



COMMONWEALTH OF AUSTRALIA

Proof Committee Hansard

**HOUSE OF  
REPRESENTATIVES**

STANDING COMMITTEE ON INDUSTRY, SCIENCE AND  
INNOVATION

**Reference: Research training and workforce issues in Australian universities**

TUESDAY, 9 SEPTEMBER 2008

MELBOURNE

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**HOUSE OF REPRESENTATIVES**  
**STANDING COMMITTEE ON INDUSTRY, SCIENCE AND INNOVATION**

**Tuesday, 9 September 2008**

**Members:** Ms Vamvakinou (*Chair*), Fran Bailey (*Deputy Chair*), Mr Bidgood, Mr Champion, Mr Cheeseman, Dr Jensen, Mr Johnson, Mr Ramsey, Ms Rishworth, Mr Symon

**Members in attendance:** Fran Bailey, Mr Jensen, Ms Rishworth, Mr Symon and Ms Vamvakinou

**Terms of reference for the inquiry:**

To inquire into and report on:

1. The contribution that Australian universities make to research in Australia, including:
  - The contribution of research training programs to Australia's competitiveness in the areas of science, research and innovation;
  - The effectiveness of current Commonwealth research training schemes; and
  - The adequacy of current research training schemes to support Australia's anticipated future requirements for tertiary-qualified professionals in a wide range of disciplines.
2. The challenges Australian universities face in training, recruiting and retaining high quality research graduates and staff, including, but not limited to:
  - Adequacy of training and support (including income support) available to research graduates in Australia;
  - Factors for graduates that determine pursuit of a career in research;
  - Opportunities for career advancement for research graduates and staff;
  - Factors determining pursuit of research opportunities overseas;
  - Australia's ability to compete internationally for high quality researchers; and
  - Whether Australia's academic workforce is ageing, and the impact this may have on Australia's research capacity.

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**Committee met at 8.37 am****RENSHAW, Professor Peter, Secretary and Treasurer, Australian Council of Deans of Education****ROGERS, Ms Lucy, Executive Officer, Australian Council of Deans of Education****WILLIS, Professor Sue, President, Australian Council of Deans of Education**

**CHAIR**—I declare open this committee being conducted by the House of Representatives Standing Committee on Industry, Science and Innovation. The inquiry arises from a request to this committee by Senator the Hon. Kim Carr, the federal Minister for Innovation, Industry, Science and Research. Written submissions were called for and 105 have been received to date. The committee is now conducting a program of public hearings and inspections. This hearing is the 12<sup>th</sup> for the inquiry. I welcome representatives of the Australian Council of Deans of Education to give evidence. Although the committee does not require you to give evidence under oath, I should advise you that these hearings are formal proceedings of the parliament. Consequently, they warrant the same respect as proceedings of the House itself. It is customary to remind witnesses that giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. We thank you for your submission and now welcome you to make a brief opening statement before we proceed to questions.

**Prof. Willis**—Thank you. I would like to thank you very much for the invitation to give evidence today and to discuss further with you our submission. High quality educational research, we believe, will be a critical component of the Australian government's efforts to deliver the education revolution which we hope will result in the best possible education system in the world and a socially and economically engaged community. The significance of educational research, however, extends well beyond the schooling sector. For example, COAG's national reform agenda has two planks—education and health. Clearly, in delivering the first plank—education—educational research is critical. But any sensible reading of the COAG agenda for health suggests that educating rather than medicating is likely to be effective there as well.

High quality educational research is needed both within and beyond the formal school sector. Faculties and schools of education in Australian universities produce the great majority of educational research in Australia. They do that very well by international standards. Indeed, Australia leads the field of education in terms of its international rankings of productivity. While this is good news and we would like to rest on our laurels, we know we cannot. It is not good enough. It needs to be better. In fact, nationally and internationally we need to do a better job in producing the kind of sustained and programmatic educational research that systematically builds a body of knowledge rather than reinventing it. This, of course, requires talented researchers who are able to devote extended periods of time to developing their knowledge and their accumulated evidence base around particular problems. It cannot be done in 10 months or a year or even five years. It takes a career. If we are to enhance our research capacity and productivity, we need well-prepared people entering the research workforce at a sufficiently early age that they can dedicate sustained and substantial periods of time over their lifetime to developing their skills and knowledge.

There are, however, serious capacity problems facing us which may inhibit our capacity to even maintain, let alone improve, our research productivity. Firstly, we are an ageing profession. I do not need to tell anybody here that teacher education and education generally is the oldest profession in higher education. Secondly, the age of our average doctoral student, at plus 45 years of age, is some 15 years older than the nearest competitor. Given that most of our students are also part time, that means that by the time they graduate, the average doctoral student is 50. Thirdly, the majority of our research candidates will have had a four-year initial preparation which will not have included an honours degree because of the professional requirements. So they will leave university already four years prepared, need to get professional experience but not yet have the honours degree which would give them access to a research degree. So for them the pathway can be often long and torturous. At a period when they have got their most significant professional demands and often also their most significant family demands, they are having to pay in actual cash and spending a lot of time getting ready to go into research degrees. So once they are in the research degree, that is fine, but it takes a while to get there. We believe that we need to find more attractive models to encourage education and other professionals into research pathways at an earlier age so that our productivity can increase.

We are committed to continuing to provide part-time and distance research qualifications for many of the professionals who want to enter our field but are in work. Nevertheless, we do believe that induction into a research culture is a critical part of increasing productivity. I am going to pass over to my colleague, Peter Renshaw, to comment on that.

**Prof. Renshaw**—Thanks, Sue. I guess Sue and I entered into academic life in the late 1970s and early 1980s so we have a sense that the whole group of educational researchers have sort of grown old with us as we have moved through. So there is this sense that when we came into academic life and into research, it was a young place. We were looking forward to 20, 25 or 30 years as researchers and building our research programmatically over a period of time. Certainly now when we go to national conferences you get a sense that there is not that same young generation coming through. I think this contrasts with my experience, at least in Europe. If I go to education learning conferences in Europe, you see many young people—cohorts of young people—coming through in their 20s and 30s. They are entering into research and research training and developing themselves as researchers. So I think there is this real sense that we need to develop younger people in educational research.

As Sue was saying, typically PhD students in education are over 40. Many of them are over 50. Many of them are part time. So you do not get a culture of research developing within faculties of education because the people are not necessarily on campus. I guess the nature of research itself is not really an individual enterprise. It is actually a group enterprise. It means that you need to develop communication. You need to be around other people. You need people at different levels of development. So the honours students, the PhD students, the postdoctoral students and the early career researchers coming together is where you get innovative ideas. That is a vision that we have. We would like to see policies put in place that enable that kind of culture to develop and to be re-established in Australia.

I think as deans of education we are in an interesting situation here. On the one hand, we can point to evidence to say that education researchers do a good job, that we actually perform very well internationally and that comparatively within Australia we perform well. So we are saying

that we are doing a good job. But really I think it is this ageing group of people. We are looking for renewal at the younger age groups.

**CHAIR**—Any further comment? Thank you. My apologies for being late again. I will start. You have raised a couple of issues that have been raised with us before. Certainly there is the whole issue of an ageing academic population right across the board. It seems to be the case in non-academic sectors as well. That sense of rejuvenation is critical if we are going to continue to be able to develop. We have had a number of discussions in the course of our hearings about PhD students, especially in teaching. It has come up because in evidence given to us in Queensland, one of the academics there was of German background. She talked about her experience in Germany and then went on to say that most of her teachers while she was at school were actually PhD qualified. Obviously this is an issue that is now becoming something to think about in terms of training teachers at secondary school anyway. Are you aware of the number of teachers in the school system we may have in Australia who have higher degree training?

**Prof. Willis**—Actually, I do not at my fingertips have that statistic. That sort of statistic is available, but I do not actually have any idea of that. I think you probably would find that there are a very high number who have master's level qualifications and even a significant number who would have master's level qualifications that are technically research degrees. I know quite a number of our own students do one and a half year research degrees. But I do not really know how many teachers have research qualifications. Quite a number of principals do.

**Prof. Renshaw**—The typical thing in teaching, I guess, is for coursework doctorates and coursework master's degrees as part of professional development. Certainly principals are being encouraged to do further study. A lot of them would be doing professional doctorates as a route.

**Prof. Willis**—I think there is actually—

**CHAIR**—I do not mean to put you on the spot. It is just that it is something that I am sure other committee members tell you. It has just occurred to us that when we talk about how you develop and encourage this generation to go forward, with all the impediments and problems, you have to find alternative pathways.

**Prof. Willis**—One of the reasons we have a problem in higher education at the moment is that in the period of the late 1980s and through the 1990s, pretty much almost immediately following the introduction of full fees for postgraduate studies, of course, teachers were not in high income brackets and they could not get tax deductions for them. In fact, I believe that systematically education systems around Australia withdrew support for people to engage in higher degree research. So it became trendy to say, 'That's all academic stuff and what you really need is grassroots, local kind of professional development that helps you deliver tomorrow.' When I was a young teacher, if I got a higher degree, I went up an increment. That was all withdrawn. That all disappeared. There was almost a conscious rejection of the academic view of schools. So there is a group of people who now would be between maybe 35 and 50 who did not get higher qualifications. Now I think that is shifting again. Around the country, systems are starting to say, 'Our leadership needs master's degrees. Our young teachers who are going to be the leaders of the future need to be in environments where they think differently from the way we think.' So there is actually almost a revival of that interest in higher degrees, but it is not coming through

yet. It sometimes takes a decade because it is right at that critical period before they get that master's qualification and so on.

**CHAIR**—I agree with you. We are trying to ascertain just to what extent government policy and funding itself is responsible for what appears to be a declining interest in research right across the board amongst younger people. You try to look at it from a sociological point of view and work out whether lifestyle and expectations are different and they do not quite fit in with slogging it out at university on virtually nothing while others are doing extremely well in other prosperous employment sectors. So in trying to understand that, you have raised a very important issue about almost consciously withdrawing because it was a case of having to pay to get those higher degrees. Now you are suggesting that it has turned. They are still paying, but the demand from industry and the new way of thinking is higher qualifications.

**Prof. Willis**—Where I think it has turned is that I still think many teachers find it a big ask to ask them—

**CHAIR**—Especially if they are not going to be remunerated accordingly afterwards, yes.

**Prof. Willis**—Well, they are not going to get any extra remuneration. If they get a HECS based place—a Commonwealth supported place—it is not tax deductible. If they pay full fees, it is. They have to make a choice between basically buying a new couch for the kids or investing in this. That is the choice if you have a young family. So it is actually a big ask for them. It is not supported generally. Where it is supported systemically, it will often be supported through developing partnerships with universities and delivering at a slightly cheaper price or the system will provide a bit of relief. That is helpful. But there has to be a culture which says, 'We value different thinking. We value the fact that you come back with an odd idea. We cannot even see how it applies at the moment but in a year or two years suddenly you will be the person who has created new stuff for us.' I will give you an example. In my faculty, we had at one stage enrolled in education 130 police officers. What they kept saying was, 'We don't want you to teach us to be police. We actually know how to be police. We're not going to come to you to teach us how to be police.'

**Prof. Renshaw**—We are paid for it.

**Prof. Willis**—That is right. Yes, exactly. What they kept saying was, 'Our minds are spinning. Our minds are working overtime.' That is what we need. That is what I think schools need, yes.

**Prof. Renshaw**—I will make a comment. A lot of education academics have been teachers. I was a teacher. Sue was a teacher. So you are thinking about a career path. Are you going to stay in teaching or are you going to sort of move into the academic realm and become a researcher within that? I guess what we are looking at is that gap. There are not as many young people coming into the research profession, if you like. The interest of the system is not necessarily to facilitate that. For example, we have a Master of Public Education just starting up in Queensland. It is a joint enterprise between Education Queensland, Queensland university, QUT and JCU. But the interest of running that program both at master's and doctoral level is to help the system. People are coming in to upgrade their qualifications but to stay within the system of education and schooling. So what we are looking at is those people who want to move into a career in research full time. But actually the salaries at the levels they are coming in—which is

level A, or postdoc, or level B academics—do not match up to what they are getting as teachers. Most people who would make that move drop \$10,000 to \$20,000, so there is a disincentive to actually come in to be a researcher.

**Prof. Willis**—Interestingly enough, when I became an academic, I dropped \$5,000 in salary from being in a school to going in as an academic. But I was a single person who could make that conscious decision. I was not deciding, therefore, that the kids cannot do this or my partner cannot do that. So it was actually possible for me to make such a decision. But it is not possible for lots of people to make a decision to take that kind of drop in salary even to be employed. So I am not talking about that kind of drop in salary to go into the research degree. You assume you are not going to have as much money while you are studying. But this is actually after I got a PhD. So I went from teaching. I had a PhD and still entered. Now that is actually very common, but we have to find some way to make it a practical reality. My view is that, if we had more people from both the school sector and the non-school sector see research as something that enriches their own life and their professional practice, some of them would become researchers of the future in academic institutions. Some of them we would like to identify early because we have a problem. But for some of them, if the kind of research thinking is more widespread, it both enhances professional practice and generates people who want to focus particularly on becoming academics and researchers.

**CHAIR**—I agree with you. I cannot help thinking, just listening to you speak, that it is interesting that you want to take teachers out of the classroom and encourage them to come into research. Certainly I was thinking about how you get them into a higher degree and back into the classroom. Ultimately, that is the key. The culture you talk about has to be fostered early. I have the view that we have a generation that does not value further learning because they do not see any value in it. It is not lucrative. We are living in a time when our values are different. Certainly for this generation of young people, having to convince them to do research in whatever area it might be is very, very difficult. It is not being fostered at a very, very young age. People say, 'People make a decision when they are undergraduates.' But they are the very few. If you are talking about a critical mass of people, you have to start very early. I just think that we really do not see a money value in research. I could be wrong, but I see this in other areas. Doctors today are too busy to work like the doctors of a generation ago. So there is a problem there with GPs not wanting to work 10 hours a day. Everyone has this idea of a lifestyle that has to fit in with what they are doing. That is interfering with the traditional way of doing things and the expectations.

