C O R R E C T E D V E R S I O N

EDUCATION AND TRAINING COMMITTEE

Subcommittee

Inquiry into promotion of maths and science education

Melbourne — 18 July 2005

Members

Mr S. R. Herbert
Ms A. L. Eckstein
Mr V. J. Perton
Mr N. Kotsiras
Ms J. R. Munt

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Witness

Ms P. Danby, market development manager, Science Industry Australia.

The CHAIR — I declare open this hearing of a subcommittee of the Education and Training Committee. It is an all-party joint investigative committee of the Parliament of Victoria. The committee is hearing evidence today in relation to the inquiry into the promotion of maths and science education.

I wish to advise all present at this hearing that all evidence taken by the subcommittee, including submissions, is subject to parliamentary privilege and is granted immunity from judicial review pursuant to the Constitution Act and the Parliamentary Committees Act. I welcome Ms Pamela Danby. Perhaps you could give the committee 10 minutes of information, and then we will then open it up to questions, if that suits you?

Ms DANBY — That is fine by me. I thought I might start by telling you a bit about what Science Industry Australia is and a bit about the science industry itself. As background to our submission, I will start off with what Science Industry Australia is. It is actually the industry association formed in 2000 to appeal to a broad science industry, to form a significant group to mainly lobby government. So I guess that is why I am here.

We have approximately 100 member organisations. It is an organisation-only industry, so companies, research institutes, educational institutes such as Melbourne University Private — which has an interest in science — are the members of our association.

The science industry itself — and we are talking about the commercial sector now — means companies involved in research and development. They manufacture, they market, they distribute, they export, and they provide service and support of scientific equipment and other associated accessories and consumables, and we generate in Australia approximately $3 billion worth of sales in the domestic market.

We manufacturer almost a billion dollars worth of products here in Australia, the bulk of which is in Victoria. We export about $670 million per annum, we employ approximately 8000 people in the sector, of which more than 50 per cent are graduates of a university or a technical college, with a higher degree; and our research and expenditure is eight times higher than the industry average.

Our export sales as a proportion of production are five times higher than in the industry generally. So we are a rather interesting group in that we are a very high-tech, knowledge-capable, and knowledge-intensive industry, and that is really what science industry is defined as.

In 2002 we met with the Victorian government to set up more formal links, and the Victorian office and my position was actually made possible by a grant through the Victorian government under its strategic plan. I am not sure whether you are aware of this. It is the Victorian medical and scientific equipment industry strategic plan, which actually includes people, training and skills; but in 2003 we decided we needed to take this more nationally so we applied for what we called an action agenda with the federal government, again with some support from the Victorian government.

We have spent the last 12 months working with industry and other stakeholders to arrive at recommendations for the future of the science industry in Australia. The report, called the Measure by Measure report, was actually tabled in federal cabinet last Tuesday and was endorsed, and I have the draft copy right here, but I cannot let you have it because it is still in-confidence until the Minister for Industry, Tourism and Resources, Ian Macfarlane, does his launch in August.

But I can tell you what is in it. This is the recommendation phase, then we spend the next three years doing the implementation phase. Under the studies carried out during this action agenda recommendation phase we had a working group that particularly looked at education and skills shortages. We discovered that there was a growing skills shortage in our industry, emerging particularly in the area of engineering and science.

It is of great concern for the future of the industry, particularly in Victoria — which has by far the largest manufacturing exporting scientific industries — as the current work force ages, that we are not able to replace it with people coming through who have suitable training and education.

So we think more needs to be done at the primary and early secondary school level to encourage children to continue with the study of maths and science. Unfortunately it is all too easy to neglect this subject, particularly as the cost of provision of suitably qualified teachers and the provision of adequate laboratory teaching facilities is perceived to be high. So investment is needed.

Also the study of these subjects is perceived to be boring and have no real value in the future. It does not lead to exciting and physically financially rewarding careers. It appears to be much better to be a business person or a lawyer or an accountant instead of a scientist.

Teachers themselves need to be motivated to enthuse their students, and some engagement with industry — both in the classroom and in business and excursions to workplaces, where science and maths are the basis of the business — could be of great assistance.

Careers advisers in schools also need to be made aware of the range of science-based careers that are available outside the traditional academic research area and other areas people generally perceive as being the only opportunities; and we need to encourage students to continue science and maths in their secondary schooling so their career choices are not limited because of their subject selection in year 9. We welcome more engagement with industry in trying to assist children to become aware of this.

I will just let you know that there has already been a couple of initiatives along these lines from the Queensland government. I am not sure if you are aware that they do a thing called Science on Saturdays, where kids aged between 7 and 14 are offered exciting experiments, and two or three hours of experimentation and a bit more excitement. They pay $5 or $6 to go. It is run all around regional and suburban Queensland — Brisbane and those sorts of places — where they actually have hands-on experiments that are relevant to their daily lives so that children get an actual hands-on experience on a Saturday. It is held in their school grounds, but it is funded through the government.

Another initiative in Queensland is the BioBus. Because Queensland is very fond of biotechnology they got together with a lot of biotech companies up there, and a combination of the government and industry have put money in to form this bus that actually drives around to all the schools, to show children experiments, again, but also have actual researchers and industry people on the bus talking to the kids.

So that is a couple of ideas from Queensland. We do not necessarily want to use the Queensland ideas — I am sure we can come up with our own — but it is a way of engaging industry with secondary school students to excite them about science, which is what we need.

So that is really all I have to say. My submission gives you a few more ideas, but I do not need to repeat that because you have all read it. I am open for questions.

The CHAIR — Thank you. I might start off the questioning. I have a couple of questions about your submission, as a matter of fact. You indicate that you have done a small survey?

Ms DANBY — Yes.

The CHAIR — Or the education, training and work practices working group has undertaken a small survey on skilled staff demand. I refer to the other assertions you make in the report about likely reasons for the trend of a lack of resources in schools, a lack of suitably-qualified and motivated teachers and the perception of a lack of career paths et cetera. What are they based on? Are they based on experience or surveys?

Ms DANBY — Anecdotal evidence from employers, from people in our association, talking to try to get graduates and trying to get — —

The CHAIR — But there is a qualified or qualitative study that you have done?

Ms DANBY — Yes.

The CHAIR — The other thing is that I notice that you have major skill shortages in terms of laboratory technicians, technical trades, chemists, mechanical and software engineers, and sales and management. Do most of these rely on tertiary degree qualifications from university or on diplomas? Where exactly is the training pressure on those areas increasing?

