand to the humble calculator. We all take technology for granted. All these gizmos and apps are underpinned by science, technology, engineering and maths. Yet fewer people are studying those STEM subjects and when it comes to girls and women, the picture is even grimmer.

David Glanz: Hello and welcome to this podcast brought to you by the Australian Academy of Technology and Engineering. I'm David Glanz and today I'm talking to Dr. Roslyn Dubs, who spent a lifetime in STEM, about why STEM matters and what we can do to reverse the negative trends. Ros is a member of the Board of the Academy of Technology and Engineering. Someone who has worked in executive roles in the defense, aviation and transport industries and in higher education. She is a director of a range of companies.

David Glanz: Can I just ask, obviously with your career, you've beaten some fairly hostile odds to rise to senior positions in both industry and higher education. How did you do it? What were the stepping stones along the way? Were there people who were particularly important in your success?

Ros Dubs: I think probably it never occurred to me that I wouldn't be successful. I mean obviously I've had a few setbacks in my career, but they've actually all turned out very, very well. Because once you have a particular fork in the road and you choose another path, it can often be better than it may have been, had you had you continued on. But, I guess I come from a scientific family. My father was a mining engineer, my brother is a chemical engineer. My two children are computer engineers, which of course is a profession that didn't exist when I went through.

Ros Dubs: I found out very early on that in fact I wasn't really suited to the research career that I thought I was destined to do. If you do a science degree at university and you know, you are encouraged to do honors and then a PhD, you automatically think that you will go into research. Well, I discovered fairly early on that I would be better in a management position. So I shifted to the CSRO where I was able to do just that, while still being able to nurture the researchers who in fact were ... Well, I guess better than I was at it.

Ros Dubs: But, I perhaps had a greater affinity for being able to get the funding in and perhaps help with the prioritization for that company. I think it comes down to just having a positive attitude. Obviously there were a few mentors along the way who encouraged me and yes ... I mean maybe it was all an accident David, I don't know.

David Glanz: Ros, Why do STEM subjects matter?

Ros Dubs: David. There are many reasons why STEM subjects matter. I'll just give you one example to start off with. Let's think about the fact that governments around

Australia they're all talking about new infrastructure projects. I myself, I've worked in the ship building industry and obviously we have huge naval shipbuilding projects coming on board. But, that they're all going to need more engineers in this country than Australia is currently graduating out of our universities.

Ros Dubs: In my view, it is quite dangerous to place your national future in the balance, if I could put it that way, by hoping to attract enough workers to fill that gap. That's happens to be the solution at the moment. But, in another way, I should also say that almost half the population, the women, have until now taken themselves out of the running. Because they are very much in the minority in relation to having studied science degrees, engineering degrees in the like. So my own view on that is that if we can persuade more girls to study science and engineering, that's a risk reduction measure for Australia's industrial future.

Ros Dubs: But, STEM subjects are in fact important in many ways and I believe that in future, particularly with future digitalization, many or at least most ... Yes, I should probably say most industrial companies are going to need more STEM skills in their senior executive teams. They're going to need them right throughout their workforces because people do have to understand those types of concepts, mathematics, et cetera, in order to be able to sell their products and do their customer service.

David Glanz: We often talk about how technology destroys jobs and in fact some people find technology a little bit scary. But, it also creates them. So what kind of jobs are emerging right now?

Ros Dubs: Well, I've already mentioned David, the current massive shift towards digitization of our economy. This means that all companies and businesses are going to have to engage many more qualified STEM graduates to be able to stay on top of their game. That's just an example, I couldn't quote the profession of data scientist. This is definitely in the ascendancy and in fact Australia can't graduate enough of them, which means they can at the current time, name their own price in the workforce.

Ros Dubs: But, what is a data scientist? Well, whether you are a supermarket chain or a department store, or online sales brokers such as Amazon, you need experienced data scientists. Who can sift through the mountains of customer data that gets collected and extract from it the information and trends that support decision making. To give customers what they need or want, and indeed to make your own company grow and become even more profitable.