**Prof. Willis**—In my graduation address, in one of the welcomes that I do to students all the time, I draw an analogy between good professional practice and good research practice. I talk about the fact that good research thinking makes you restlessly critical and constantly asking questions. I tend to agree with you. One of the problems is that we confuse what we call evidence base with being research oriented when they are not the same thing. Very often when people talk about being evidence based, they actually think of evidence as something that is still, that just sort of exists out there—'Oh, we get that evidence and then we've got best practice.' I say there's no such thing as best practice. There is only best at the time, there is a whole range of best practices and there is practice that is informed by critical thinking, by constant querying, by questioning and by evidence. But there is not this thing out there that is the evidence and then we will all practice. If that is your view of professional practice, then you are confusing being a technician with being a professional. So I actually agree with you that it is that orientation to

constantly questioning your own work, to having an orientation which says, 'When I ask a question, the answer might be no, this does not work.' It is not always looking for confirmation that what you are doing does work, which of course is a human tendency but not a very helpful one. So I think you are right.

**Ms RISHWORTH**—I want to follow up on one of those points. The concept that you are talking about is one that a school is trying to explore in my electorate, where they actually can facilitate higher research degrees in the early learning centre. It is more about early learning. Students come and do higher research degrees at the early learning centre and vice versa. Obviously there are a number of barriers to that. Being able to go part time is one of them. A lot of those teachers want to work at the same time. So there is that interconnection between practice and their research, and that is the best way to generate ideas. I was just wondering if you are able to elaborate on any other barriers that you see in terms of things that could change within the system about the PhD or about the master's that would allow for that sort of connection between practice, research and being able to meld those together a little more.

**Prof. Willis**—I am hesitating here because in my own university and in my colleagues' university we are engaged in a whole range of things which we think actually meld research practice and research very closely. I can give you an example of one of the local schools near my university. We have 18 research master's students from the same school enrolled in a research master's program. They are all studying problems that are associated with the fact that they have got a refugee community with a whole range of literacy issues. So they are all working on projects that will enhance the productivity of that school but at the same time they are getting a research qualification. We go to them rather than them coming to us, which means that they can meet at four o'clock and not be exhausted and all that sort of thing. That has lots and lots of strengths. That is, I think, doing exactly what you want it to do. We also have a partnership with the Catholic Education Commission, where teachers in five schools are enrolled in our master's degree and are all working on issues regarding the inclusion of kids with special needs. That has been happening for years. We have a linkage grant that has funded part of it. So we are doing that. That is actually critical.

Interestingly enough, I think that is what we are doing well at the moment. To draw it back to the other point, the thing we are not getting is the next generation of academics who are going to be able to do that. Actually if we want to improve what goes on in schools, you also have to have a higher education sector that can feed that. To draw it back to the issues that obviously as the Australian Council of Deans of Education we are finding critically important, we think in order to do this, you have to have find academics who are actually able to be critical friends to those teachers in those schools and who are able to bring the world to them through the knowledge that they have rather than have everything be reinvented. The risk is that this school over here with its 15 teachers will discover the same things that this school over here with its 15 teachers is discovering and this group over here with its 15 teachers is discovering. Now each of those would be becoming oriented to thinking that way, and their own practice may be improving, but we are not taking forward systematically sustained research that builds on top of each other. What we are doing is using it as a learning ground for all of these groups, but the field is not going better. So nationally and internationally we are relearning over and over again. Every school is using the discovery method, in a sense. We have to as a field also move forward. That requires sustained cumulative research that draws on the best in the world.

**FRAN BAILEY**—I want to follow up there. It is fascinating listening to you. You should know that both the chair and I are former teachers.

**Prof. Willis**—We did our homework.

**FRAN BAILEY**—So you are almost preaching to a converted audience.

**CHAIR**—I would be rewriting the curriculum if I was going back into the classroom now. I am not teaching and I can tell you it would be more interesting.

**FRAN BAILEY**—I want to ask you about some specific recommendations that you have made in your submission. It occurs to me, in listening to you, that we could make recommendations that achieve some quite revolutionary ways of funding and changing aspects of pathways into higher education. But I think part of the problem that you have is that education is actually not sexy for a lot of younger students. I appreciate that many of the students, as you say, are mature age and meeting almost a demand of their profession throughout their professional careers. But surely is not the name of the game to attract younger people? As the chair was saying, if we as a nation are to deliver the best for our people in the future, we have to have the best and the brightest teaching our children. That is an aim that really we should be doing everything possible to achieve. If that is our aim, what do we have to do to attract more young people to not only follow a teaching career but also follow it up with higher degrees? It is almost like a change of culture.

**Prof. Willis**—Well, how blunt do you want me to be?

**CHAIR**—Carte blanche.

**FRAN BAILEY**—You have the opportunity.

**Prof. Willis**—Well, I am going to say something.

**CHAIR**—We want real things to respond to.

**Prof. Willis**—I am going to say something. I would not exactly say that it is evidence free. I would not be able to provide you with statistical data to establish this. I suspect there are not many deans in Australia who have been around for more than 10 or 15 years who would not say there are cycles in applications into teacher education. To be absolutely blunt, when politicians and the media talk up teaching, our applications increase and the quality of our students increases. It becomes the subject of first choice. When politicians and the media slam teachers, young people think, ‘Why would you want to go there?’

I will be blunt about this. I can almost track year in and year out with the media and the stories that are told about teacher education. To be perfectly blunt, why would somebody go to a party where people are going to kick you? That is not the sort of party you want to go to. Why would somebody want to join a profession that is constantly denigrated? Why would a bright person want to join a field where everybody says, ‘All the students that enter are illiterate?’ You immediately become part of a crowd you do not want to join. So it does not actually help when we do not talk it up. When we talk it up, we get an immediate impact.

I would be perfectly happy to show you. It is public data, but I have analysed it separately. If you look at Victorian tertiary institutions between 1998 and 2004, you find that the ENTER just increased, increased, increased, increased and increased. In the mid-1990s, teachers were constantly being slammed. Around the turn of the century, all of a sudden they became heroes again—Australia's unsung heroes. All of a sudden the ENTERs in my institutions were 10 to 15 points higher than they were a decade ago. This included the rural campuses. It just increases. In every university—I have all the universities—the distributions are different. We have to be honest about that. But in every case it went up. So the university that has the lowest ENTER students has students who are entering at the same rate that the highest ENTER institution was 10 years ago. About two or three years ago, what happened? The story changed. Suddenly teachers were again the enemy. They are the problem again. What has happened? It has started to soften. We have having difficulty now.

What we want is, as you said, very high quality people making it a career of first choice. That is the critical thing for us. A person who puts teaching first is a much better bet than a person who puts every other thing and by the time you get to the fourth thing they are in. So we want them to make it the career of first choice. I think working conditions and all of those things impact, but actually it is the working life that impacts, not just the salary. Teachers are not actually that badly paid by comparison with some other fields that attract people. But they have to feel as if they are respected by us, even my own colleagues. I am stunned when teachers talk the profession down and when academics talk the profession down. Why would you want to join that club? I do not know.

I believe that teaching is a heart job. We have longitudinal research about what attracts people to teaching and what keeps them in. It is almost always heart. When you unpack it, it is heart. They actually really want to do something that is worth doing.

**FRAN BAILEY**—I want to follow this. This is not a theme that we have actually touched upon previously at all. It stuns me that with our university entrance scores education does not require a higher score. This is not the purview of this committee, but let us tease this out a bit. If the entrance score were higher, in your opinion, would that make it more attractive for students who are more likely to pursue higher degrees? Would we have a higher likelihood of people wanting to pursue research in education? You know as well as I do that one of the criticisms is that the score is lower to get into education. There are some students who see that as simply as a means, at times, to get into uni and change into another course. They use it as a means to get into another course. I take your point about first choice. But if we are to really be serious about that, should we be looking at changing that entrance level?

**Prof. Willis**—First of all, there is a kind of a theory that the higher the ENTER, the more applications you get because it becomes prestigious. I do not think there is actually any doubt that that is the case. Certainly those people who are in a position to have a choice, so to speak, will often manipulate their ENTERs in order to make sure that it does not dip below a certain level. If it gets too high, you do not get them because they think they will not get in. So the manipulation of ENTERs is actually alive and well out there, I have to say.

On the other hand, very often what appears to be very lower ENTERs will be one student or two students. I will give you an example of that. I have a floor on my ENTERs. We have a floor. We will not take anybody below 75. In some of our programs, 88 and 89 is the NTER. So it can

be a lot higher. But we have a floor. But we had a student who was a maths student who had done maths all the way through school and had put down mathematics teaching as their subject of first choice. What they wanted to do was be a maths teacher. They had an ENTER of 73. With equity points, they could get up above 75. Did we take them or not? We had to seriously ask the question: do we want to publish an ENTER that low? So we were exactly in that game of saying that an ENTER of 88 looks altogether different. If Monash University has an ENTER of 88 on its teacher education, it looks like prestige. Do we take this student that the system needs? We need maths teachers and we are constantly being exhorted to take maths students. If we were to fill all of the demand that the state has for maths teachers, our ENTERs would be a lot lower. We could fill the place were we prepared to go down.

So my view is absolutely that we want strong ENTERs and absolutely the effect in the long run—in the short term you have problems—is that when you raise the ENTER, you also raise the number of applications. But that is in the long run. In the short run, we have whole rural communities that survive on the fact that their local university does teacher education and that for many working class kids this is their way into higher education. We have whole areas like mathematics teaching and other areas where we need desperately to fill the places. We have, for example, 500 new places in early childhood education this year and for the next two years. We have institutions that have been admitting students with very low ENTERs into those programs because they are so underpaid. If we suddenly raised the ENTER, we basically just would not get the students. Now that may be true of every university. Some universities are more comfortable in that respect than others. But rural universities and some universities that cater for the western suburbs, for example, would find a great deal of difficulty, at least in the short term, in attracting people. So there are complications.

**Prof. Renshaw**—It varies across universities. In the University of Queensland, our degrees are dual degrees. People come with a degree already into a DipEd. The ENTERs into education are no different than ENTERs into science or arts or anything else. The issue about quality is not clear.

**Prof. Willis**—In fact, in my institution, the ENTERs into education are consistently five to seven points higher than the ENTER into the other degree. So the ENTERs into science and education are six points higher than the ENTERs into science. The ENTERs into arts education are eight points higher than the ENTERs into arts. Other institutions are not in as good a position in that regard.

**CHAIR**—I have been out of the game a while. My understanding is that a considerable number of secondary school teachers are still going through a first degree, whether it is arts or science, and then doing a DipEd. I did mine here in that way. The ENTER score for science and arts in various universities would be much different. It would be higher, would it not?

**Prof. Willis**—This is the point I am making. In my university—

**CHAIR**—The point I want to make with this is that the perception is that the entrance score for teachers is really low.

**Prof. Willis**—These people have already got degrees.

**CHAIR**—But it actually is not. Because somebody could get in and do science at 88.8 per cent and then go on and do your BEd. So their original entry into higher education was at a very high level.

**Prof. Willis**—Whatever the ENTER is, it is a sign. For example, most universities, when they have double degrees, do not allow you into the double degree with a lower ENTER even though there is a story around that people use education as a back door way in. Because that myth is so prevalent, the other faculties protect themselves from these apparent education people who are going to lower the tone. Basically, therefore, they require that you cannot get into the double degree with an ENTER lower than either of the degrees. So the double degree ENTERs, which are all the teacher education students, effectively, in secondary have to have a higher ENTER than either of the component degrees.

**Prof. Renshaw**—I do get the sense, though, that we are in a different committee in some sense. This is important, but it is not actually totally relevant to the issue of research and research training.

**CHAIR**—No, it is not.

**Prof. Renshaw**—Research in education is importantly about schooling and schooling processes, but it is much broader than that.

**FRAN BAILEY**—And it is important that we have a well-rounded and contemporary understanding of the issues.

**CHAIR**—It is important also because we are trying to ascertain if the problem of the lack of research at universities is a money problem and that is all it is. That is why we tease these issues out. Then you can say, ‘Right, here’s \$10 billion. Go away and prosper.’ But the reality is that it may not just be a money problem. It may have broader areas that need to be addressed rather than just the specific ones. I think schooling is important. I do not know how you engender the culture. Culture is just as important as the money. That is why we do it. No, it is outside our terms of reference, admittedly, but it is interesting. I will not go into the public and non-government schooling debate, where teachers get slammed as well.

**FRAN BAILEY**—I have some other follow-up questions, but Dennis is champing at the bit.

**Dr JENSEN**—I have a couple of questions. First of all, you were talking about people going into postgrad education. It is sort of a lifetime thing. It is not like, for instance, in many cases, a science degree, where you go straight from your honours degree straight into a PhD. You were also talking about the issue of the lack of honours being a problem. Both of those seem to be a problem for education research. How do we address it? There is the issue of the lifetime. You are wanting people to go in younger and yet you are saying there is this lifetime component before you become the researcher. Those two seem to be at odds with each other. How do we address the issue of honours? I have another question following that.

**Prof. Willis**—I think I have probably confused you in saying that. When I say it is a lifetime thing, what I am saying is not that it takes a lifetime to become a researcher. What I am saying is that a researcher who has had 10 or 15 years working on a whole constellation of problems that

affect each other is now a more productive person. They are able to lead the next generation. We are not saying that it takes them that long to be a researcher. But we are saying that if you are, say, 30 or 35 when you enter research, you have 20 to 25 years to develop your thinking and to build sustainable research outputs. If you are 55 when you enter your research career, you are going to have retired before you have reached your peak. To be blunt, we probably cannot afford in universities to be investing in 55-year-olds who are just beginning their research degrees. We are saying that if somebody is a teacher and they do three, five or seven years or whatever as a teacher or work in some other field that is not necessarily teaching and then enter their academic career, they both have an experiential base to work on and they have enough time to do the kind of research that may make a difference nationally and internationally to the way we think. That is what we are saying.

**Dr JENSEN**—There is the issue of honours versus obviously the equivalent for the education stream, which is a DipEd. How do we get around that impasse? How do students who are going into education research get something like an APA?

**Prof. Willis**—Well, at the moment they do master's qualifications. That is what they do. A great many of them do a thesis that is the same length as an honours thesis. It is usually a semester's work on a thesis. The great majority of teachers would do a master's qualification.

**Dr JENSEN**—So it is like the Bologna system?

**Prof. Willis**—Yes. It is not unlike the Bologna system. Basically, it depends on the institution. In my institution, it is full-time equivalent 18 months, which means it takes them three years part time. In Peter's institution, it is one year.

**Prof. Renshaw**—We have one year. So essentially it is one semester of coursework with research training in there and one semester of a dissertation. So it is equivalent to an honours year. If there were some way to support people—younger teachers, I guess, we are thinking of—who wanted to come back and do a research master's, that would be the ideal. But there is a tension between the interests of the system and the interests of developing the research workforce. The system does not necessarily want to lose that person. I think there are differences. I am totally on the side of researching your own practice and research as part of teaching, but there is a group of people who need to build a research career, an academic career. That is the group we are looking at. We hope to find some way to support however many people who want to come back and do a research master's, the equivalent of an honours year, and then move on from there.