Ms DANBY — It starts at finishing VCE-level science and maybe even only doing a one-year course in laboratory skills, which is what is needed to go on, through to people with a three-year bachelor degree in science to become a chemist, or whatever.

The CHAIR — I assume some of those skills could be taken up by young people who have not necessarily done the enabling sciences — the physics and the chemistry — in secondary school, or the specialist maths? Or is that really a requirement?

Ms DANBY — That is really a prerequisite. You really want to have some of those enabling sciences to be able to understand.

The CHAIR — In any of those jobs?

Ms DANBY — Yes, that is right. That is what the pressure is on the industry.

The CHAIR — We have not had a drop in the number of students who do those subjects per se. But basically, what are the skill shortages that can be met from people coming out of the secondary system if they have the enabling sciences and perhaps maths methods and maths specialisation and motivation? They do not necessarily have to go and do a degree, they could go into TAFE to fill up a lot of your major skill shortages?

Ms DANBY — Absolutely. It is the motivation of getting them into TAFE and perceiving that there is a career path for them that is interesting and financially rewarding because I tend to think they have got this perception of science as not being terribly well funded in terms of rewards.

Mr PERTON — We have heard a lot of evidence and the problem seems to be clear. The question is: what do we actually do to change things? I visited Port Melbourne Primary School on Friday and it, like every other primary school, has the problem that the average primary teachers do not have good mathematical education themselves, are unable to teach it well, and are unable to enthuse students and the like about mathematics and science. It seems to be common ground that that is the problem. From your perspective, starting at that primary-school level, what is the solution?

Ms DANBY — I do not think I can offer you a solution. All I could suggest would be: are there some ways in which we can enthuse the primary school teachers when they are being taught to teach at their training level? Can we do something with industry — helping them or getting them some mathematical training? I am going back to basics here. I just wonder if there is a role for industry to enthuse kids, students and teachers by throwing them alternatives. I am not necessarily suggesting that we can teach them mathematics, by any means.

Mr PERTON — Let us say, for instance, that we could stereotype primary school teachers as people who, in the main, are not highly accomplished mathematicians and have been unlikely to have done any major maths study post secondary school themselves. The window is there today for industry to become involved in schools. There are examples of companies being involved in schools and mentoring. What it requires now is action — people actually saying, 'I am happy to turn up at Broadmeadows primary or Faulkner primary or Doncaster Gardens primary and say, "I run a computer company. I am happy to come and do a couple of supervised classes on practical maths for a grade-5 or a grade-6 person" '. But people are not doing that; people are saying, 'I've got a busy life, I'm running a company; teachers are there to run the schools'. How do we change the attitude from industry?

Ms DANBY — I think it has got to be through their hip-pocket and their skill-shortage nerves. I think that will be a real issue for them. My industry association and members are already seeing that. If a more formal program of that was put out, I know my members would certainly be interested in assisting by not going to every school in Victoria, but obviously by dividing up some of the schools and going out to do some visits. I believe they would be only too willing to do that. We have a few individuals who are also passionate about this sort of thing and who would be willing to give their time to that.

Mr PERTON — Do you have any case histories of people doing it?

Ms DANBY — Going to primary schools? No. They tend to go more to the secondary school and tertiary levels, where more formal careers nights and those sorts of things are on offer. That is why I am saying that a formal program is the go, because they will go to careers nights, they will go to graduate things and talk to people about opportunities when such formal occasions are put on.

Mr PERTON — Or you could in fact make that part of and adopt the Queensland model of a place to go to do experiments and have fun with Science on Saturdays?

Ms DANBY — Absolutely.

Mr PERTON — You could incorporate the company that does dyeing, or whatever.

Ms DANBY — Whatever.

The CHAIR — Just on that, I should have asked earlier: what level of industry do you represent? Do you represent the Shells, the Rio Tintos, the Exxons — the large companies?

Ms DANBY — No, we are talking scientific manufacturing of laboratory equipment — so the Varians, the SGEs, the GBCs; those sort of very high-tech, vision-systems-type companies.

Mr KOTSIRAS — Have those companies come together and come up with some ideas, or are you waiting on the government to put up some ideas for you to jump on board? Or have you been proactive?

Ms DANBY — That is why the action agenda working group started sitting down and saying, 'Well, we recognise there is a skill shortage now that we actually have some quantitative data that there is a skill shortage. So the implementation phase is to come up with the strategies of what we do to overcome that'. These were some of the suggestions that I wrote in the submission that actually came out of the working groups thinking of what we might do to overcome skill shortages by enthusing children. We were more looking at the secondary-school level because that is where we saw that the change in direction really took place. So we were looking at the secondary-school and the post-secondary-school level.

The CHAIR — That is a crucial point, because it is understandable that small businesses need organisational capacity and they do not have their own HR models like companies; they have one person doing it.

Ms DANBY — That is right.

The CHAIR — The question is about the larger companies, the major industry players, which probably do have the resources of their own to put into the education sector, and whether it needs a government head, top down, or an industry bottom up to encourage more maths-science — for the big players who have their major resources.

Mr PERTON — But a framework. There is a place and a time to come and do it.

Ms DANBY — I think a framework is what industry needs, because you can have lots of little industries running around doing bits and pieces, but it is not very effective.

The CHAIR — Some schools do, but others do not.

Ms DANBY — Exactly.

Ms ECKSTEIN — So someone to organise it for you to plug into?

Ms DANBY — Exactly, if there was a program. I use the example of Innovation Insights, which is an industry program that the Victorian government runs where tours are run for people to learn in industry by going to visit other workplaces. One company runs that every year. It is well publicised; the government publicises it as well as industry. There is that sort of thing. Industries then plug into it by saying, 'I will be a workplace that you can come and visit because I have got experience in this'. That might be a sort of model you could use, just as an example. But I believe that there needs to be a framework for industry to hop on board, because we will just sit here and do our own thing.

The CHAIR — It does beg the question, though, about how effective are one-off kinds of things with students. With the Biobus there are 200 secondary schools in Victoria, but to visit all of them once a year is probably the maximum. Science on Saturdays is probably the same sort of deal; it is once a year for kids. We have heard of other examples that are one-offs. Once every few years a kid might go to a CSIRO. session. The question is: how effective are these single — once or twice a year, if you are lucky — sessions? Even though they might be really enthusiastic, how effective are they in motivating students over the longer term?

Ms DANBY — I cannot answer that.

Mr KOTSIRAS — I suppose if they go back to a classroom where the teacher is appalling and has no interest in science it would be a waste of time.

MS DANBY — It is not going to do anything.