Ros Dubs: If I now talk about the scientific world, it's getting more and more difficult for scientists such as astrophysicists, who obviously examine the universe, to make sense of the many petabytes of data that are collected from their digitized telescopes. The same is true for all the climate data that is collected and the information about ocean behaviors. They all need scientifically trained

professionals to make sense of them and importantly, to pull valuable information from the masses of background noise. Looking even further ahead. Once the challenges of quantum computing are solved and we start seeing quantum computers and quantum communication activity actually being applied to real world problems, who knows where we will end up.

David Glanz: That's an exciting scenario, there's obviously careers which are emerging at the moment. Yet the message isn't getting through to kids in school, boys and girls, but unfortunately it's worse for girls. Why is it that there is a reluctance to engage with STEM subjects at school and even into university?

Ros Dubs: Well, there's no doubt that the number of students studying math, science and engineering has been dropping and that's very worrying. It certainly seems that for various reasons, students aren't pursuing these subjects with any great enthusiasm through to year 12. This is quite surprising because I've already mentioned my belief that chiefly because of future digitization, all companies will need to transform themselves into being STEM underpinned.

Ros Dubs: If I give an example from our own academy, we have operated the STELR program for at least at 10 years now and under this regime, currently almost 700 schools across Australia teach STELR within the science curriculum. STELR employs teaching methods that encourage senior high school students to better perceive and appreciate the relevance of science in their lives.

Ros Dubs: For example, the types of modules that we provide to the teachers are renewable energy, sustainable housing, car safety, chemistry, and climate change. So they're all what I call "Real world problems", that every young person would have heard about and will indeed be concerned about. STELR is working with the education department teachers on that. A major STELR expansion has recently been made into more schools in western Sydney in partnership with Western Sydney University, which is just great.

Ros Dubs: But, I think we can't just do that program and I do think moving the dial on this issue of why aren't enough people studying STEM and particularly girls? I think the issue will also come down to educating parents of the opportunities that their sons and of course their daughters as well, are likely to miss out on if they're not encouraged to study STEM subjects until year 12. Mathematics is perhaps the most important subject here because it is extremely hard to pick up later on.

Ros Dubs: If you look at the pipeline of students who start school in kindergarten, obviously they graduate through years six and seven and rise to year 12, it is of course a cylinder because of compulsory school education. But, the study of STEM is more like a pyramid unfortunately, much narrower at the top than at the bottom. So something needs to be done there. I mentioned STELR earlier, but currently we only operate that in high schools. However, the academy, has

recently teamed up with a partner on a pilot program to design and implement a STEM education program, as always, aligned to the national curriculum.

Ros Dubs: This would build scientific curiosity, skills and knowledge in year two students, namely in students who are just seven years old. Now, why is that important? Because at that age parents are much more likely to be involved. So if we can excite, for example, the young girls at that age with hands on fun experiments on robotics, or biology, or whatever, they will catch the bug at a time when their parents are still supervising their homework. So parents are more likely to be part of the ongoing encouragement as years go by.

Ros Dubs: So while we can't solve here and now the entire problem of ensuring students catch the bug to do STEM at primary school. There's a lot for departments of education and indeed their philanthropic partners and sponsors to be looking at.

David Glanz: Despite the statistics and the statistics are worrying in particularly the drop in number of students studying maths at school and into year 11 and 12 in particular. There are some who say that the emphasis on STEM education is something of a fad and in fact the people who are pro STEM like yourself and obviously other fellows of the academy, are somehow hostile to the humanities. What do you say to that criticism?

Ros Dubs: I don't think it's has to be one or the other, David. I mean, certainly in my own background I speak three languages and I picked up two of those when I was at school. So it is possible and I think it comes down to the curriculum. It comes down to the teaching methods. There are certain things you can pick up later. Languages, for example, is one that it is best if you do it when you're young as well as STEM. So I am definitely not anti humanities. I think the curriculum has to be a school curriculum, whether at primary or at high school level, has to have a balance. That's certainly what I would always advocate.