**Dr JENSEN**—I have one final question.

**Ms RISHWORTH**—I just want to ask whether they get income support and do they have to pay upfront fees for that one year that is sort of equivalent to an honours year?

**Prof. Willis**—Yes.

**Ms RISHWORTH**—So they pay upfront fees. In honours you do not.

**Prof. Willis**—Sometimes.

**Prof. Renshaw**—It is varying a bit now. Commonwealth supported places are being used to support coursework master's.

**Prof. Willis**—In some places.

**Prof. Renshaw**—In some places. There are scholarships that universities will give to relieve the upfront fee. So the practice varies.

**Prof. Willis**—I think the number of scholarships would be very modest. Mostly they would be doing it part time. The majority are still paying upfront fees.

**Ms RISHWORTH**—So that is quite different to honours in other disciplines—that honours year?

**Prof. Willis**—No. The honours is a little different. The master's is what I was talking about there. In the case of honours, there are only about 150 honours students in education around the whole country. Usually it is very small numbers. Often they are provided with some sort of income support, not including a scholarship.

**CHAIR**—Dennis has one more question. We are running out of time.

**Dr JENSEN**—Yes. I realise that. I notice the issue of science and science teaching pathways. One thing that interests me is that I had a parliamentary intern last year. He came up with something quite profound. I was asking him to look at why the number of students wanting to do science and maths these days in higher education has gone down. The profound statement he had was that when he read the literature about science education, it was fundamentally about teaching about science rather than teaching science. Could you comment on that issue, please, because I see that as something very important.

**Prof. Renshaw**—I think science educators—people who teach science method in faculties of education—have been emphasising this for a generation. Science teaching should be about inquiry, not teaching about science. It is enabling students to become scientists through inquiry methods. Of course, a lot of good teaching is going on. It is not that there is not good teaching going on. I have been out in schools in the last 18 months as part of a research project looking at teaching in secondary schools. You see excellent science teaching going on. But you see a lot of boring lessons, where it is just teaching about science.

I think the problem with science partly is the growth of the health sector. The health sector is massive. If you look at science faculties around Australia, they are losing market share to people who go and do health related degrees—semi-professional and professional degrees in the health area. So whilst health is expanding as a sector, straight science at universities is contracting. I think part of the problem with science teachers is the whole area. You can earn so much more money in the health sector than in the education sector. So people who might have come in to do general science degrees and then go on and become science teachers are now going in to do health related professional degrees and becoming health professionals. If you look at the investment in health versus education, I think you can see why that shift is happening. That is why we say it is not just a matter of medication. It is a matter of education.

**Prof. Willis**—Interestingly enough, I was actually talking to the deputy dean of the faculty of medicine in my institution only last week. He was actually making a comment, interestingly enough, that was agreeing with what Peter was just saying. He was saying that the problem in medicine is that we cannot actually get the benefactors or the grantees to grant us the funds to do the things we need to do, which is health education. What they want to do is point at a disease and a cure. He said, ‘If we can’t name the disease, we can’t get the money.’ It was quite interesting because here I was thinking, ‘Oh, health gets all the money and education doesn’t.’ He was saying that, within health, education does not get any money either; only the disease does.

**CHAIR**—Thank you.

**Mr SYMON**—I suppose the theme of this morning has pretty much been about money. I sort of want to step back into that. I am disturbed that to move from teaching back into academia, as it were, there is a pay drop. I actually wonder that you get anyone come out of that when it is as substantial as \$10,000 to \$20,000 per annum. I come from an industry where there is a set rate of pay. It did not actually matter how much extra study you did; you got a nice certificate to put on the wall. I have quite a few of those. But when you turn up and you do your work, even though you have all that extra knowledge, you are not valued any more highly than the person you are working next to. My question goes to teacher salaries. Should there be a progression with more knowledge? Especially in terms of postdoc fellowships in universities and the support that is given to them and the number of them that are available, are you having trouble getting people to come across (a) because of the salary that can be offered, (b) because of the number of positions or (c) a combination?

**Prof. Willis**—All of those. I was actually complaining to Peter this morning about my salary bill. Basically, as you know, even though we are part of the public sector, we do not get salary supplementation. So if we pay more salaries, it just comes out of the same amount of money. The amount of money that a teacher education student gets, the average income, is less than a secondary school student in Australia. Out of that we also fund our research. So we fund both our research and teaching out of the funding that comes through the students. So basically we cannot afford to pay more. There is no doubt whatsoever that we have a struggle in attracting people in at the levels that their academic qualifications would warrant. Their professional experience we value. We want that thing, but if you have somebody you are paying at a lecturer or senior lecturer level, which is what you would have to pay them to match salaries in schools, and they have not yet got a PhD and you are going to have to invest for six or eight years with them having a teaching load but no research load because their research load is getting their qualifications, that is actually a big ask. We do find it a struggle; there is no doubt.

There is even the level of postdocs. In my institution, we decided to put all the money that we had earned through contract and consultancy work into providing five postdocs. The level at which we could afford to pay the postdocs meant we either attracted a baby—somebody who was 20 and prepared to eat spaghetti every day—or people who had already raised their kids and had families and were almost retired and, therefore, were prepared for this as their time. Do you know what I mean? This was the time that they were investing in the love of their life—‘I always wanted to do this.’ The people in the middle—the people between 25 and 45 or 50—we could not attract on that level of money.

**Prof. Renshaw**—I think part of it is the lifestyle issue. I think people are prepared to come in with a salary drop as long as they can see a career pathway that will lead on to better things later. I think that is part of the issue. I do not think it is just the money issue. When I say they drop \$20,000, you are probably talking about somebody who would have been a principal in a school coming in as a senior lecturer or a head of a department coming in at a lower level. Because the people who are really good are the ones who are making the jump into academic life, they are the ones who are dropping. But I think people are prepared to do it because, I guess, they are interested in this academic life itself. But if they can see the career pathway, I think that is part of it.

**Mr SYMON**—We have heard previous evidence in this committee about the extremely low number of teachers with PhDs actually still involved or who have ever been in the profession in Australia compared with other countries. Germany is certainly an example put up.

**Prof. Renshaw**—I would like to see the evidence on that. I am not convinced that that is the case. The example that we know is Finland, where a master's degree is a requirement. But I have never heard of a teaching profession where the majority of people have PhDs.

**Mr SYMON**—No, not the majority. Just a much higher level. It is about 9 per cent.

**CHAIR**—A tendency, I think.

**Mr SYMON**—Nine per cent.

**CHAIR**—When you look at the number of PhDs per capita in Germany compared with Australia, it is much higher.

**Mr SYMON**—So not a majority. Certainly not that. One of our aims is obviously to encourage that greater level of learning, to actually be out in the school as it were. It is also then competing against the research purpose in a university setting. Any suggestions on that one?

**Prof. Renshaw**—We have a number of PhDs in our DipEd this year. I think there are three. But they tend to be people who worked as research officers. There was not any career path so they decided to come into teaching. So I do not know that it was a career of first choice really. It was because there was not the research funding to sustain them in their research that they came into teaching. Whether a PhD is good preparation for teaching is another issue, I think. It can be very specialised and so on.

**Prof. Willis**—It is interesting because there are two different kinds of PhDs, obviously. There is the PhD who is maybe the mathematician or the physicist or the historian and decides to become a teacher and then there is the teacher who decides to do a PhD, which is likely to be in education and who stays in teaching. They are obviously quite different clientele, so to speak. I know I had three or four of my ex-doctoral students never ever plan to leave the classroom. I think they might have been a deputy principal or they might be in schools, but that was not why they did it. Sometimes they do it for all sorts of funny reasons, including catharsis, but they did a PhD just because that is what they wanted to do.

**CHAIR**—Which is fine.

**Prof. Willis**—It is great.

**CHAIR**—If you can encourage that tendency, you are lifting the level as well. I do not see why you could not even do it in preschool. That is just a general discussion. I am sorry. We have run out of time. It was a very good discussion. I am sorry if we fell outside our terms of reference. I think when you have to make recommendations, you have to try to understand the context in which you place some of those recommendations. Often they are not apparent strictly within the terms of reference. They become apparent elsewhere.

**Prof. Renshaw**—I just wanted to get back on to a point.

**CHAIR**—That is fine. We have really enjoyed this. Our next presentation is from the Australian Education Union. No doubt we will get right back into the classroom. Thank you very much.

**Prof. Renshaw**—Thank you.

**Prof. Willis**—Thank you.

**Ms Rogers**—Thank you.

[9.31 am]

**GAVRIELATOS, Mr Angelo, Federal President, Australian Education Union**

**CHAIR**—Welcome. Although the committee does not require you to give evidence under oath, I should advise you that these hearings are formal proceedings of the parliament. Consequently, they warrant the same respect as proceedings of the House itself. It is customary to remind witnesses that giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. We thank you for your submission and now welcome you to make a brief opening statement before we proceed to questions.

**Mr Gavrielatos**—Thank you. It was very interesting coming in at the time that I did, when much of the discussion focused on the future wellbeing of the profession and the necessary preconditions, if you like, that one would wish to have achieved in order to continue to attract and retain teachers and, in this case, teachers of science and maths particularly, but it is not restricted to that, in the profession. There has been some debate about this in the last week or two. What we say with respect to issues about attracting our best and brightest young students and making sure that teaching is the first and most popular choice amongst young students is that the only way you increase the UAI entrance, which is the question being pursued by you, is to look at it simply from the perspective of the market. The UAI will increase when there are more people making teaching their first and more popular choice. What we say is to achieve that greater interest and attract a greater number of our best and brightest into teaching, the preconditions that are necessary to do that include not only remuneration, which is a key factor, but also a healthy respect and recognition of and for the profession. It also includes a professional working environment and working conditions. Neither of the latter two are in existence in our schools.

So it is an interesting discussion and one which we would certainly wish to pursue because it is fundamental in terms of attracting the teachers necessary to instil in our students that desire to learn, that love to learn, that inquiring mind and that inquisitive mind, all of which are key features with respect to research and inquiry in Australia. If as a nation we want to become genuinely competitive and successful on the global stage, we must build our own human capital. We cannot rely on continually importing human capital from overseas. That is particularly true of science and other research areas. Similarly, we cannot continue to lose our best minds overseas. So we must build our human capital and attract and retain it not only in terms of the broader field of research and inquiry but also within our teaching sphere in our schools and, for that matter, both in primary schools and secondary schools. So they are the necessary preconditions that I believe are necessary if the nation is going to be genuinely competitive and successful on the global stage.

**CHAIR**—Thank you. I will start off very quickly. I was going to give my colleague Mike the prerogative to ask the first question. He will go directly after me. There are a number of questions I guess we all want to ask you, Angelo. You have talked about needing to build our human capital and not relying totally on importing. It has just occurred to me that I would like to raise an issue with you. In all the submissions that have been put to us, the issue of international students vis-à-vis domestic students comes up. Obviously universities are very keen to be

involved in the international knowledge economy and to be out there competing, which is important. They also want to address what they see or what might appear to be a plateauing of interest from domestic students into doing higher degree research. So we often ask them the question: how are they anticipating to get the balance right between meeting the needs of Australia in an international context but not at the expense necessarily of growing the domestic human capital that you are talking about? I do not know that we have received adequate and specific responses to that question, but it is a point of tension that obviously concerns this committee as well. Do you have some views on that?

**Mr Gavrielatos**—They would be only views because it is not within our purview to comment on those matters.

**CHAIR**—I understand that. We are going outside of our terms in a number of cases. You have raised that as a concern.

**Mr Gavrielatos**—I can certainly say at the outset that that is a question that is better put to university administrations and vice-chancellors and others who are totally focused on the tertiary sector. My understanding, having read recently one of the discussion papers on tertiary education and the future direction of tertiary education, with respect to why we are seeing such high numbers of international students in Australia is largely because universities are cash strapped and they see that as the means by which to supplement their income. That is a regrettable scenario and a regrettable state of affairs with respect to the financial wellbeing of our universities. If you are driven by those economic imperatives as opposed to educational imperatives, that is where you can get unstuck in terms of the balance. That is by way of observation from a keen observer, if you like, of matters pertaining to education.

**Mr SYMON**—Thank you, Chair. My question is an easy one to ask. It certainly does not have an easy solution. One of the concerns of governments of recent years has been the lack of school students coming out with an interest in science and then going into that career. Maths is alongside that. My question goes to whether you think that is a problem that is occurring in early or later secondary school years, or is it a problem that is beyond that? Are we, from a government point of view, not providing a sufficiently bright or well-advertised career in that area, or has it actually been just let go to the point where it does not matter what we say, that there is not an interest there? Could you expand upon that.

**Mr Gavrielatos**—If only it were so simple in terms of the answer. I think there is a combination of factors. I think a lot of it rests with what happened with school curriculums some 10- or 15-odd years ago or 20 years ago, when maths and science were simply not considered sexy, if I can use a populist term. A lot of our subjects were no longer considered sexy. We had a dramatic decline in the number of students participating in the high school spectrum. They were not participating in the same numbers in the sciences, the maths and the humanities, including history, for example. There was a dramatic drop-off in the number of students participating in those subject areas or those disciplines. That is largely because we saw an expansion—this is not uniform across the country, of course, but it is applicable in some ways—of a range of other subject areas that were introduced in the senior curriculum, including computing studies and legal studies. A whole series of studies were introduced in the curriculum, such as business studies. There was the whole expansion of vocational education and training subjects in the higher secondary area.

You only have a finite number of students. When you offer a broader curriculum, clearly the number of courses you can run when you have a finite number of students is restricted. That diversification, if you like, of the total number of subjects and type of subjects saw a skewing or a redirection of students. In an era when the study of subjects and disciplines such as maths and science, modern and ancient history—I could go on—and languages was no longer sexy and something else was being marketed as advancing you in your later life and career in some form of utilitarian purpose, we saw a decline. I think that was a contributing factor and certainly something that I would hope will be the subject of some discussion by the National Curriculum Board as it continues its work in the development of such.

**Mr SYMON**—Would it be fair to say that these more specialised courses—I think you have already said it—have taken away from the more pure courses that were there? Rather than someone going to maths, they may well do computing studies of some form. It may well have a maths component, but that is not where the shortage is at the moment. Is it that there are so many specialised courses that businesses obviously like because they want a person to do a particular job? They maybe do not want the full range, just a piece of that. Is that the problem—that it is employer driven in some way?