Mr PERTON — If it was every Saturday you could set it up, just thinking aloud, with Little Athletics. Why could you not set it up as a tent next to Little Athletics, so that every Saturday the kids from Little Athletics as an adjunct are taken by their parents off to the science show?

Ms ECKSTEIN — That relies on a lot of volunteerism.

The CHAIR — Little Aths does.

Mr PERTON — But you fund the organisers.

Ms MUNT — I am interested in what you are saying, and I am reading through your submission. It is hard to get your head around exactly which model to do, how to do it and what the problem is with the curriculum. I agree that there has to be a framework, but even then it is going to be hard to find out what the framework is going to be. You have written here that likely reasons for the trend in the decline in studying science in schools are a lack of qualified, motivated teachers, lack of career paths and stuff like that. I have an email here from the head of research and development for Conzinc Riotinto, and he thinks the problem is cultural and our desire for instant gratification and unambiguous answers. When you try to put it all together it is really hard to find out what the problem is and where to point the finger. He also has particular comments on what he feels are problems with the curriculum as it stands. It is not so much that the curriculum is set, but more that the curriculum is old fashioned and does not itself lead to more widespread problem solving rather than particular problem solving. I do not know what I am asking, but what I saying is that it seems to be really hard to point ourselves in the direction.

Ms DANBY — There is not one answer.

Ms MUNT — Can industry get itself together and fit in to a framework if it is put together?

Ms DANBY — I think it can if we know what the problem, as you are saying, is.

Ms MUNT — It is hard to know what the problem is even.

Ms DANBY — I did not mention our survey, but one of the managers said he found that the generation X people were a particular problem because that had a desire to try many different things before they would even settle down, so they may have done science or engineering at university or at secondary school or whatever, but they give that two years and then, 'No, we are off to something else'.

Ms MUNT — Off to another career.

Ms DANBY — Yes. So the cultural thing the Riotinto guy is saying I think is also important, and we have got to realise that young people are not, as we perhaps were, 40 years in the one career sort of thing. They are much more willing to change directions totally from what we were trained in, so we might even all be barking up the wrong tree by saying, 'We need to study science and maths'.

Ms MUNT — That is what he is said. He said that he would be anxious not to stream people too much in school. He does not want to stream, and he does not want to put people into boxes because they just do not fit our modern world and our modern problems.

Ms DANBY — One of the things I want to empathise is that we do not limit our subject choices at year 9, because that forces them into a stream. We often find that people end up doing science because they are stuck in that stream, but they absolutely hate it.

Then they turn around and go, 'This is dreadful', so of course it gets another bad name because everybody is saying that you are not going to earn any money and it is a boring career. It has got all those things that we do not want it to have. How do we get kids enthused? Well, that is great, but they are going to change their minds anyway.

Ms MUNT — That is right, and you have got to offer a curriculum that enthuses them. I have just been through year 11 subject selection with my daughter, and I looked at the curriculum that was on offer for year 11. I would have trouble getting interested, so I do not know.

Ms DANBY — Perhaps it is as fundamental as making the curriculum choices broader and more interesting.

Ms MUNT — More fascinating, yes.

Ms DANBY — To allow the kids to all get the maths and science as well as the arts and to cover a broad range of — —

The CHAIR — However, the dilemma is that — —

Ms DANBY — You cannot do everything.

The CHAIR — The dilemma is reciprocated. I have a school in my electorate that is increasing the numbers of people doing sciences. We have heard evidence from other places, but the areas they want to do it are not in the enabling sciences; they are in biology, psychology, environmental science and forensic. The question is: how do you get more than the broader interest in science? How do you get an interest in the sciences that link to the jobs in industry and where the needs for our economy are? That is the $64 dollar question.

Ms DANBY — And it is the enabling sciences that allow them to go on to do much more in their lives than just become 'scientists'. I guess that is the thing that gets back to the teaching again, where the teachers have to be fairly well trained in those enabling sciences to pass that enthusiasm on to the kids, because if you are well trained and you know your subject matter and you are enthusiastic, then that naturally comes through in the teaching.

Ms ECKSTEIN — But is that not only one part of it, in terms of enthusing kids?

Ms DANBY — Probably.

Ms ECKSTEIN — As we all know, at the moment they all want to be forensic scientists or whatever because it is sexy.

Ms MUNT — *CSI*!

Ms DANBY — It does not happen like that, let me tell you. You do not push the button and out comes the answer.

Ms ECKSTEIN — We need maybe one or two a year. Is it not all about what is attractive in terms of the work?

MS DANBY — Of course, yes.

Ms ECKSTEIN — I do not want to underplay the teachers — yes, of course the teachers have a role in enthusing kids — but is it not also what is perceived to be attractive in terms of — —

Ms DANBY — The career options?

Ms ECKSTEIN — The career options, in terms of what is an interesting and creative thing to be doing as well as a financially rewarding thing.

Ms DANBY — That is why one of the things that we have suggested is people's perception of the science industry — and I am using the manufacturing of scientific equipment and consumables — as an exciting career. You can go into sales, you can go into management and you can go in to running a factory. You can go into all sorts of things.

Ms ECKSTEIN — Sure, but is it financially rewarding enough for kids to be interested in? I do not know.

Ms MUNT — They just do not know.

Ms DANBY — It is, in terms of being an accountant or whatever. If you are the floor sweeper obviously you are still the floor sweeper, even though you are in a high-tech industry.

Ms ECKSTEIN — No, but if you are, say, a research scientist in a lab — —

Ms DANBY — Hard work!

Ms ECKSTEIN — Is it going to be hugely financially rewarding?

Ms DANBY — No.

Ms ECKSTEIN — And is it going to be sexy?

Ms DANBY — Yes, if you are Peter Doherty or somebody with a Nobel prize or whatever.

Ms MUNT — The guy in the Ford car looks pretty appealing.

Ms ECKSTEIN — I bet he does not work there. Do you know what I am saying? It is an interplay of all of those things to make it attractive to people, and perhaps what role industry can play.

Ms DANBY — I think all industry can do is make sure that everybody is aware that there are these options and it is not just research. That is just one aspect of it, but there are a whole lot of other things — having a business background with science and how that can work, and having a legal background with science and all of those sorts of things, and that the enabling sciences allow you to have so much further opportunity.

Ms ECKSTEIN — Can I quickly ask you a bit more about your survey? How small was it; was it your members; and what industries did it cover et cetera?

Ms DANBY — They were purely in the scientific equipment manufacturing industry. We had about 12 companies in it, ranging from the biggest ones, which are Varian and those sorts of ones, through to the two and three people groups. They were Victoria, New South Wales and Queensland based.

Ms ECKSTEIN — So they were along the east coast?