David Glanz: You've worked your way up to some very senior positions in industry and in higher education. But, unfortunately women like you tend to be the exception rather than the rule. Why is it so difficult for women to break in to the executive level? Particularly in industry?

Ros Dubs: David, you're talking here about I guess, one of my unfinished challenges and certainly a one of my regrets has been that I had so few female peers along the way. So one of my unfinished challenges is that of what are we going to do to see more senior operational women in industrial companies? I believe the solution there, we must work out how to get more women into what I call "The waiting room", to become CEOs of companies, the c-suite, the so called c-suite. They're best placed if they've already run a business line or have perhaps been a head of a local company, subsidiary of a multinational because they're then part of CEO succession plans.

- Ros Dubs: So executives who run substantial business lines, which deal with customers, they have generally come up through the engineering R&D, or project management arms of the business. In some companies marketing as well, because marketers need to have deep knowledge of a company's products in order to be able to sell them successfully. Which, means they will all have had some STEM training on the way up the corporate ladder. So not having a solid background in STEM areas immediately puts you at a disadvantage, which means that women end up being at more of a disadvantage because there are so few of them who've had that training.
- Ros Dubs: Again, I don't have a silver bullet on this particular challenge of getting more women up the up the corporate ladder. I know that a number of organizations have had great success thus far in getting a greater percentage of women onto company boards. But, to me that's not sustainable unless you also bring them up through the organization. You have to have a large pipeline, obviously all the way up to the c-suite that I've just been talking about. However, I can say that the academy is currently working with the Academy of Science on a decade led plan for women in STEM. You can be sure will have some robust elements in that plan aimed at driving more qualified women into industry.
- Ros Dubs: In the same way that Sage Athena Swan is starting to tackle the cultural barriers for women reaching senior levels in universities and research institutions. I stress, this is not just a matter of equity, it's a matter of proven economic sense that companies perform better when their management teams operate with a diverse set of viewpoints and bring different perspectives. Certainly adding women into those teams does improve that diversity.
- David Glanz: Okay. Well we have to put our money where our mouth is. The Australian Academy of Technology and Engineering, I have to say is historically a male dominated institution. So what's the academy doing to deal with the challenges around diversity and inclusion?
- David Glanz: We, we've done several things, David. We started a few years ago, a Gender Equity Committee. That has now been upgraded to a committee of the board, it is now known as the Diversity and Inclusion Committee of the board of the Academy. It is headed by a vice president of the Academy board. So a lot more focus is going onto it. We have a new policy, we have a new action plan, and over the past few years we have been paying a lot of attention to ... I guess internally you can't tell other organizations what to do, even if you are a national lobby organization unless you're walking the talk yourselves.
- David Glanz: So we have had over a number of years a target of, one third of our new fellows will be women, and we have succeeded that certainly over the last few years. We now have a new target, which is that by 2025 women should comprise 50% of the fellowship and that will in fact be a ... it is a stretched target, if I could put it that way. But, although people have said to me, fellows and others, that this is far too difficult. I think I've proven, certainly because of my scientific

background also, as throughout my life that if you set your mind to it and you have a methodology, you can actually find the people who are needed.

David Glanz: People were concerned that standards would have to be dropped, that is absolutely not the case and we would never do that. Of course, because a fellow is quite a ... it has a particular standard and status in society, and it comes from the contributions that fellows have made. We simply work harder at finding the women as well as, I suppose, more men who, who have also achieved. I believe we look forward to actually, over the years, moving our percentages up of new female fellows.

David Glanz: All right. Thank you very much for your time, Ros. It's been a pleasure.

Ros Dubs: Thank you very much. David. I've enjoyed it as well.

Ros Dubs: (Music).