**Mr Gavrielatos**—Not so much in the high school area, but it certainly permeates into the high school area. It is certainly the case in the vocational education and training area. We run that risk in this nation if we start to apply such thinking in our high schools and in our lower years in high schools. In our high school years and, prior to that, in our primary years where we prepare our students for high school, we should not lose sight of the importance of a broad and balanced education and a broad and balanced individual. If there is too much specialisation early, we are streaming kids too early and we are losing sight of that capacity to develop them broadly. I think it is an important issue that we should take stock of. Again, the discussion that is occurring around the whole question of a national curriculum can hopefully focus some attention on the importance in that area.

**FRAN BAILEY**—Angelo, we are looking at ways of making it more attractive for people—I should not just say students—of all ages to pursue research. We are looking at the flexibility of models. That includes the financial issue of the amount of the stipend and the length of the stipend to enable those engaged in higher levels of research to attend international conferences. It is just making the whole model more flexible. Have you as a union looked at a similar sort of model as a means of attracting the best and the brightest into pursuing a career in teaching and retaining the best and brightest? Are you looking at much more flexible models? Just as the model that has been there for funding research has been there for quite some time—we believe as a committee it is very timely to look at different ways of providing a new model—similarly have you addressed this specifically with regard to education?

**Mr Gavrielatos**—Absolutely. We approach that issue from a variety of perspectives. The first and the most directly related to what you are saying is in the realm of what we call professional development and ongoing professional development and professional training. There is a strong argument that says that teachers should not only seek but should actually access professional development to continue to keep abreast of changes in terms of their own disciplines. What was held as true some years ago is no longer true as new science emerges. I was taught as a student that there are nine planets. Well, that is no longer the case. There are only eight and a few other little ones. So for people who say that the curriculum should never be contested, it should be

contested because there is new science and new knowledge that informs the curriculum. So as teachers we should always keep abreast of those new developments. The best way of doing so is offering quality professional development. Different models can apply for that professional development, including the capacity for teachers to take a period of paid leave during the course of their career in order to be able to upgrade skills and knowledge and apply them in the classroom. They are important things and I think they would go a long way towards retaining teachers in the classroom.

But something more fundamental needs to happen. I suppose I am deviating a bit from the question you have asked. As a country we need to ensure that we attract the teachers required and in the numbers required to guarantee that in every single classroom across this country, no matter where it is, there is a qualified teacher delivering the same program of high quality to students regardless of geography, socioeconomic status, ethnicity, race et cetera. If we want to be serious about imparting knowledge to students—in this case, the love of learning, in this case, the inquiring mind, in this case, the inquisitive mind, building a love for research—we have to guarantee that we have qualified teachers in front of those kids in those classrooms. That is what I am really worried about at the moment. We cannot really talk about ensuring that every child has access to a rigorous, rich and rewarding curriculum if we cannot guarantee a teacher in front of every classroom. I am not talking about the inner suburbs of Sydney, Melbourne, Brisbane and Adelaide et cetera. I am talking about right across the nation. Without that fundamental resource of a teacher and without the fundamental resource of modern buildings, facilities and equipment, we cannot guarantee that fundamental access.

**FRAN BAILEY**—This does not come under the terms of reference of this inquiry, but let me say I agree wholeheartedly with you. How can we ever expect to retain our top teachers if we send them out to a school where the physical infrastructure has not changed since the 1960s?

**Mr Gavrielatos**—Can I put it to you that it is demeaning. It not only demeans the worth of a teacher—more importantly because as teachers we have become desensitised to it—it demeans the noble act of teaching and learning. It sends some very clear messages to students about the value we place on education. Our buildings, our facilities and our equipment are run down and, in some cases dilapidated. We released a research paper earlier this year by education economist Adam Rorris that exposed what the shortfalls in funding were when it comes to capital investment in our schools. I invite you to select a number of high schools at random and visit their science labs. It is not pretty.

**FRAN BAILEY**—Well, I could take you on a tour of some in my own electorate. I quite forthrightly would put it to you that if what exists in some of my high schools existed in a factory, the unions would close the factory down.

**Mr Gavrielatos**—Are you calling us weak? Is that on record?

**Dr JENSEN**—On the issue of science and maths education, I agree with the point that you are making. You are talking about a sufficient number of trained scientists, science researchers and science educators reliant upon the foundations of knowledge and a love of learning and so on. My concern is that we are very close to getting into a death spiral on this issue with science and maths education. Kids doing science and maths at school will not look at it as a potential further career because they see the teachers themselves, who often these days are underqualified

in those areas. They see the teachers struggling with the subject matter, so they actually end up thinking, 'Well, how hard is this subject? If the teacher is struggling with it, there is no way I want to do this.'

**Mr Gavrielatos**—It is a serious assertion that you are making, and it is true. It is true to say there are many classes being taught by people who are not properly qualified because of the shortage in this area. That is why for a long time we have been saying to governments of all persuasions and at all levels that measures need to be taken—short-term, medium-term and long-term measures—in order to ensure an adequate supply of teachers. But it is not any teacher. It is an adequate, highly qualified teacher. By qualified teachers, what we talk about in the way we define a qualified teacher is someone who has had access to high quality, high standard pre-service and in-service training induction and support. That is vitally important. You establish that as your principle and you then start to build around it your short-term, medium-term and long-term objectives.

In terms of the medium and long-term objectives with respect to your supply of teachers, I think I have already spoken about that in terms of the preconditions necessary to attract and retain. It is pay. It is fundamental. We live in a society where we value what we pay for rather than pay for what we value. For as long as that is the case, as altruistic as anyone who enters teaching may be, there is a pay packet to be measured at the end of the day. So pay is the first thing. But the second thing is the professional working environment and learning environment. We talked about science labs. We can talk about staffrooms as well, but that is another proposition in itself. That is what you do for the long term to attract and retain.

The previous government commissioned an inquiry into the supply of maths and science teachers. Brendan Nelson was the minister when it was commissioned. It was commissioned by Professor Kwong Lee Dow. At that stage there were some silly propositions by, dare I say it, certain politicians at the time. I know it is outrageous for me to suggest the two in the one breath. But some people were saying we should pay maths and science teachers more. The Kwong Lee Dow report showed that that is not what you do because other countries that have gone down that path just created bigger problems for themselves. What you do is lift the salaries and status of the entire profession rather than create problems.

The way you address this in the short term—we know what you need to do in the medium term and long term—because there are shortages, is look at some quite aggressive and well-marketed scholarship programs. It is bizarre in this nation that when state and territory governments introduce scholarships to address teacher shortage areas, the Commonwealth slugs them with an FBT—the fringe benefits tax—of more than 90 cents in the dollar. So when a state introduces 250 scholarships, for example, if they were not slugged with an FBT from the Commonwealth, they could overnight make that 500 scholarships. This is madness as a nation. We talk about a teacher shortage. One way of addressing the issue aggressively in the short term to ensure you have enough supply is through scholarships, yet we are restricting our capacity to do so because the Commonwealth charges a fringe benefits tax on the states and territories. If there is anything you can look at by way of attracting and retaining qualified science and maths teachers, it is a scholarship system. The Commonwealth has to take action in that area once and for all.

**Dr JENSEN**—Angelo, there is another thing that I think your submission has that we have not seen in any other submissions. I think it is actually quite profound and I would like to see further information on it. It is this business of the curriculum and looking at changing the curriculum. I think that is one of the pillars that is actually exacerbating the problem.

**Mr Gavrielatos**—Notwithstanding what the popular press may often choose to do by way of characterising us, what we stand for is excellence and equity for all students regardless of where they are educated and regardless of their background or circumstances. The fundamental in ensuring or driving excellence and equity for all students is the curriculum. The curriculum is the tool of our trade. That is what we meddle in. That is what we peddle. So we need to ensure that every kid has access to the same rigorous, rich and rewarding curriculum. That is not to say that you do not look at different pedagogy in terms of how you deliver it, but it is the same curriculum. People who talk about a different curriculum for some kids as opposed to others basically are arguing that some kids should not have the keys that open the doors of opportunity in this world of ours. Kids have to have access to the keys that open opportunities. That is the curriculum that as a society defines us and drives us. So curriculum is certainly key.

We need to get it right with the science and the maths curriculum and other areas of learning. The inquisitive mind is not only restricted to science teaching and maths teaching. History can develop an inquiring mind and instil a love of research; any subject can. If we properly resource it and provide the resources in our schools to achieve it, then we will go a long way as a nation.

**Ms RISHWORTH**—I just want to pick up on something that the previous witnesses, the deans of education, talked about. Their evidence really suggested that they were very concerned about the academic workforce that teaches teachers. I am trying to tease out what would make it more attractive for teachers to go and follow an academic career. They spoke a little about having to take a pay cut going into an academic career. You spoke about perhaps having unpaid leave to—

**Mr Gavrielatos**—No. Paid leave.

**Ms RISHWORTH**—Paid leave, sorry. I will get that right. Do you have any other insights and can you summarise them? From your experience of speaking to teachers, what things would attract them into an academic workforce and actually ensure that there are going to be in the future teachers to teach the new teachers?

**Mr Gavrielatos**—I suppose you could do that either in a permanent capacity or a flexible capacity in terms of a temporary capacity. I think there are a number of models. There is a discussion occurring nationally around the whole question of a national accreditation system for teacher education courses. That discussion is occurring. There will be further discussion, as I understand it, on Friday as part of MCEETYA. There will be a whole dialogue around quality teaching and a developing, what we are told, a national partnership as part of the COAG process of quality teaching. That is a good thing. That is a good thing if we can come up as a nation with some sort of minimum criteria in terms of teacher education courses and accreditation thereof.

As part of that, you can look at models that ensure that our teacher education courses remain current, relevant and comprehensive enough to deal with the complexities of teaching in this day and age. Can I assure you that teaching today does not resemble at all what teaching used to be

like 15 and 20 years ago let alone 30 and 40 years ago. That said, there was never a golden era. I do not subscribe to a golden era in anything. But it is a much more complex world in which we live. The complexities are born out of social factors that are imported into our schools. I think we need to acknowledge that. Our kids are growing up in a far different environment to what we were growing up. So we have to ensure that our teacher education courses prepare teachers to remain relevant and properly prepare our new graduates for the world of teaching. One way you can do that is build in programs for the secondment of outstanding practitioners into teacher education courses to deliver some of the practical aspects of those courses. That is happening in some areas.

I think we need to look at a lot more cooperation and planning between teacher education courses and the larger employers—our public education systems, if you like—in order to ensure that complementarity and cross-fertilisation as we continue to prepare teachers. That happens in some cases. I think we need to build on that in ways that assist.

In terms of teacher education courses, we need to keep our eye on that. There were some disturbing things said this week, if you like, about teacher education courses. The Deputy Prime Minister, for example, is quoted as saying that she would like to explore shortening the teacher education course, the DipEd year. I would counsel people against such notions. All the research shows that if you look at a pathway of study which looks at an undergraduate degree and then on top of that a Diploma of Education, or whatever it is called from state to state, 12 months is about the minimum. One academic year is the minimum you require with respect to teacher education. What happens in teacher education is a lot of things, such as modules in classroom management, modules in special education, modules in integrating information computer technologies, modules in the methodology of your subject area and modules in understanding indigenous education and the needs of indigenous students. The list goes on. So if anyone wants to reduce that equivalent 12-month DipEd experience, they had better start designating what it is that we do not do with respect to preparing teachers.

These are serious matters that you cannot tamper with. We want qualified teachers. By that we mean teachers who have had access to high quality, high standard pre-service and in-service training, induction and support. We cannot as a nation talk in one breath about emulating Finland, which has teachers with master's degrees, and then import failed ideas from overseas, such as Teach for America and Teach First, where we fast-track people through with five-week training programs. It does not work, folks. Let us be careful what we do with teacher training to ensure high quality and high standards.

**Ms RISHWORTH**—I want to follow up. Do you see a process of that secondment also being able to be used for research and further research?

**Mr Gavrielatos**—I think we can build employment conditions that are flexible enough to allow for that transfer. They exist. If I am not misinterpreting what you are saying, should we expand on them and build them?

**Ms RISHWORTH**—Yes.

**Mr Gavrielatos**—Absolutely. That cross-fertilisation of ideas is a respect for knowledge. It is a respect for intellectual inquiry. As teachers, we respect intellectual knowledge and inquiry. If

that allows greater cross-fertilisation between universities and schools and vice versa, we should do it.

**CHAIR**—I want to pop in here. You said something a little while ago about social factors and a more complex society impacting in the classroom. I agree with you as a parent. I see it. We have been thinking about what it is that is going on in the lives of young people today that is actually impacting on the decisions they make. I find that kids today tend to question more aggressively the relevance of what they are being taught. They are more dismissive than I was ever or my generation. I do not know if it is the generation gap. The reason you talk about that is that that impacts on what they decide to do. So you have touched on it. You have obviously acknowledged it. I sense that it is there. We are here talking to universities. They are saying to us, ‘We want to encourage research. We want to do this.’ I am wondering whether the universities at this level—we often ask this question; I am not sure I have been convinced by the response—recognise what is going on in the minds of schoolkids and in the teaching environment, the very ground that they rely on to actually do what they want to do at this end. That is why we go outside our terms of reference. You cannot ignore that ground. I am not sure that they get it. I know this might be controversial. I do not know. I am not sure that they understand.

**Mr Gavrielatos**—Far be it for me to comment on what our colleagues in the tertiary sector know or do not know. I think what Amanda has touched on is very helpful. If we expand and build the links between teacher education at least and schools and see a greater cross-fertilisation, then there will be a greater currency. We will be trading much more in terms of the knowledge that needs to be known and needs to be shared. Our kids—

**FRAN BAILEY**—It is actually the model that is there in voc ed.

**Mr Gavrielatos**—It already exists. I think we need to look at how we build on it. My children—my little girl in year 10 and my little boy in year 8—are certainly not as compliant as I was. When people—

**CHAIR**—Mine are in the same years and I can see it.

**Mr Gavrielatos**—People talk about our young kids today not showing evidence of the same knowledge we had and of being less literate and less educated than what we were. They are simplistic statements. The children I see as a teacher—I do not see as many students as a teacher nowadays—have a capacity to deconstruct information and knowledge and attack it that is far greater than ours ever was. They are so much more literate in different ways. There are many forms of literacy.