Ms DANBY — We did do the east coast.

Ms ECKSTEIN — That is just to give a perspective of what it means. Thank you.

The CHAIR — Thank you very much. We may come back to you with more questions when we are thinking about our report in more detail.

Ms DANBY — If we can assist with a framework or anything like that, that is fine.

The CHAIR — That is excellent. We might even have you back once your report has been released by the federal minister.

Ms DANBY — You certainly will. Thank you very much.

Witness withdrew.

CORRECTED VERSION

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Witnesses

Mrs J. Davey, director; and

Mr P. Corboy, director, Numeracy Australia.

The CHAIR — The committee welcomes Numeracy Australia to the inquiry. We apologise for having this hearing in our training room; all the committee meeting rooms are being used, which shows how active the parliamentary committees of the Victorian Parliament are. I welcome Peter Corboy, who is the director of Numeracy Australia, and Jo Davey. The normal way we would operate is to ask you to make a short statement, but we have had your submission and read it, so perhaps we might open up to questions.

Mr CORBOY — We have been going since 2000. We run a program called Maths Mania. We have four divisions in the company. Maths Mania is our major entity at the moment. We go around to primary schools in four capital cities and set up interactive activities for children from prep to year 7, depending on what state we are trading in. They break up into groups of four, and they spend 70 minutes going from station to station — there are 18 work stations — and they go through the process of working through the activities. It is all hands-on. It covers all the strands. There are a lot of magnets and mirrors; it is endless; it has got ladders and rooms.

We talk about outdoor maths — how we can use outside of school; the applications. We spend about 5 to 10 minutes on that. The activities were not designed to be completed, so we leave extension activities for the teachers so they can emulate the activities the young ones missed out on — it is an event, basically. We are now trying to change it into a process with the follow-up of our maths book.

In the five years of our market research I have been looking at the resources in the four states, and I know there is not much around for teachers in the way of resources written by teachers. They can use our book as a tool once a week, as a subject. Our consultants put a fantastic book together, which you have probably seen. It supplements the Maths Mania program. We were leaving the teachers' extension activities until the last three years and there were only two or three pages, so we need more depth in our follow-up material. We asked the teachers over the five years, and they are all saying, 'We need hands-on maths books for teachers. We need something in the schools, because there is nothing out there'.

As I said, we consulted that out last year, and we have come up with what I call the Crown jewel of books. Every school we have been to has jumped on it. As I said, that is a follow-up to our program, which is hugely successful. We have just come back from Ballarat this morning after running a program there, and we have 4500 children booked in over the next 10 weeks. It is a very successful program. It is a confidence program; they walk about feeling confident about themselves.

We talk about the applications outside. It is very important to talk about how we can use maths outside school. Some days they get bogged down in school and find it hard doing their addition or their multiplication or their decimals, and when they are told that we can use maths outside school, they find it not so hard to apply it back inside the school. It is all about confidence. Teachers come up to me and say, 'Johnny Blow will not perform inside school, but with this hands-on program he is going through the roof. It is fantastic'.

Mr KOTSIRAS — Who pays for you to go out to a school?

Mr CORBOY — We charge $4 per student for a 70-minute program, and we have a minimum of about 40 in each class — that means two classes are joined together.

Mr PERTON — What is the minimum number?

Mr CORBOY — Forty, which is roughly two classes. Say there are 22 in each; it is up to 45. The maximum is about 55 or 60, depending on the hall or the multipurpose room. We run parent programs and so on.

Mr KOTSIRAS — Have you done any research or got any feedback from going back to the school a few months later to see how those students are doing? Is there a change in their attitude towards mathematics?

Mr CORBOY — Yes. We get a lot of referrals in respect of clusters of schools. We do one school, which then talks about the program, and then we are inundated with calls to 'Come to our school'.

Mrs DAVEY — A bit of feedback comes more so in relation to kids who are not really all that confident or good at maths who have seen that they can do something that is hands-on because they have come at it from a different angle. The teachers have said to us when we have rung to see how it is going — because we are not really teaching anything; we are just basically supporting the curriculum they have got — that the kids who were underachieving tend to look at another way of doing it. Rather than just responding to chalk and talk, they are more

prone to going to use the MBA blocks or whatever to try to solve something. It gives confidence rather than their just sitting back and saying, 'I can't do it'. So much praise goes on in the Maths Mania program that they think, 'I wasn't good at maths, but, hey, I could do this when the kid who was good at maths couldn't do it, or took longer than me to get the answer, because I used a different approach.'. It is about the confidence they get.

Mr KOTSIRAS — Can you tell me what the difference is between what you are doing and what the department of education is doing in primary schools to encourage kids to do maths? What is so special about Maths Mania? What do you offer that teachers are not doing?

Mr PERTON — Being engaging!

Mr KOTSIRAS — There are resources out there which teachers can use, so why would teachers call on you to come to their schools?

Mr CORBOY — Instead of children going out of schools, because of the cost, we are an incursion — we come to them, and they love it. They think it is tremendous. There are no buses or insurance. We come into schools. In the market there are only about two proprietary limited operators in the country doing it. It is a huge market. We started off pretty slowly in 2000, but it has just snowballed, because teachers have not got the activities that we have. They have got the card and dice games, but they have not got the huge number of activities that we come in with, such as magnet mazes and shark and boat. We have about 120 activities. We only set up 18 in each school; we have got lower, middle and upper different activities. We set up and run the whole program. The activities have never been seen before; they are all original.

Mrs DAVEY — On that question, teachers teach the maths program; we support their teaching the maths program. You cannot really ask what we offer that they cannot. We offer an extension of what they are doing. They are confined to the classroom and have a curriculum that they have to follow, and we offer them some ideas.

We offer them incentives to say, 'Okay, this is how I teach it. They've done it this way and this way, so when I go back and I want to teach measurement, addition or whatever' — it gives them some ideas and inspiration that they can use back in the classroom. We are not competing with them; we are just complementing their program because we offer two different things.

Mr CORBOY — We run the parent nights where we have 300 parents come in with the children, which is fantastic. The young ones run through the program, they are excited and they go home and tell mum and dad. They come down from 7 o'clock until 8.15 and the children teach the parents — because they are very stand-offish because the young ones know all the answers. So it is a very exciting atmosphere and the teachers are — —

Mr KOTSIRAS — You have been going since 2000. In your experience with primary teachers, what do you say about their ability and competence in teaching science or maths? I am not asking you to give a score; I am asking what do you feel?

Mrs DAVEY — I think they are competent in maths but I think they get a little bit hesitant and cautious when a new curriculum is brought in, with new buzz words. They think, 'Oh, is it a whole new thing that is changing?'. They know that the kids love hands on because you are teaching a different style of kid than we were when we were going through school. They know the kids love this interaction, but they do not have the tools or resources. There are heaps of maths books around but when we talk to them they say, 'We really want a hands-on book. We've got the ones that can give us the black-line masters to go through this, and plus and minus, etc, etc'. But they do not have something that is a little bit different. 'If I am teaching measurement, what are some activities that are going to take me away from the chalk-and-talk method onto the classroom floor, out into the playground, that are a little bit different from what I have normally done?'; that is what they are lacking, and that is why I feel they lack the confidence to experiment a bit more with hands-on activities.

They have to get through the curriculum. They have to get Johnny in grade 1 to go from A to B, but it is how to do it and how to keep the kids interested. That is where they like the ideas that we have, because the activities give them ideas. Every time they come into our sessions, they come with pen and paper and they leave with 20 or 30 ideas, 'Oh, yes, I can use this'. Once you give them one, it snowballs and then they come up with another 10. Sometimes it is just a stimulus for them.

The CHAIR — Can I just follow that up with a range of questions? You have included in your submission a section of a maths book, author unknown — I guess a lot of maths books have a few authors — and in that piece you have said also that a large section of the population fears maths.

Mrs DAVEY — Both of us do.

The CHAIR — There are a number of issues here, including that a lot of people have maths anxiety, they are anxious about mathematics and do not feel comfortable about mathematics either in the school or out of it. The article says that it can be traced back to the first few years of school and that often it is passed down from generation to generation. One thing that is of particular interest is that it says that a high percentage of people with maths anxiety are female. Is that generally your experience? Does this article reflect your experience?

Mrs DAVEY — We get a lot of parents coming to work with the children. They are very hesitant. Unless you say, 'Here is the answer sheet', they are very anxious.

The CHAIR — We have heard that before, that in a number of cases there is a lack of confidence among primary school teachers in particular about teaching maths, because they feel they have to know all the answers and they do not feel all that confident. Just on that point you make, though, given that a large part of the primary school teaching work force is in fact women — and I guess maths/science has not in the past, and probably still today, been a traditional area for a lot of women in universities and secondary colleges — is this a substantive issue for our teaching work force? That is, do we need to have some more proactive programs in terms of looking at maths anxiety amongst the existing teaching work force in primary school?

Mr CORBOY — Yes.

The CHAIR — How do we go about that? What are the real issues from your practical experience?

Mrs DAVEY — Being a female — and I am not very confident with maths anyway and I think that is why I enjoy teaching maths, because when I see the kids struggling I know exactly how they feel — when you have the hands-on stuff it tends to relax you more because you then start using verbal skills and girls are a lot more comfortable with the verbal part and with using a different part of the brain to solve something.

Men, or male teachers, are very comfortable with the chalk and talk because that was the way they were schooled and maths has also been something that they have been very comfortable with growing up — this is a generalisation — whereas I think women really need more hands-on instruction because it helps them teach maths because they can relate to it. They can talk about it while they are doing it rather than just doing it.

The CHAIR — I do not want to put words in your mouth at all so if you do not think so, say it. That opens up the whole area of teacher training and what happens in secondary schools.

Mrs DAVEY — We have two points here.

The CHAIR — What do you say about how we instil a greater confidence and reduce maths anxiety within our primary school teachers, starting at the teacher training level running right through? What are the answers to what we do need to do to increase confidence in our primary teaching work force about teaching maths/science?

Mrs DAVEY — We have spoken to a lot of first, second or third-year-out teachers. They look at the program and they say, 'I wish we had had this at university, had more hands-on stuff.' So they do hands-on stuff, they touch on it, but it is still probably not enough to give them the confidence to take them hands on into the classroom to the magnitude that they want.

As a solution, we have two things we want to do. We want to take Maths Mania into universities, into third and fourth years — or even start at first year — and run a program that could be a semester program that looks at how you do hands-on maths in the classroom. We want to say, 'This is the curriculum. These are some activities we have come up with'. If they have a bigger budget they can bring in others, but we talk about other small activities so that when they come out into the primary schools they are a little bit more au fait.

The CHAIR — A bit more confident about teaching maths/science.

Mrs DAVEY — That is right; even the teachers who are in primary school and have been through university, and more so the older teachers who are less confident because they have had more traditional ways of teaching, to in-service them in a hands-on workshop. That is another avenue we are looking at.

The CHAIR — So more practical, hands-on teaching lessons and experience for student teachers and existing teachers to get more hands-on teaching in the classroom?

Mrs DAVEY — Yes, they are so hungry.

Mr CORBOY — They are; they are very hungry.

Mr PERTON — There has been some discussion about the fact that preschool children are not sufficiently prepared with basic maths skills and the like, (a) for life, and (b) in preparation for school. Have you looked at the preschool situation?

Mr CORBOY — We have looked at it. My wife is a lecturer in that area of early childhood. I was in Tasmania three weeks ago. I ran some kindy programs with preps, but on the same campus. It was only one school, but I could not distinguish between the kindies and the preps — they were tall, very social and very good at what they were doing. I have run the program in Geelong with preps and kindy children and it has been very hard; we have lasted 20 to 40 minutes on the program. They are basically seeing at first-hand, before they get into the primary sector, that maths can be fun. It is just changing that whole idea. You know, kangaroos hopping down; we count the kangaroos. They think, 'Oh, that's different from doing the beads' — kangaroos hopping, opening doors, finding little Johnny. There are certain things that the kindy kids love, but still it is not my field — they are so young, only four-year-olds and five-year-olds.

Mrs DAVEY — But that is the age that you should encourage teachers to look at the perspective because if they can see kangaroos hopping outside — if they live in the country — they can then relate maths to every day. I think that is probably where it should start, that it is an everyday occurrence that is then taught in the classroom and not something that is taught in the classroom, thinking, 'Let's try to grab something from the every day to try to relate to it'. The perspective needs to change, so that you see maths differently — it is not up on the board; it is brought into the classroom.

Mr PERTON — Taking the question of English literacy, the problem for many children starts pre school and now there is a great focus on read-aloud programs, encouraging parents to spend 10 minutes a day reading to their children. Have you seen any recommendations or the like to teach numbers or early mathematical principles to children from 0 to 5, any guidance for parents that is useful?