**FRAN BAILEY**—They have IT.

**Mr Gavrielatos**—They have. Their access to knowledge is far greater than what ours ever was. Their capacity to digest it and deconstruct it is greater than what ours ever was at a similar age. That is not to say that that makes it easier in terms of acquiring the kind of knowledge that needs to be acquired. That is where it is important to ensure that your curriculum keeps on driving the capacity to discern good knowledge versus Wikipedia kind of information and that

research and understanding. Our kids are much more tuned on than what we were at a similar age. It is a different generation.

**CHAIR**—Maybe that is what the questioning of the relevance of teachers and curriculum and research is all about. Maybe that is what is driving it. They have just a different idea.

**Mr Gavrielatos**—Well, they have certainly got access to different kinds of information. It is also instantaneous. It is at their fingertips.

**CHAIR**—Whereas research takes 10 years, they can get something instantaneously.

**Mr Gavrielatos**—Yes. But there is a danger there.

**CHAIR**—Of course there is.

**Mr Gavrielatos**—What we have to instil in our students is that nothing replaces that intellectual rigour.

**FRAN BAILEY**—That questioning.

**Mr Gavrielatos**—That is exactly right.

**CHAIR**—The library, the photocopying, that is being replaced by that instantaneous resource.

**Mr Gavrielatos**—You may find it on Wikipedia, but that does not make it true.

**Mr SYMON**—Yes.

**CHAIR**—Well, I think we could go on for quite a while. Is there anyone else with any questions?

**Mr Gavrielatos**—Well, I am having a very good time.

**CHAIR**—I know you are. We will invite you for morning tea, actually, because I think we are about to go into that. I think you have probably covered quite a few areas.

**Mr Gavrielatos**—I will sum up by saying this.

**CHAIR**—Yes. Certainly. You could sum up, yes.

**Mr Gavrielatos**—This requires investment. It requires a dramatic investment starting at our earliest stages in order to ensure that we have the qualified teachers, the resources, the buildings, facilities and equipment in order to be able to do our job to instil that love of learning. We will do it anyway. As teachers we take our responsibility towards our students very seriously. We will continue within the context in which we find ourselves to do the best we possibly can to instil that love of learning, to instil that love of inquiry and that love of research in the minds of our students. I have yet to meet a single teacher that goes in the classroom to do anything but build

on what was taught and learnt the previous day. We do not go backwards. We seek to go forward in terms of that love of learning. But we need the resources, both physical and human, to do our jobs. The state of our schools is certainly not what it should be.

**CHAIR**—Were you here when the previous speakers talked about the demands for entry into teaching?

**Mr Gavrielatos**—Yes. I heard Sue.

**CHAIR**—The business about bagging the teachers.

**Mr Gavrielatos**—It is true. It is true. Whilst tangible resources are a critical factor, there are some other very important intangibles when it comes to the profession. One way of improving or building the status of the profession is by properly recognising and respecting the role of the profession. When people who hold senior offices in this country denigrate teachers, it does not auger well in terms of attracting and retaining teachers. As was said by the previous speaker, why would you want to join the teaching workforce when it has been subject to such public denigration day in and day out for significant periods of time? I always say to our elected leaders and other opinion-makers and policymakers, ‘Please let comments be measured. In denigrating the profession, you are denigrating the love of learning. So let us be measured in those comments.’

**CHAIR**—I have one final question. We have raised the situation of Finland with teachers and higher degree training. Do you think we should be opting for a system where we encourage that here in Australia? Is it possible?

**Mr Gavrielatos**—Absolutely. It should be encouraged, as we should be encouraging the accountability systems of Finland rather than importing failed accountability regimes from the UK and the US. In Finland, the culture is not one of ranking schools and naming and shaming and blaming schools. They have got an accountability structure within their education environment which is one about constant evaluation and, through constant evaluation, the progressive refinement and progressive improvement of the teaching and learning effort working together collaboratively and creating those enabling conditions to improve educational effort. That recognises that education is more than simply a crude score. It recognises the social and human dynamic of education. We are not a production line. We deal with complex and complicated factors that are called the human social development of the child. They cannot be reduced to an individual score or any comparison between any form of schools. We require a culture of inquiry, evaluation, progressive refinement and progressive improvement. That is what we should be aspiring to as a nation.

**CHAIR**—You have raised another issue. Very quickly, what would your view be on the often talked about opportunities for schools to have industry links which could lead, perhaps, to industry in its general form having an impact on curriculum?

**Mr Gavrielatos**—This is a huge issue. It is good timing.

**CHAIR**—I am sorry, but I think it is important.

**Mr Gavrielatos**—Schools have always to varying degrees had links with community, including local businesses. It has always happened. As a country, though—this is an issue that confronts education everywhere—we have to be very careful about what demarcation lines exist between the role of industry and education. That is not to say that industry should not be playing a greater role and showing a greater interest in education. We are talking about school education. What we have to be careful of, though, is not to cross a divide where the children in our schools, in the safeguard and haven of school, become prey to the market of industry. We have to be careful that the children within the haven of our schools are not exploited by the market. We have to ensure that business, if they have an altruistic, responsible corporate policy, of course invest in advancing education in this country but not if it means wanting to take control or influence that which is taught in the classroom. There is a fine line between being a responsible corporate citizen and contributing to the education wellbeing of a nation and then wanting to use your corporate dollars to influence outcomes. Education is not a market. Children are not a market.

**FRAN BAILEY**—I want to take you up on one point where you say that industry should not influence.

**Mr Gavrielatos**—Wrongly put.

**FRAN BAILEY**—Voc ed is actually working extremely well because of industry involvement and industry working with teachers. Industry has hands-on professionals. For teachers, it is not their area of expertise. The two are listening to each other and working together.

**Mr Gavrielatos**—I am glad you picked me up on that. It was careless language. It was not intended to be interpreted in that way. Indeed, there is a place for industry in the development of a broader curriculum. In many of our states and territories, for example, where we have curriculum authorities, the curriculum board, if you like, consists not only of educators. It also consists of community members, industry representatives and, obviously, parent representatives. So by all means there is an absolute connection. It is just when you cross the line where industry wants to sponsor certain aspects of curriculum in the lives of schools. There have been examples where the intrusion of industry has gone to the classroom, if you like, and the development of materials and what have you. That is where there is some concern about the role of industry and corporate dollars and corporate sponsorship.

**CHAIR**—Because they seek to address those short-term needs in the market which do not necessarily fit consistently with long-term educational needs about preparation.

**Mr Gavrielatos**—To be more precise in the use of my language, we do not have a concern in terms of industry partners and industry involvement in the development and shaping of curriculum. It is more in the realm of the potential influence of corporate sponsorship and what pressures that may bring in terms of conformity or otherwise.

**FRAN BAILEY**—Schools often feel that they have no other source. If they are wanting, for example, a new sporting oval, let us say, and they cannot get the funds anywhere else, they are going to go for corporate sponsorship.

**Mr Gavrielatos**—You are right. Then you will get ‘This school oval proudly brought to you by’.

**FRAN BAILEY**—Yes.

**Mr Gavrielatos**—I do not think that is good.

**CHAIR**—It is fine if it is left to the use of the school. But if it seeks to interfere with how it is being used, I guess that is where the issue is.

**Mr Gavrielatos**—I think we are raising some big issues.

**CHAIR**—We are, yes. We are straying way beyond our reference. There is an industry linkage program with research, so industry is relevant there as well.

**Mr Gavrielatos**—To be clear, my choice of language was poor. But there is no question about the involvement of industry.

**CHAIR**—Yes. That is fine. I understand what you are saying too. I agree with you, actually. Thank you very much, Angelo.

**Mr Gavrielatos**—Thank you.

**Proceedings suspended from 10.14 am to 10.33 am**

**BROADBRIDGE, Professor Philip, Director, Australian Mathematical Sciences Institute**

**HALL, Professor Peter Gavin, Chair, Scientific Advisory Committee, Australian Mathematical Sciences Institute**

**RUBINSTEIN, Professor Joachim Hyam, Chair, National Committee for the Mathematical Sciences**

**CHAIR**—Welcome. Although the committee does not require you to give evidence under oath, I should advise you that these hearings are formal proceedings of the parliament. Consequently, they warrant the same respect as proceedings of the House itself. It is customary to remind witnesses that giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. We thank you for your submission and now welcome you to make a brief opening statement before we proceed to questions.

**Prof. Rubinstein**—I have just prepared a very brief statement. We see a number of key issues for the Research Training Scheme. From the point of view of the mathematical sciences, we are finding that the pressure of trying to get students to complete in three to three and a half years really produces non-competitive PhDs by international standards. The demands are that students need a broad range of skills. They need to be able to work in interdisciplinary areas at the highest levels of research. The typical PhD at leading universities internationally involves coursework as a key component. Some of the universities around Australia are trying to do this, but it is extremely difficult with the pressure of quick completions. AMSI has a very important role in this, which Phil will talk a little bit more about. So what we are trying to do as a community is organise ourselves to pull scarce resources to try to ameliorate this situation, but it is extremely difficult.

The second point is that, in fact, the reality is that a lot of departments are now basically carrying the cost of keeping students on until they can complete. For example, in our department here at Melbourne, we are currently spending a very considerable amount of money to pay students for the extra six to 12 months it requires them to do a decent PhD. I think this is an extremely poor situation to have to be in. The length of a PhD just really is not competitive.

The next thing I would like to say a few points about is supply and demand in the mathematical sciences. I guess it is very difficult to say exactly what the situation is. Certainly our experience is that our PhDs get soaked up in areas like financial institutions, banks and insurance companies doing high-level analysis. A number of my PhD students have gone into this area. My colleagues have had similar experiences. I actually work on the advisory board of a large hedge fund. They cannot recruit suitable mathematical scientists so they have advertised. We also have full support for a PhD scholarship from this institution and we have not been able to get a student to take this up.

There really are major problems in the mathematical sciences. The number of honours students has remained flat for 20 years. There has been no increase in that number. There certainly is not a large supply of students. The two areas, I think, where there are extremely important shortages are operations research, which is needed for areas like transport, logistics,

scheduling and all the large companies—airlines et cetera need people with this sort of expertise—and statistics. Peter Hall is the pre-eminent statistician in Australia. He can say a little bit more about the situation with regard to statistics.

Generally, the medical area—all the big medical institutes—has teams of statisticians to help with the design of experiments and the analysis of data et cetera. The Australian Bureau of Statistics cannot recruit trained statisticians. They try to train them themselves. I think this is a really big problem. They are the major points that I would like to make.

**CHAIR**—Anyone else?

**Prof. Broadbridge**—I could back up what Hyam said. I was in the US up to 2005. I was head of a mathematical sciences department there for three and a half years. I did find, as Hyam said, that the American system of education gave a lot more breadth. There are some strengths and weaknesses in both systems. I think our system used to be very competitive at the time when the pipeline into mathematical training was a lot stronger. But now there are weaknesses in the pipeline down at the schools end. There are weaknesses in the pipeline in engineering education, where there are now fewer compulsory mathematics subjects. There are fewer numbers of students coming into undergraduate mathematics overall. Therefore, our pipeline of obtaining high quality graduate students in mathematics is weaker. Typically, it is not enough to give a one-year intensive honours course to give these students some breadth training before an intensive research program, as has been the case in the past.

The extent is such that colleagues overseas are recognising that Australian PhD graduates are now coming through with weaknesses. At AMSI we have a benefactor, say, from the Wellcome Trust, which is a medical trust at MIT and Harvard. They say they have doubts about employing mathematicians from Australia because they do not have the breadth.

At AMSI we are doing an awful lot to redress the situation. We are doing all we can with some limited short-term funding. We are doing a number of things to improve the breadth training of our graduates. We run an annual summer school, which regularly attracts in the order of 100 honours students from all around the country. That is really improving the quality of our honours students and increasing the retention rate into graduate programs. We run an annual graduate school, which due to funding has now been cut to one-third of its former size. But, even so, we choose a theme each year and we bring over some of the best lecturers from the world to teach on particular topics of national need. This year it was, for example, statistics of resource and environmental science, which is a very important area. We had two of the best statisticians from the USA as lecturers.

As well as that, we have set up a national access grid room network because of the shrinking numbers of academic staff in universities and the shrinking number of courses. Most universities at honours level have a required number of enrolment before a course can run. That means there are now fewer courses offered. We set up an access grid network, where we have funded 12 universities to set up high quality video conferencing access grid rooms. They now run shared honours courses to improve the breadth.

We also have funding from a CASA grant from DEEWR, which is the collaboration and structural reform fund, that is now defunct. We have some carryover funding from that. We are

setting up an industry internship program. There is a very similar scheme run by MITACS, an organisation in Canada, where they now have 250 graduate students from mathematics and IT working as interns on three- to five-month projects in sponsoring industries. We would like to set up something like that in Australia to broaden our graduate training for mathematics and statistics graduates so they know how to relate to industry needs.

Unfortunately, the very structure of the funding scheme in the RTS is working against that program because universities are funded for PhD completions only after the thesis is handed in. Therefore, if they release one of their graduates to work in industry for three months, that is three months later that they receive their money. Simple economics says no, we prefer not to release our students. So we are actually having trouble setting that up even though just about everybody I have ever spoken to in government, in universities and industry thinks it is a wonderful idea. Right now we have a number of government instrumentalities, both federal and state, and industries that have signed up, but we cannot yet find adequate students who are free to be released. So they are some of the problems we face.

I also want to say that the mathematical sciences themselves have to be regarded as a core infrastructure at the base level. This is why we have 28 member university departments from around Australia all contributing subscription fees to run AMSI each year. Take biotechnology, for example. In the university I worked in in the US, biology students had two compulsory maths subjects. As far as I know, in Australia there are only two biology programs that have two compulsory maths subjects. As far as I am aware, they are the University of Melbourne and the University of Sydney. But over there it is considered standard. In fact, the head of biology came to me apologetically one day and apologised for asking for an extra compulsory maths course for their students, realising we were already in high demand. But the situation here is quite different. Unfortunately, through the high school programs, the biological sciences are regarded as a separate strand from the physical sciences. Therefore, there are very few students coming through universities who are well-prepared mathematically to get into these new areas of biotechnology that require the graft theoretic, discrete mathematical and statistical analysis of the human genome, for example, and agricultural genomes. So if Australia really wants to be part of that game, there has to be a greater awareness to at least patch up this problem somehow.