Mrs DAVEY — The main guidance is to not formalise it too much. While they are putting Weet-Bix in their bowl, that should be the mathematics that the kids do. I think that as soon as it comes into an educational institution maths becomes educationalised and they lose that thirst for knowledge. When mum is counting the Weet-Bix, that is fun and is relevant, but when you have to add 1 plus 1 plus 1 together in the classroom on the board, the Weet-Bix suddenly become totally irrelevant and they get confused. It seems that the parents are doing quite a good job at home, but when the kids get into the classroom it just becomes, especially at a very young age, very formalised. It is about trying to deformalise that, even though you still have to teach everything, to still make it fun and applicable to what is going on in their lives.

Mr PERTON — In one of our previous inquiries on the training of teachers, and in this inquiry too, there seems to be a problem with the training of teachers in this area. You are probably aware that tests have been done that indicate that many primary school teachers are incapable of passing a year 8 maths exam.

Mr CORBOY — Yes.

Mr PERTON — So the problem of retraining a work force that is so poorly prepared to teach maths is very long term.

Mr CORBOY — Of course.

Mr PERTON — We are probably talking a decade, if not more.

Mr CORBOY — Sure.

Mr PERTON — We have a generation of kids now in the schools — were you a minister for education or a secretary of the department what would you mandate, what would you do to fix the situation or more quickly than, for instance, retraining the entire work force?

Mr CORBOY — You would start with graduates, would you not?

Mrs DAVEY — You would have to start with the graduates.

Mr CORBOY — That is the first port of call.

Mrs DAVEY — Because they are the ones who have the enthusiasm and the passion to do it. And yes, they may not feel confident in maths, but if you can change their perspective on what maths is — and I think it is a training of perspective as much as a training of how to teach anything — then once with the graduates you have got the ball rolling on that court, and into the primary schools, it is just about bringing in things slowly — taking away the books, where it is being read out of books all the time. Our kids are not learning that way.

Ms ECKSTEIN — I am sorry, but I have been sitting here listening to this. That has not been my experience with primary schools for an awfully long time.

The CHAIR — Can we just finish off — —

Mrs DAVEY — No, I know, but they base their maths on books.

The CHAIR — You can ask about that in a tick. Victor will finish off his questions and then I will ask Janice.

Mr PERTON — The school I visited on Friday has adopted an approach, and it has a highly qualified principal and assistant principal, both of whom are secondary-education trained in maths. In their case they are using the teacher to actually teach classes at the lower levels, except for the fact that the teachers in the lower grades are not particularly qualified to teach maths and are not particularly enthusiastic about using specialised teachers. You have obviously had the opportunity to observe lots of primary schools and to observe the children's interaction with you on a one-off basis. Should we be looking to adopt a specialist maths teachers model for primary schools? They have a numeracy hour now — —

Mr CORBOY — Yes, I know.

Mr PERTON — But if you have a numeracy hour with someone who is not particularly tuned in to teaching maths — —

Mrs DAVEY — I think it really comes down to your passion for something. You do not have to be good at any particular subject, like a specialist maths teacher is, but if you have the enthusiasm, that makes up for so much.

Mr PERTON — But if we look at the population as a whole and at the literacy problem, it is said that between 20 per cent and 30 per cent of the population are functionally illiterate in English. The figures must be similar in mathematics.

Mr CORBOY — Sure.

Mr PERTON — And from what we have observed — and the chairman has talked about it — there is a percentage of primary school teachers who are not particularly adept. So it does not matter how enthusiastic they are — —

The CHAIR — No, I said they are not confident, not that they are not competent.

Mr PERTON — About teaching.

Mr CORBOY — That is right.

Mr PERTON — You have quoted the anxiety.

The CHAIR — They have anxiety about that?

Mrs DAVEY — Yes.

Mr PERTON — So they might be utterly enthusiastic about teaching, but they communicate that anxiety about maths to the children.

Mrs DAVEY — Yes.

Mr PERTON — So in maths, how many primary school teachers do we have — 30 000?

The CHAIR — Public, private?

Mr PERTON — Even if it was 5000 or 6000 of those teachers who are in this position, we will not be able to reverse that in two or three — —

Mrs DAVEY — No.

Mr PERTON — So what do we do in the midst? I mean, you are offering a program, you are there once a year or the like, making yourself available to a school. What do we do in all those schools in which these teachers who are not particularly confident or adept at maths are employed and will continue to be employed for years to come?

Mrs DAVEY — A lot of teachers do team teaching, where one who is more adept in maths will say, 'I'll take the maths section' or, 'I'm more passionate about science'. From my experience in primary schools that has worked really well.

Ms MUNT — I wonder whether you have a background in teaching yourself. Do you come at this from having experience in schools, where you thought you could improve — —

Mr CORBOY — Firstly in my direct family of six children, five are teachers. I was not a teacher; I left school very early. It is a long story. I had a lot of pain with maths — shockingly. I was embarrassed; I ridiculed myself. It was shocking. My little boy did reading recovery. I thought, 'Wow, that is tremendous, breaking up the words' — which I remember they did 20 or 30 years ago. Then the family said, 'We should do a hands-on program in maths'. I said, 'Well you have all the degrees and you know all the stuff. You put it together and I will handle the sales and marketing'. And now we third party it. We ring up this school, we ring up that school. I cannot tell you how good we are; ring up the maths coordinators and ask them. Ring up Haileybury College on South Road, or the other sites.

We, especially I, have to burn for that. I do not know how hard young boys and girls have it in school, because I had it tough. When I was in school this morning we were high -fiving and working with them and saying very highly encouraging words. They want to stay longer. They want to stay longer than 70 minutes; they want to come in at lunchtime because they did not do the magnet maze and they did not do this or that. So we say, 'Sure, you can come back in; why not? It will make it fun'.

So we open the doors a bit at lunchtime, where we do not have to, and they come in and play with the activities. It is put together by teachers, and we have about 12 consultants online. You have seen our maths book; we have the masters and the teacher-of-the-year awards. We delegate it out basically, except for the directors — they are teachers, besides myself; I am not a teacher. I had 20 years in commercial business.

Ms MUNT — Are the people who actually go to the schools teachers?

Mrs DAVEY — I am a teacher; Peter is not.

Mr CORBOY — I am not a teacher. The other presenter is a teacher and I am now training up a person as a presenter who is a teacher.

Ms MUNT — Do you mostly get your business through private schools or the public sector?

Mr CORBOY — No, the government, more government. It is starting to kick in now.

Mrs DAVEY — Can I just say that I live in Queensland, and I have been doing the program up there. Victoria is so far ahead in respect to being hands-on and the way education is running. I mean, I would love for the Queensland primary schools to see what is going on down here.

Mr CORBOY — It is very open in Victorian schools, compared to those in Sydney. Adelaide is very open; it is extremely open in Adelaide. Victoria is the best, probably because certainly as you market it, one cannot please — —

Mrs DAVEY — And teachers are really keen to try to experiment and to look at — —

Mr CORBOY — Compared to the other states, there is no doubt. Queensland is a shocker.

Mrs DAVEY — I love Queensland, but — —

Mr CORBOY — It is tough.

Mrs DAVEY — It is just different — it is very formal.

Mr CORBOY — They do not like spending $2500 on something that is not good; they would get a bad reputation. So I say as a businessman, 'Ring up a school; ring up Joe or some other maths coordinator, or even look at some of our articles from the *Education Today* magazine', and so on.

Mrs DAVEY — But from saying what is happening with teachers in training and teachers in the schools, it must be working because they are keen, they are more than happy to bring people in, and they want to know more and want to experiment more — more so than in any other state. So it is on the right track.

Ms MUNT — Good; thank you very much.

Ms ECKSTEIN — That might explain some of where I am thinking you are coming from.

Mrs DAVEY — Yes, with the books; I know.

Ms ECKSTEIN — Because, quite frankly, I have had a flip through that book. I was trained as a teacher in Victoria over 25 years ago, in a very hands-on method. I was in the education department up until a few years ago, in primary schools — not in the maths area, but you go in and you see stuff. What you are saying about teaching off the board or teaching out of a book is not my experience of maths teaching in Victoria.

The CHAIR — In primary schools?

Ms ECKSTEIN — In primary schools. We are talking about a primary program here because year 7 in other states is still primary level. Therefore I have been a bit puzzled about some of the things you are saying.

There are some great ideas in there, and I am sure teachers will take them on, but I just wonder how much of what you do is the novelty factor. You come in, you are a different bunch of people, it is all exciting, you have some aids, perhaps, that the school does not have, although I do not know of too many primary schools here in Victoria that do not have a lot of maths equipment and do not do a lot of hands-on stuff. But how much of it is the novelty or is it that they are teaching really crap maths in other states?

Mr CORBOY — If it were the novelty factor we would have been out of business in our first six months of trade. We would be gone. I have been in sales marketing for 25 years, in business broking, you name it, right across the board, and I know that if something does not work, you are gone. The product will not survive. Our product is getting better because the schools are ringing us up with 600 or 700 children — 450 at a time — and the whole school wants to run the program and repeat it every two to three years. The scale is going up rapidly, and it is very exciting from a business point of view.

Mrs DAVEY — But there is a novelty factor there.

Mr CORBOY — Yes. It is working because they would not be coming back to us and saying come again — —

Ms ECKSTEIN — They might be coming back for the novelty factor. That is what I am trying to say.

Mrs DAVEY — But they are also coming back for a fix for the kids.

Ms ECKSTEIN — Another boost in motivation.

Mrs DAVEY — Exactly, and that can sustain and that is why — at the moment we are only doing this once a year, but if you could do it once a term, that fix is entrenched more and more, and it can then become a little more specialised and progressive. I agree it is novelty, it is a fix, but it is giving the teachers a fix too. I can use this with the kids, the kids are excited, they move on. So there is a little bit of both.

Ms ECKSTEIN — Okay.

The CHAIR — I might finish off with a question on one of the points you made in passing about the Weet-bix. It strikes me, listening to you, in terms of both combining what happens in the classroom, the approach teachers take and of course what happens at home, that one of the crucial factors is the linkage between home and school. Former federal Labor leader Mark Latham had the homework reading program, and a lot of other governments have done that.

Mr PERTON — Parents reading to their children.

The CHAIR — Yes, parents reading to children, and it strikes me that that is a very relevant point that you have made. The activities that happen at home and the activities happening in the primary school, particularly the junior primary, are crucial.

I think many parents would think, 'Yes, we need to help children with their times tables and that sort of thing', but have you given much thought to how you have perhaps a more creative parental involvement at home with the maths programs that you do and which happen in schools? Have you thought about perhaps formalising that type of activity so that parents link in with what is happening in the school?

Mr CORBOY — Through our database we send out newsletters every quarter as to what is happening in maths, new activities we are putting out and so on. We run parent nights for that sole reason — they come back to the school. I say to them, 'Talk it up; go down to the shop and get 1.25 litres of milk. Pour milk onto your cornflakes — spatial skills. Talk it up!'.

It comes back to the parents. It is an education, it is a long process, and as Jo said earlier, which I was very impressed with, it is great to see this stuff going into the universities, to the undergraduate classes, who spend two days a week running through different types of applications, different times of activities, getting enthusiastic about it. It is like a disease. It just keeps multiplying. You cannot stop it once it starts bubbling.

Mrs DAVEY — With the parent-school relationship, it needs to be a little more formalised as has occurred with the reading recovery or maths recovery programs. The parents are very comfortable with maths at home but not with the maths at school. It is the teachers' responsibility to make the parents comfortable with the activities they give the children, but a lot of the time the worksheets go home cover very formalised maths, as opposed to: how can we make it where you are doing maths with the kids?

Rather than saying, 'Get them to do these sums' and so on, we should be saying, 'When you cook tonight, this is your homework. Johnny has to tell me how many times you stirred the pot, how many spoons of salt you put in', and that is his homework.

Mr CORBOY — And how many paces from your bed to the fridge, as I say to the preps.

Mrs DAVEY — And when they come back, they have done their homework. It is all maths. They might have done multiplication, division, subtraction, but it is maths and they don't see that as maths. They say, 'I watched mum cook.' Then the parents think, 'That maths is easier than when I was at school', but it is actually exactly the same. It is again the change of perspective.

The CHAIR — Thank you very much for that. We are encouraged by your enthusiasm.

Mrs DAVEY — We are enthusiastic.

The CHAIR — We wish you well in spreading the word that maths is fun amongst the schools.

Mr CORBOY — We are the only proprietary limited company that has put its hand-up. That is what I cannot understand. I am only a baby in this industry — five years!

The CHAIR — We will get the competition authority on to this one, that's for sure. It sounds fantastic, and it is great to hear such enthusiasm about maths in schools, and you are making it fun as well. Thank you very much.

Witnesses withdrew.

CORRECTED VERSION

EDUCATION AND TRAINING COMMITTEE

Subcommittee

Inquiry into promotion of maths and science education

Melbourne — 18 July 2005

Members

Mr S. R. Herbert
Ms A. L. Eckstein
Mr V. J. Perton
Mr N. Kotsiras
Ms J. R. Munt

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Witnesses

Professor M. Adams, head of applied chemistry; and

Mr T. Rook, senior lecturer, department of applied chemistry, RMIT University; and

Associate Professor D. McFadyen, school of chemistry, University of Melbourne, Victorian Institute for Chemical Sciences.