I think the mathematical sciences will be key to rejuvenating Australian manufacturing. I do not think we are really supplying enough people with those capabilities at the moment. Obviously to compete in manufacturing, we cannot compete with cheap labour, so we have to be smart and we have to be more efficient. All these things are underlain by mathematical planning, optimisation, quality control and clever design. That is about my piece anyway. Thanks.

**Prof. Hall**—I am a statistician here. I would say that, in areas of the mathematical sciences, statistics has been the most hard hit of all fields over the last 15 years or so. If you go back 15 years ago or so, you will find there were 10 freestanding departments of statistics in the country. There are now only two left at the University of New South Wales and Macquarie University. The one at Macquarie is somewhat under threat as well. This very substantial decline in the teaching of statistics, of course, as it has been has come at the same time as a substantial increase in demand. So we have seen a lot of unfilled demand in the area of statistics.

For example, I have here a letter from a colleague of my mine who used to be in the mathematics department at Monash University until the science department at Monash was

largely demolished in the late 1990s and early years of this century. Phil McCloud, who is now head of the Asia-Pacific biometrics unit for Roche Pharmaceuticals, wrote to Minister Nelson in 2003 pointing out that Roche had decided to invest in Australia, to set up a group of highly trained statistical scientists to participate in the trials and other activities that the company had in the Asia-Pacific region. It made that decision on essentially two grounds. First of all, of course, Australia is a politically stable country. Secondary, Australia had a very high international reputation in statistics and was producing a substantial number of high quality honours graduates in the area. By the time his company had got down to actually establishing a group, the cuts to university budgets that began in the 1990s had really bitten hard. The people his company was hoping to hire simply were not present on the ground. So he wrote to Minister Nelson saying that not just Roche but also other pharmaceutical companies—I think he mentions here Pfizer and Eli Lilly; of course, there are others as well—are really going to have to face the decision about whether they set up operations in Australia at all or whether they go to another country to do this work.

Since that letter was written, a consortium of biostatistics programs at a number of universities that have jointly taught has significantly alleviated the problems for Roche Pharmaceuticals. However, the problems in statistics as a whole have become substantially deeper over the five years since that letter was written to Minister Nelson. There is substantial demand. The evidence in this letter points to what we hear anecdotally—that companies that are in Australia already and which are looking for mathematics skills are actually setting up their operations in other countries, such as China and India. BHP Billiton is frequently mentioned, for example, as a company which has sought mathematics skills but cannot find them here. Therefore, they look abroad. BHP has a large operation in Johannesburg in South Africa, for example, where it employs mathematicians.

So I think what we are seeing in Australia—it is very hard to get data on this, but there is the letter McCloud wrote to the government five years ago—points to Roche's concerns about this. There is evidence that it is not simply a question of whether we are producing enough skilled mathematical scientists, particularly statisticians to meet demand in this country. The fact that we have not been able to produce those numbers over a longish period—a decade or so—means that the demand has actually fallen away. In Australia, for work at a high level where we are adding a lot of intellectual value to the products that we make, we rely very heavily on foreign investment. As this letter foreshadows, Roche would be forced to reconsider its investment in Australia unless the skills it needed were available. So I think the problems that we are facing of supply and demand are problems at the demand side as well as the supply side.

I visited South Africa a few years ago. I was invited by the South African statistical society. I travelled widely around the country giving lectures. At that time, of course, the issue of what was happening in Zimbabwe was a major talking point. I have to say that I was, I guess, not surprised that a large amount of statistical work that was being done in South Africa was turning towards analysis of the AIDS epidemic in southern Africa more generally. But there was a sort of a black joke that went around. It related to the fact that Zimbabwe had managed finally to cope with the problem of supplying enough educated people to meet the demands of business and industry. It had not coped through the number of graduates increasing but because the economy had fallen so far or the nature of the economy had changed so much that there was not the demand any longer that there had been before. I would not be surprised if there are some elements of this in the tension between supply and demand for mathematical scientists in

Australia. As people are not available, the companies that would require those skills do not look to set up office in Australia. The companies here which use those skills find those skills abroad and not within Australia.

I have a fractional appointment at the University of California. I go there in the spring. I take leave without pay from my position at the University of Melbourne and I teach there. I have graduate students there. I work with colleagues there. The nature of the syllabus there is really quite different from what we would encounter in a graduate program here. There are courses I teach there, or one course in particular which I teach there, which I could not really offer here since the students who would take it just do not have the background. But it is a popular option among the courses for the PhD program at the University of California at Davis.

The nature of the employment destinations of the graduate students there is such that there is enormous demand for statisticians in the Bay area from companies such as Google and other IT companies. There is enormous demand from the bioinformatics industry. There are now some pharmaceutical companies setting up offices on the west coast. In the past, they have been largely over on the east coast of the US. The nature of Australia's economy and the levels of people that we employ in the mathematical sciences, I think, are really quite different from those in the US. Although we struggle at the moment to supply the skills that our economy needs in areas like statistics—the demand is significantly greater than the supply of graduates that we can provide to them—it is probably fortunate for us that our economy is not operating at the same level as you would find, say, around San Francisco or San Diego or other parts of California or even in many other places in the US. The economy has accommodated itself more to the sorts of skills that they can find here relatively easily, even though, as I say, those skills are often in short supply.

**CHAIR**—Thank you. I do have a question, but you can start if you like.

**FRAN BAILEY**—You paint a very serious and gloomy scenario, which we have certainly heard some evidence in other states about. You paint a depth to the problem that I think is very worrying. Really, in painting the extent of the problem to us, you are identifying right back at the secondary school level through to recruitment. I have asked this question of other university staff in other states. One of the things that has changed which you have identified—certainly in my time at university there was always one—is the department of mathematics. They rarely exist now, as you have identified. There is only a couple of universities—

**Prof. Hall**—I was referring to departments of statistics.

**FRAN BAILEY**—Statistics, I know. But it applies equally to general mathematics.

**Prof. Broadbridge**—Yes. That is correct, yes.

**FRAN BAILEY**—You have nominated, especially when you were speaking to us, Professor Broadbridge, a number of things that you are attempting to do as a society to correct the problem. I guess what I want to ask of you is: if you could fix the problem, tell us how you would fix the problem. Is it greater incentives for teachers of mathematics or different incentives into tertiary study, especially for those wishing to pursue research in mathematics? Does it mean changes to the way universities structure their own departments such that rather than the

biological sciences having their own stream of mathematics lecturers, their students would have to go and attend lectures within a department of mathematics? Does it mean radical change to that degree?

**Prof. Rubinstein**—I will answer that first. We did a national strategic review of the mathematical sciences in 2006. I have a copy of it here. We had a number of recommendations. We had really an action plan coming out of that. One important recommendation has been acted on, but the other ones have not. Let me just quickly say where we see some of the problems. I think some of them are very complex, as you have raised, and very difficult to tackle. But I think some of them are actually very easy. It is extremely frustrating for us that we have had this action plan and we have been trying to get it acted on.

**FRAN BAILEY**—Could you provide us with a copy of it?

**Prof. Rubinstein**—Yes. I will leave this with the committee. There are three things that we wanted. One was to increase the funding per student for mathematical science students in universities. Traditionally, the relative funding model, which is about 25 years old, classified mathematical sciences basically as a very low cost discipline, which we felt was extremely unrealistic given the intensive nature of the extra help that students need nowadays to cope with mathematical sciences. It is often the most difficult course that they have at university. It is an important part of engineering, commerce and science et cetera. There are computer costs et cetera. So that was one recommendation. One recommendation was proper support for AMSI. AMSI, we feel, is absolutely critical national infrastructure. Just about every country in the OECD and many other countries have fully supported national mathematical sciences institutes. The reason is this is the way they share resources, collaborate and deal with international issues as well. So we are sort of limping along with a cooperative arrangement where the university departments, which are all struggling, are actually paying subscription fees to support AMSI. That was the second recommendation.

The third one was to have a proper career awareness campaign. A big problem we find is that there is a lot of misunderstanding about what the career opportunities are in the mathematical sciences. Careers advisers do not understand it. Parents do not understand it. I go to open day here every year. You have families coming along. The parents are saying, ‘My son or daughter loves maths. How can I talk them out of it and get them to do some serious profession?’ I have to say that there are wonderful careers in the mathematical sciences and tremendous demand. It is a much better option than many others. If the children want to do that, they should be supported.

**FRAN BAILEY**—I thought maybe the problem would have been that the kids are not interested in maths and they think it is too difficult.

**Prof. Rubinstein**—I think a real problem is the supply of teachers. That was not in our strategic—

**Prof. Hall**—Of trained teachers.

**Prof. Rubinstein**—In the strategic review, this was about universities, not about schools. But there is a real national crisis in the area of mathematics teachers.

**FRAN BAILEY**—If we get back to the action plan, that is the first point—having the number of trained maths teachers.

**Prof. Rubinstein**—Yes. So the issues there—

**Prof. Broadbridge**—And primary teachers. I will cover that later.

**Prof. Rubinstein**—That is a very complex issue. Teacher training is split. Part of the problem is that the federal government is in charge of universities, but the state governments employ the teachers. There is almost a code of silence about the problem of people teaching outside their field in schools. We know that there are a large number of non-trained people teaching mathematics.

**Prof. Hall**—A lot of language teachers are put in front of maths classes. It must be terrible for them.

**Prof. Rubinstein**—PE teachers are teaching mathematics. We recently had a very heartfelt letter sent from a teacher in outer metropolitan Melbourne saying he is teaching in a large government school. In the surrounding area there are 4,000 students. They cannot put on one advanced mathematics class for specialist maths amongst the four local high schools because they cannot get enough properly qualified teachers. They cannot offer, you know, the preparation at year 10. Because there are no proper teachers at year 10, there are no students who are ready to do specialist maths at year 12. So if a student wants to do specialist maths, they either have to move out of the area or go to a private school. I think this is really disgraceful. It is a terrible situation.

We have been having discussions with the Australian Association of Mathematics Teachers and the Maths Education Research Group. One of the big issues that we see is teacher registration. If there is going to be a proper national system of recognising teacher qualifications, it should be about what the teachers have actually done. There should be a recognition of teachers who have actually studied mathematics. That should be part of the teacher registration. There should be some recognition of that if they are going to be teaching even year 9 to 12 in high schools. I think it is appalling to ask people to teach if they have no university training in mathematics.

So we see this as a fundamental issue. I would also mention the fact that, in the review, the DEST figures are that Australia produces 40 per cent of the OECD average of mathematics graduates. We really have a big problem here that the number of mathematics graduates at university is extremely low. So it is not surprising that we are getting very few people going into maths teaching in schools. The numbers are extremely small.

We think that through better support of mathematics programs at universities, to get support for putting on good programs for teachers, we could really help with this problem. Unfortunately, the universities are going in the opposite direction. They do not see themselves as having a responsibility. This year, the University of Southern Queensland, which had an extremely good program for training maths teachers, has abandoned it. They have completely sacked half their staff.

**CHAIR**—Can I interrupt you and ask you why they have done that?

**Prof. Rubinstein**—For financial reasons or purported financial reasons.

**Prof. Broadbridge**—Those financial reasons are actually incorrect. As you are aware, the per capita funding for a mathematics full-time student load was increased in the previous federal budget by some \$2,700 per year. The University of Southern Queensland has an equivalent full-time student load in mathematics, mainly through service teaching and computer science, of around 300 students. On those figures alone, the increase in per capita funding alone would have been enough to pay the salaries of the staff they used to have. That is the increase alone. But, despite that, they are foreshadowing cuts from 13 down to five staff in mathematics.

**CHAIR**—And the reason is?

**Prof. Broadbridge**—I can only theorise.

**CHAIR**—I want to get to this because I was going to ask you about administration costs.

**Prof. Hall**—They are not applying the money in the mathematics department. They are sending it to other parts of the university where they can get a faster and greater return on investment than they can in mathematics.

**Prof. Broadbridge**—We did our own survey in February. We found that eight universities out of 37 or 39 that teach mathematics have so far agreed to pass down a significant fraction of the increased funding down to the mathematics coalface. The others have made no commitment. In fact, some that I could name have declared that they will not be passing any of the extra money down.

**Prof. Hall**—They are not passing it on.

**CHAIR**—I will stop you there. This may be a naïve question for a politician to ask. If money is allocated in the federal budget targeted for specific outcomes at university, how is it that the university is able to then siphon that money off elsewhere and not do what it is that that money has been allocated for?

**Prof. Broadbridge**—That is a very good question, which I did put to the current minister in writing. The reply that came from the department was that the government at this time views teaching allocation moneys to universities as a block grant. The universities have discretion internally.

**Prof. Hall**—It is a one-line budget. The universities get funding from the government for all sorts of purposes. For example, James Cook gets money for air-conditioning. At the University of Melbourne, we get money for heating on days like this. The university gets a one-line budget with its—

**CHAIR**—That is block funding?

**Prof. Hall**—Yes. It can spend all of its money for mathematics on the teaching of English if it wants to.

**CHAIR**—I understand that. In the context of that block funding being given, there was obviously a narrative that came with it from the government which talked about mathematical teaching at university.

**Prof. Broadbridge**—Unfortunately, we have never seen that narrative.

**Prof. Hall**—I have never seen that narrative.

**Prof. Broadbridge**—It was a case made largely by AMSI and my two colleagues either side of me and other colleagues. It was agreed to by the government.

**CHAIR**—It is just that here there was funding for teaching in the mathematical sciences.

**Prof. Broadbridge**—It was agreed by the government, but there was no message sent to the universities that there was an expectation that that is what the money was intended for.

**CHAIR**—So the government agreed. How does the government convey a message to the universities? The reason I am asking you this is this: how can it? We are also being asked in various submissions to increase obviously the funding for research students in the form of block grants so that universities can then allocate what they need to so that they do not run around chasing grants. That makes sense. But in light of what you have also said, the decisions that universities make to spend that money in areas that we are identifying as in need of urgent attention may not be best made. It is a worry.

**FRAN BAILEY**—I think the reality is that unless a government specifies targeted funding, it is not going to happen.

**CHAIR**—But they put the intention for teaching.

**Prof. Broadbridge**—That is right. I think that is the problem. I would like to explain to the committee that this extra funding was not funding within a zero sum game. This was additional funding for the teaching of mathematics and statistics.

**CHAIR**—So that was stated, was it not?

**Prof. Broadbridge**—Yes.

**CHAIR**—So there was no misunderstanding about why they had increased it?

**Prof. Broadbridge**—No. There is approximately \$25 million per year extra funding on top of the previous total. That was for teaching mathematics.

**CHAIR**—But universities are making decisions not to allocate that money?

**Prof. Broadbridge**—That is correct.

**Prof. Hall**—That is correct.

**CHAIR**—So the problem is how they are doing it. The government does not have a view on it. It should have a view on it.

**Prof. Hall**—I think all of this problem is part of the tension over government interference in what individual universities do. From the limited contact I have had with the bureaucracy about these things when I have been in Canberra, it seems to me that the government is reluctant to get down to a university by university audit of how they spend their block grants. It is seen as direct interference in how the university manages its affairs.

**CHAIR**—I understand that tension and I am very sympathetic to it. I am not suggesting that we do that. All of us here have sat and listened to submission after submission. You made a statement about Harvard University no longer wanting to employ Australian trained mathematicians because we are not up to scratch. That is a very alarming statement, a damning statement, about our education system.

**Prof. Hall**—It is true, though.

**Dr JENSEN**—By the way, this is an egregious example of the university saying, ‘Damn you’ to the government—‘Whatever you think in terms of where the allocation should go, we will decide differently.’

**Prof. Hall**—Yes.

**Prof. Broadbridge**—I could not have put it better myself.

**Prof. Rubinstein**—I want to make a couple of comments. Since the previous review, which was in 1995, when we found that approximately one-third of the staff in universities in Australia had left, the numbers have declined by about one-third in mathematics and statistics.

**Prof. Hall**—It has been more than that.

**Prof. Rubinstein**—Since 2006, there has been a further decline of around 10 per cent. Now as far as we know, this is the largest decline of any discipline. I think this shows that the universities do not really take mathematics and statistics as seriously as they should. A number of universities basically have no mathematics and statistics program at all any more, which is absolutely amazing.

**FRAN BAILEY**—While this is happening in Australia, the opposite is happening elsewhere.

**Prof. Rubinstein**—Is happening in other countries.

**Prof. Hall**—That is right.

**Prof. Broadbridge**—Thank God there is an increased recognition that the new technologies—that is, nanotechnology, genetic biotechnology, new materials technology and information technology—all require new mathematics. So there is a recognition that there has to be an expansion.

**Prof. Rubinstein**—I think the universities are concerned. The GO8 have announced that they will conduct a review to try to get to the bottom of what is happening with mathematical sciences. I think we have been making a bit of a nuisance of ourselves sort of complaining about this issue about the funding not being passed on. So it will be interesting to see what happens in that review.

**CHAIR**—You have just floored me a little. We are thinking about making recommendations that ultimately will benefit universities, as we believe they will pursue the training of our future scientists and everybody else that we need to underpin our innovations and all that. You are now raising issues about universities consciously making decisions to run down areas that actually underpin and drive the new knowledge economy. They then talk about them and want us to free up international student programs in order to—

**Prof. Broadbridge**—Not all universities. There are exceptions.

**CHAIR**—I understand that. But how many? A lot of them are into this if we have a decline going on.

**Prof. Rubinstein**—I do feel some sympathy for the universities even though we have a great sense of frustration. The reality is that the universities have been driven for the last 10 or more years by getting international fee paying students. That has been the driver of funding to universities. The big areas where they get international fee paying students are economics, commerce and engineering and professional areas like that. Now those areas traditionally have been very strong supporters of the mathematical sciences through service teaching. But what has been happening because of this extremely important requirement to get the funding in is that those areas have been gradually teaching more and more of their own mathematical sciences to keep the income. That is why the departments have collapsed.

Monash, which had one of the biggest admission programs in the country, had international recognition in statistics. It went from 60 staff to 20 in the mathematical sciences in a 10-year period. It is just appalling.

**FRAN BAILEY**—One of the things I am struggling with—given that a few universities still have an emphasis on mathematical sciences—is that if these universities are wanting to remain internationally competitive in attracting these overseas students and these overseas students are obviously wanting qualifications in these key areas where maths is a major prerequisite, why on earth have they allowed this to happen?

**Prof. Hall**—The competition is not just on the basis of quality. It is significantly on the basis of price. If you talk to university vice-chancellors at the major universities in the UK, they will say to you that they do not regard Australia as offering any significant competition. They say Australia can compete on price with the UK as far as fees are concerned. But in terms of quality, Australia cannot compete. Although we might kid ourselves that we have in Australia the germs

of a Harvard, a Stanford or a Berkley, we do not. We have our shining lights if we compare one another with one another, but not if we look internationally at the major institutions of the world, where we are really trying to compete.

**FRAN BAILEY**—I want to follow up. This is a question that is a bit of a hobby horse of mine; I ask everyone. I want to follow up on this point. We have had, in a sense, a proliferation of university campuses being started up in regional areas in particular. I have to put my conflict of interest out there. I represent a very large regional area. I want my students living in regional Victoria to have access to tertiary education. But at the same time there is this funding pool which the national government can provide for tertiary education. Many of these smaller regional university campuses want to be all things to all people.

**Prof. Hall**—That is right.

**FRAN BAILEY**—I have a view that perhaps what we should be doing is focusing on centres of excellence. JCU would be for marine biology and tropical medicine, for example. Instead of diluting this finite pool of funding in so many different ways, we would be better off as a country to target funding into centres of excellence. In that way, we would elevate our overall standing within international communities as well.

**Prof. Hall**—This is what is referred to sometimes as the third way. It is the alternative to being a teaching university only or a research university only. When the research quality framework was discussed last year and the year before, there was some criticism by Roberts, the UK adviser to the government, on developing the RQF. He could not persuade the federal government of the day to put resources into a third way—that is, to provide an alternative path, particularly for regional universities, where they could serve their community or other parts of science and the arts where they had particular strengths. Gareth Roberts gave an interview; I think it was to the *Financial Times*. I think I have a copy of it somewhere on my computer. He almost despaired of the fact that Australia seemed to be destined to split its university system into either research intensive campuses that were struggling to be Harvards and places that were little more than teaching only institutions. So I think you make a very valid point.

There are precedents for this. I visited South Africa a few years ago. A former colleague of mine is now the deputy vice-chancellor for research in the university in Potchefstroom in South Africa. I asked him how that country was coping with what the rest of the world is doing trying to motivate their universities to improve their standing in research and things like that. He said, ‘The way that our country has done this is the department of education has asked universities to put forward their proposals and their visions for their future and how they might achieve their goals. There has then been a dialogue between the government and the university in order to refine this in a way which is suitable for the university and for the nation as a whole.’ Now I do not really understand what the federal government here has in mind for its compacts, but if it is something like that which involves a diversity of different paths for institutions, I would think that is a good outcome.

**Prof. Broadbridge**—I would also like to point out that I do not know of any university that is successful in a modern area of research that does not have some research areas that are underlain by mathematics and statistics. That honestly is the way the world is going. I would be very surprised if there were any university that was world recognised as being very strong at research

that did not have some mathematics and statistics presence. I think there is scope there for every university to have some representation in those areas, even if it is only half a dozen good people on campus.

**Mr SYMON**—I will get back to one of my favourite subjects, and that is stipend levels. I must say I do not think I have seen one single submission that has not actually touched on the subject. Yours is different in that it actually calls for a larger increase in stipends than many others have, based on competition from industry for people with those skills. I certainly have a great deal of sympathy for that. I am sort of wondering what level you would be looking at. What would you think is fair that would allow someone who had finished their honours and had a very promising job back in an industry to actually remain within the university system whilst doing a postgrad degree? Have you got any ideas of a figure for that?

**Prof. Rubinstein**—I am involved in a number of industry projects trying to attract students where we are competing with industry. I think what we find is that we have to offer top-ups to students to get them to come. Around \$25,000 is in the right ballpark. For some projects, that is probably not quite enough. But certainly that is a starting figure.

**Mr SYMON**—So that \$25,000 is a top-up on top of the \$20,000?

**Prof. Rubinstein**—No. Sorry. We are offering about a \$6,000 top-up to about \$25,000. But then we also need some money for other expenses for the student, particularly when they are involved in industry projects, where we want them to go on site. This is in the mining industry.

**Mr SYMON**—So you are talking about more from the Research Training Scheme funding side of things?

**Prof. Rubinstein**—Yes. Just as a specific answer to your question, we find that if we do not offer in the order of \$25,000, we are just not going to get anyone. So we have to find \$6,000 or whatever.

**Mr SYMON**—I must say I wonder how you can find anyone for that level. We have heard plenty of evidence that, as of this year, the \$20,000 stipend will actually be below the poverty line.

**Prof. Rubinstein**—No. It is very difficult. I am trying to be as conservative as possible because I realise money is very short. My view is that if we could have a four-year PhD, that would be a big advance.

**Mr SYMON**—You are leading into my next question.

**Prof. Rubinstein**—From an academic viewpoint, I think that is as important. I would not say it is more important, but it is as important.

**Mr SYMON**—With the term of the PhD, is that four years with an extension, or are you talking three and a half with a six-month extension?

**Prof. Hall**—I think ultimately we are going to have to see something like five years after the undergraduate degree. That is after a three-year undergraduate degree. I think that is the only way we are going to ultimately be competitive with the US and Europe.

I was a member of the review committee for the national review of mathematics in the UK a few years ago. One of the things that really opened my eyes was when we travelled around the country and interviewed PhD students and asked them how they saw their futures and the preparation that they set, almost to a man and a woman they said, ‘We don’t think we’re competitive relative to the young men and women who are coming in from Europe.’ With the freeing up of education and employment in Europe—and increasingly with the Bologna agreement education is going to be more comparable among different countries—there have been significant numbers of mathematicians and statisticians entering the UK, particularly from Germany and France, to make their careers in England. In some cases, they leave their families in the home country and commute home on a weekend. But many of them have lived there for 20 years or more now. These PhD students are saying, ‘These people who are coming in here have two years more experience than me.’ They have more research papers. They are more mature. Students do not say that, but what they say is that when these people make a presentation, they have a much clearer idea of the research they are going to do in the first year of the position that they are applying for. They say, ‘We fear we’re not competitive.’

We do not have that situation in Australia yet since we do not have people from France and Germany wanting to come here to make their careers as mathematicians and statisticians. But the remarks that Phil made a little earlier about the, let us say, disdain with which some Australian PhD students are viewed at major universities in the US are a reflection of the comments I have just made. In order to get to a position where we are internationally competitive, bear in mind the fact that our school system has declined a lot in the last 30 years and that there has been a continual shift of students from advanced to intermediate and from intermediate to the low level of mathematics in schools. This has meant that the teaching of mathematical sciences in universities has all gone back too in order to cope with the lack of preparation of kids coming in. We will need in the future at least five years after a three-year undergraduate degree in order to produce a trained PhD graduate in the mathematical sciences. If we do not have that, we will not be competitive with Europe or North America.

**Mr SYMON**—From that—this will be my last question—I take it that that necessarily would not apply to other disciplines. There could actually be different completion times for other disciplines outside mathematics?

**Prof. Hall**—I would expect that that would be a minimum for some of the experimental science disciplines, where the acquisition and the construction of the equipment will take time off in addition to the five years I have mentioned.

**Mr SYMON**—Because obviously this impacts upon the APA stipend duration.

**Prof. Hall**—That is right.

**Mr SYMON**—And the RTS funding duration.

**Prof. Hall**—That is right. I will hark back to the national review of mathematics in the UK. We struggled with this issue when we made our recommendation because we were sure that if we said that you need to give students at least an extra year on top of the three years that the students are presently funded for in the UK, if the government agreed to that, all they would do is reduce the number of stipends by one-third and add the year on to the stipends that remained. So we were kind of fuzzy about that in the final report. Nevertheless, we felt very strongly about it. That is the same issue that we would face here in Australia. If we were to say to the government, ‘You must add an extra year or an extra two years on to the term of a PhD program’, I bet they would say, ‘Well, I’m afraid the only thing we can do is reduce the number of positions that there are full stop.’

**Mr SYMON**—But part of this is actually about increasing it, as you have been talking about. There is not just the actual dollar amount in front of you. It is all the things that come along with it.

**Prof. Hall**—Yes.

**Mr SYMON**—Without looking at them and without bringing up those issues in the likes of this inquiry, they do not necessarily get looked at.

**Prof. Hall**—Yes. You are absolutely right.

**Prof. Broadbridge**—I would like to make a point that scholarship funding levels need not be uniform. There could be some intermediate term targeted areas. I will mention the VIGRE program in the USA, which is vertical integration for graduate research in education. It is targeted only for the mathematical sciences and only for US citizens and only limited in numbers. That has been a big help because it means a reasonable number of American students can get scholarships at the \$27,000 to \$30,000 level. That keeps the top students in graduate education even though they can earn at the outset \$150,000 a year on Wall Street as financial quantitative analysts. One of my PhD graduates earns at least twice that. Some of our honours students where I worked at Wollongong earned something close to that even though they had not progressed to the PhD. So that is the sort of problem we face to keep people in to produce the level of skills we need. I think we just need some targeted incentives. But it need not be uniform.

**CHAIR**—We have gone way over time. We have another witness. My colleagues Amanda and Dennis can lead the questioning of the next witness. I am sure there will be a few because your submission relates very much to some of this as well. Thank you very much. It was very interesting and very helpful. Thank you.

**FRAN BAILEY**—Could you make sure we get that action plan?

**CHAIR**—Yes.

[11.29 am]

**PACKHAM, Mr David Roy (Private capacity)**

**CHAIR**—Welcome.

**Mr Packham**—I appear, I think, with at least three hats. Firstly, I am a senior research fellow in environmental science and geography at Monash University, where I now occupy an office contiguous with the mathematicians. I am also a vigneron in my retirement. I am a member of Stewart McArthur's Stretton Group, which resulted from a similar activity to yours some time back.

**CHAIR**—Thank you. Although the committee does not require you to give evidence under oath, I should advise you that these hearings are formal proceedings of the parliament. Consequently, they warrant the same respect as proceedings of the House itself. It is customary to remind witnesses that giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. We thank you for your submission and now welcome you to make a brief opening statement before we proceed to questions.

**Mr Packham**—Thank you. I am, of course, deeply honoured to be able to present to you, especially as I consider the importance of this inquiry is absolutely vital to Australia's survival as we try to prosper in a dynamic world. I think that we must build and not destroy our innovative skills, which have been born from a necessity to survive in an isolated and sometimes harsh landscape. Certainly my scientific background—I am a chemist by training—has been in bushfire research, where I will have in another month spent 50 years, I am afraid to say.

My field has been applied science. I have had little excursions into undergraduate, postgraduate and community education and even spent about half a dozen or so years in a national weather services policy area. My contribution relates only to scientific research. That is the only area I would claim to have any expertise in and, even there, only in pretty much the applied side of it. I have no special knowledge of humanities, medical research and only a little exposure to defence research, although I do regard all those areas as absolutely necessary for our national future.

I rather fear that the preoccupation in our society with process has had a severe downward pressure on creation and innovation. We have shifted to a bottom line mentality. We occasionally talk about the triple bottom line. We talk about it. We do not do much about it. I think there is some hope, though. I had a little flash of hope in the recent East Gippsland by-election—I live in East Gippsland—because there is in Australia one post office that has the bust of a Nobel Prize winner outside it. It is interesting that that post office was a major issue in the East Gippsland election. So we are not total troglodytes in Australia. There is some hope. I tried to encourage postgraduate students—I have three postgraduate students—and others at Monash to come and make a submission to you because I have the sneaking suspicion you probably have not had the opportunity to actually talk to real postgraduate students.

**Dr JENSEN**—We have.

**FRAN BAILEY**—We have.

**CHAIR**—In New South Wales and I think in South Australia too. Yes, we did.

**FRAN BAILEY**—And Queensland.

**Mr Packham**—We have not heard too much from the Victorian ones, I am afraid, in that case. I hope you do.

**CHAIR**—Point taken with the Victorians.

**Mr Packham**—I work very closely with people at the professorial level. I said, ‘Look, here’s this inquiry. It is really important. You should go and make a point there. You should give your story.’ Both my colleagues said, ‘Oh, I’m too busy. I haven’t got time to do that.’ I find that is a reflection of the pressures that these people are under both in the academic area and in the student area.

I have said that research is more a state of mind than an actual skill. There are skills involved—there is no doubt about it—as you would well know because you all have an involvement in research in your particular portfolios and other areas. But it really is a state of mind. It is something where we need people who can be creative, innovative and reasonably rewarded. I make the point in my submission that during the Second World War, when the chips were down, when we really had to perform, we did. We had lots of innovation. From that came a whole bright area of activity. Where I was located in CSIRO, within possibly 200 hundred metres of where my little office and lab was, atomic absorption spectroscopy was developed. That totally changed the way of chemical analysis in Australia. A man called David Warren, who was the developer and inventor, despite his organisation’s antagonism of the black box, was in that area as well.

In my own case, I developed a fire detection system that has totally changed how fires are detected in buildings throughout Australia. In all those cases, we have really dropped the ball, but that is another separate thing. We have given those things away overseas. We have lost our opportunity to be a little bit like Finland. Finland is an interesting country—small, hostile environment in terms of climate, but it fundamentally exists on two activities. One is an organisation called Viasala, which makes all the meteorological balloons and instruments for the world. Nobody else goes and plays in this field because Viasala is so good. They also have another company called Nokia, which is substantial. We continually give away our opportunities to develop that very special expertise and totally lead the world in those areas.

I find that the path into postgraduate research is far too constraining. I have a student at the moment who is just about to hand in a really wonderful thesis. Her strength, I think, comes from the fact that she spent a couple of years backpacking around Europe. She joined the CMF for a couple of years, but decided that that was going to lead to pain, both mental and physical. But here is a person who comes out of a dairying family in Gippsland. Here is a person who has many life skills. They pop up within her thesis—the broad width of it. So we somehow need, I think, to be able to get out of this constrained academic approach. It does have strengths in it. But where a person might do very well at secondary school, go on to a university degree and

then straight into honours and then into a postgraduate degree, their life skills are often a little bit lacking.

I asked a group of postgraduates, whom my student occupies an office with, what their problems were. Their first answer was, 'We do not get proper professional respect.' They are students. They have supervisors. There is a master-slave relationship. These are people who are the cream of our intelligentsia and they are not getting the professional respect that they deserve. They are in their mid-20s. Some are in their late 20s. They are being treated not intentionally—nothing vicious or anything like that, but it is just how it happens—as slaves and they resent it.

The other thing that happens is that they do not have a living wage. My student, who is in her late 20s, has just been offered a position at the jet propulsion laboratory in Pasadena. She is very good in an area that we need—that is, remote sensing and land management. The Americans want her. My advice to her quite seriously was, 'Stay there. Don't come back. Australia has no future for people of your category. You will be respected and rewarded in America.' I think this is an extraordinarily sad thing. She said, 'Not on your life. I'm not taking your advice. I'm coming back because my family is here and I love Australia.' Good for her. But that is a difficult thing. Now she has to make do. She is married. She has to make do on around \$20,000 a year. She cannot do it. She has income for another three weeks and then it is all gone. She will be off to the jet propulsion lab shortly. They all have to have other jobs. They go from, in her case, a receptionist at a motel on shiftwork to get sufficient to actually just live. I even know of one other person who is doing their postgraduate degree in another university who was advised by their supervisor to take up a position in a massage parlour to make do. This is not what we should be doing in this country. So they do need a living wage. It has got to be at least the minimum wage. Nothing else is fair.

The problem with research in universities—I come out of a lot of experience, including 18 years in CSIRO, where we had a wonderful time—is that once we did not have to apply for grants. We just got on with the job. I am not against some grant application situations, but it has to be balanced up. There have to be situations. I heard the questioning. Incidentally, I am collocated with the mathematicians at Monash at the moment and have a lot to do with them. I totally agree with what those three learned gentlemen said before.

The question is: how do you keep justifying what the universities do? I am very impressed with the estimates procedures that go on in the federal parliament and in other parliaments. People need to be accountable, but they do not need to be accountable for every dollar. An overall toing and froing has to take place.

Purely out of self-interest, I found myself in a position where I am retired but I do want to keep contributing to the extent that I can. I fill a useful role in the postgraduate area in our university by having students. I have three. I can be a sort of mentor as well. I know quite a lot of other grumpy old characters like myself who can contribute. We cannot be taken too seriously because we usually have a touch of grey hair. But we are very often listened to. Our views are sort of weighed up. By gee, a lot of us have enormous quantities of experience.

I would like to also see a little less total control of our graduate research education by the universities. I think we need to sort of free up things. There are wonderful places out there. The

atomic research people in Australia, for example, and some of the agricultural veterinary areas have high levels of expertise. Student participation in that could be really worthwhile.

**CHAIR**—Thank you very much. I will ask my colleagues Dennis and Amanda to lead this.

**Dr JENSEN**—Thanks, Chair. You have a very interesting submission. Some of the issues that you strike at actually I very much agree with. For instance, there is the issue of ARC funding effectively meaning that the research is almost of necessity very conservative in its outlook.

**Mr Packham**—Yes. I have a particular issue with that at this moment. In my corridor there are about four members of the IPCC. But the more I delve into particulate and atmospheric science, the more little inconsistencies that I find in the whole thing.

**Dr JENSEN**—You are talking about institutionalised group think?

**Mr Packham**—Well, a good colleague of mine in CSIRO had a lot to do with the theoretical side of cloud seeding. He was quite a whimsical sort of character. He said, ‘Oh, the definition of science, that’s easy. You ignore the minor inconsistencies to stumble over the major fallacy.’ I find certain things uncomfortable in the basic science that happens as I delve deep into the literature. But I know it would be a waste of my time sort of applying for any sort of research grant to look into these inconsistencies because it would be seen to be a threat against the current religious dogma.

**Dr JENSEN**—That is a very interesting point. You are not getting any argument from me on that, I might add. The other point that you make with regard to CSIRO becoming bureaucratic, I think, is a very interesting one. I have to admit I have had some concerns myself. That stems back to, I guess, 20 years ago when they introduced the idea of 30 per cent outside funding. I think that drove the institution in a very fundamental fashion away from some of what it actually built its reputation on. I would like you to sort of discuss that further, please.

**Mr Packham**—Well, I can only totally and utterly agree with that. At that stage or a bit before that stage there was an inquiry in CSIRO as to what should happen to it. The answer that came out was that everything should stay exactly the same. I could see that CSIRO, which came out of this post Second World War bright period where people got on and they did things, did have an extraordinarily good reputation around the world. I would travel to the States or somewhere and they would say, ‘Oh, yes. You’re one of these CSIRO chappies.’ They knew, and it was well-respected.

Between what you were doing as a scientist on the bench and the chairman of CSIRO, there were possibly two or three levels. Your section leader, your chief and your chief would be on frequent contact with the chairman or at least a member of the board. Boy, from my CSIRO mates now I hear this is not the case. The thing for which I am very honoured to have said that I got this little OAM for was to work out how we can burn the forest quickly, cheaply and safely in a fashion that will enhance the environment. That all came about because we knew a fair bit about heat and mass transfer in bushfires. Over in Western Australia, they had a pine plantation, which was in the suburbs. It contributed quite a fair bit of funding to the University of Western Australia. But it was causing problems. There were a lot of people parking at night time and, at

some stage or other, casting cigarettes and matches outside the window. This caused serious bushfire problems.

My Western Australian forestry friends said, 'Look, we want to burn it but we don't want to damage our final crop trees in this area.' I said, 'All right. We know about heat and mass transfer. We know how to protect these trees easily and cheaply. Wrap aluminium foil around the tree and off you go.' So, armed with rolls of aluminium foil on the right burning occasion, I got on to a plane here in Melbourne and went to Perth. We went out with the matches and we wrapped the trees up. What happened then was that the aluminium foil made a perfect little chimney underneath. Those trees were thoroughly burnt much more than all the others. Fortunately, for my embarrassment, it then rained. So we sat in one of the forester's cars and talked about the problems of the world. He said, 'What we need here really is to be able to burn the bush cheaply and safely.' They had just killed three people over there doing the whole operation.

Now I had been a chemist in a gasworks abroad. We learned how to make things go bang in the middle of the night. There was a little chemical reaction. I thought, 'This can be used safely in an aircraft.' And so it was. That is where our prescribed burning programs actually came from. Now there was no submission to do this work. There was no, 'Which program is it in? Have you got your ID card before you talk to somebody outside and vice versa?'

**Dr JENSEN**—David, in your view, with science today—I have specific philosophical viewpoints on it—to what extent do you think aspects such as risk aversion and conformity actually result in science being not viewed, I guess, in the same light that it was previously and, therefore, it is a disincentive to people to go into research science as a career?

**Mr Packham**—Yes. There are huge quantities of issues there. I think that large quantities of people who go into science go in because they have personality defects. The reason for this—

**Dr JENSEN**—Do not speak for me, please.

**Mr Packham**—No.

**CHAIR**—I wondered why he was different.

**Mr Packham**—The reason for this is that kids like to be popular at school. Some are popular because they are bigger and they can thump anybody who does not sort of respond positively to them. Some are physically attractive. Some have personalities that just leap out at everybody. But others who might come from a quieter little environment, they seek their recognition through being academically very good. Then the teachers pat them on the back, but they are still slightly sort of withdrawn in this. Then they go through academically all the way. They do not have to relate to people very much. I have been very fortunate inasmuch as I have been forced into areas where I do have to develop a great sympathy for the social sciences and the political process and the community processes as well.

So science is seen as a nerdy sort of thing. Cartoons of scientists show them with big round glasses and possibly a little overweight sitting there eating hamburgers at three o'clock in the morning. It did happen in the 1940s, 1950s and 1960s. I remember being here at Melbourne university in the 1950s. If you were really, really clever, you would get into science and you

could do physics. If you were really just right on the edge of actually being here, then you might have to put up with doing economics. Now look at where we are now. In the 1950s and early 1960s, a good professional scientist was paid—you can see it in the ads in the newspaper—about the same rate as a corporate accountant.

That is not the case now. So there are images. Some of the bad images of science have been generated by itself. We have done some terrible things. We have had Minamata and the Minamata disease. We have had the Love Canal. Science and technology and chemistry have done themselves serious harm. We unleashed the nuclear genie for good or for bad or both. We have not built ourselves a very good public image. But at the same time we have created soap, detergents and penicillin. We have probably contributed to people not dying at 40 but to still being as old as I am. So there have been a lot of image things as well and considerable arrogance amongst some scientists too, I must say. They have little respect for people in the bush. I am doing a fair bit now with people such as mountain cattlemen and people up there in the alps. By gee, the intelligence and the knowledge that lives amongst these people is something we should take note of.

**Ms RISHWORTH**—I have a question. I found it very interesting that when you asked your students what would make it better, the first thing they mentioned is professional recognition. Obviously we have heard a lot about living conditions and that sort of thing. But I found it very interesting that professional recognition is one of the first. I was wondering if you did have any ideas about how you might improve the supervisor-student relationship. Talking to friends that I know, they do feel like slaves at times. That is partly because the supervisor does have so much work on and they actually help the supervisor with their own work as well. I was wondering if you had any ideas or comments about what could help improve that relationship.

**Mr Packham**—I do think the change in terminology would help a lot. I do not think they are students. I do not consider Sarah Burns to be a student of mine. I consider we have a relationship where we can discuss things. This is a full professional person and a very good one. The word ‘student’ is not right. And, as her supervisor, I do not feel as though I am a supervisor. I am a person who can give another point of view or who can, as I am doing now, in a final draft, identify that, perhaps. But the option is entirely up to them as to whether they think I am talking nonsense. The poor soul has three supervisors. One is Professor Nigel Tapper, who I work with. He is the professor of geography and head of school. Another one is a very distinguished international indigenous anthropologist from the States.

So I am not her supervisor. I am another point of input into it. If she says, ‘That’s a good idea’, I feel very pleased. If she said, ‘No, that’s not right. I’m not doing that’, okay, that is right. She is the professional person doing it. So I think we need a change in attitudes or a change in title. Perhaps the research contribution in the universities that comes in can be somehow tied with the students, because academics have to take on more and more students now to financially survive. Nigel Tapper, for example, I think has 17. He cannot possibly do what I can do because I am retired and have nothing much else to think about. If that funding somehow came with the student, they would automatically get the respect because that is where the dollar sign is.

**Ms RISHWORTH**—Thank you.

**CHAIR**—I am mindful, David, that we have come to midday. We have to end here. Thank you. We have had a very insightful dialogue. Obviously there is never enough time to pursue things, but we have certainly taken on board your submission. It is a very interesting one. I did want to talk about CSIRO and breaking it up, but I think that is probably going to require another half-day discussion. So, if you do not mind, we will take a raincheck on that one. Thank you. I ask that a member move to accept the two documents received from AMSI as exhibits to the inquiry.

**Dr JENSEN**—So moved.

**Ms RISHWORTH**—Seconded.

Resolved (on motion by **Mr Symon**):

That this committee authorises publication of the transcript of the evidence given before it at public hearing this day.

**Committee adjourned at 11.59 am**