The CHAIR — I welcome the Victorian Institute for Chemical Sciences (VICS). Could you give a short presentation speaking to your submissions or to the terms of reference, and then we will open up to questions.

Prof. ADAMS — Firstly could I register an apology for Peter Lehman. The original invitation went to Peter as senior executive officer of VICS. Peter has been out of the country, and I think he only arrived back this morning. On behalf of VICS the three of us are here instead. I have two things initially. Firstly, thank you for the invitation and for giving us the opportunity to present some data and forward some things to this committee and this hearing; and secondly, I want to congratulate the committee, or whoever set it up, on what is probably a very timely and very needed look at a quite serious state of affairs regarding education and training in science.

The paper I assume you have a copy of is a couple of pages of submission signed off by Peter and by Ian McKinnon of Monash University. As I said, Peter is chief executive officer with Ian as the theme leader within VICS, partly funded by the state government's STI scheme. VICS is a consortium of three universities — Melbourne, Monash and RMIT — with large chemistry departments, and it is a chemistry structure from a research and an educational aspect.

We are trying to increase and gain the critical mass needed to be able to compete on a world stage as well as a national stage in terms of the numbers and the diversity of the chemical-based science that that we have. Education is one of the themes that is important to VICS. What Peter and his colleagues in several discussions came out with is a little bit of background with this, but also some recommendations, and we would like to focus on them. Whilst we are principally chemists — we are chemists — and here representing VICS, the comments we have really do relate across physical sciences in general, and I would include mathematics in that.

The number of students entering higher education, tertiary education, in the last 10 to 15 years has grown dramatically. This is across the world; it is not an Australian thing. What has not increased is the relative percentage of those doing science. There is probably about the same number doing science now as there was 20 years ago, and given the relative growth in education this is in a way quite surprising, since most countries, most organisations, are pushing the fact that they are science based. Virtually every country has its 'The clever country'-type heading on this. We do not know what information and evidence has been presented to you by — I do not know who you have seen. I have brought various documents along covering some of the things that really should be raised. It is a worldwide issue, the one of the science-based education and how to get more people interested in science as a career, given that it is fundamental to the infrastructure of most developed countries.

On the recommendations, what we were looking at is those which we have seen work elsewhere and have been tried elsewhere — sometimes in Australia, but certainly overseas as well — and which appear to in some cases have had good success rates in enthusing and increasing the number of people who are interested in science and who hopefully will do science as a career, and particularly science education in secondary schools. We were looking at this earlier and discussing it, and we really came down to two aspects of it. One we put down was 'the establishment of a dedicated teaching laboratory or teaching facility' and the other one is on the careers and the personal profile of those people going into teaching themselves. If I may, I will continue to have a look at this teaching laboratory. I will make some points about that and then pass to my colleague David, who will say something about the teaching aspect.

The state government has been involved in the kind of thing we have put forward here, the introduction of the Gene Technology Access Centre, which from all reports and talking to the people involved with it has been very successful in the biological sciences and the life sciences in providing a facility for students and staff to gain access to leading-edge, cutting-edge technology in the biosciences. One of the things we would be very interested in helping the state government get involved in is something in a similar vein with the physical sciences — that is, that the state support and initially sponsor a centre based in the physical sciences, in laboratory facilities and classroom facilities which all secondary schools could use and gain access to and where it can become part of the curriculum to attend this centre and to get hands on. We believe this would be a very cost-effective way of getting what can be expensive infrastructure down to schoolchildren, in years 10 to 12 in particular.

As with GTAC, it could be based after secondary school, and providing there is good access I do not think it matters particularly which one. We did not seem to know which one we would want to go into. If it were based at a secondary school with good communication facilities and where schools could get to it, then this would give access to secondary school students. They would have access to a laboratory facility, an up-to-date facility, and one with basic instrumentation that fits in with a science syllabus.

They include not just chemistry, but particularly physics and mathematics. I think we also act as a centre for professional development, and I am sure David will mention some of these things later when we are looking at the professional side of the teaching profession itself.

I think really the GTAC seems to provide an excellent example of what can be done there. We know with our own laboratories, our own facilities, when we open these to students there is a great demand from students to come to our laboratories to see what we are doing, to listen to people talking about our respective research areas and the kinds of things that excite us about science. The big problem with that is simply the time scale, the slots that we can fit students into. Quite often those slots that we might have available are simply not suitable for secondary schools, and the demand on our own laboratories for our own teaching really prevents us spending more time within the universities on doing a lot of what we would like to do. So that facility would be a great benefit to everyone.

It has to be a long-term commitment. Having said that, knowing from our own experience of going out to schools and having schools in, industry will support it greatly, I have no doubt about that whatsoever. We have laboratories equipped by industry. When we visit rural schools and take road shows out we get sponsorship from industry, and, if this was given the added status of having state government backing, I would have no doubt at all that through the contacts we and I am sure others have the various industries, the industry manufacturers, the laboratory suppliers would jump on board and would really get excited and enthused by this.

That kind of laboratory facility would be an excellent facility for the metropolitan-based schools. I think it is a different issue when we start looking at the rural schools. We cannot expect people to be bussed in 200, 400 or 500 kilometres. At the same time we also have to look at what we are going to do with rural education. We cannot keep piling these facilities into the centre. A number of countries have tried mobile laboratories, and these appear to have been quite successful — taking laboratories out to these schools and giving them access to the facilities along with lectures. We at RMIT do this to a small extent when we can. I have to say it is actually done on the cheap, really. We get some interested sponsorship for all this, and it is actually done by the students themselves. They go on a mentoring-type exercise, and I know other universities do something similar.

People like Agilent support Siemens Science — we all give support to that kind of thing. The difference that makes to the kids in rural schools is quite significant. I think the payback in terms of enthusiasm for science and the different look on science that they get, from what we see in the rural newspaper reports when the students and stuff have been out there, far outweighs the really quite small cost associated with that. It would be nice if that could be organised statewide, not just simply by individual departments or individual disciplines or individual universities. I think that could be done very nicely.

I have brought in GTAC with the state initiative. They have information on that. As I said, I do not know how much of the information you have already had. The issue of training and enthusing students to go into science education and to become science teachers is part of getting the population as a whole interested in science. Some of the articles I have brought with me relate in particular to some of the UK initiatives in this, such as the setting up of the National Science Learning Centre in York, which is huge and will be a teacher training facility for science teachers; the Lab in a Lorry facility, which will take laboratory facilities out to schools; and information on some of the problems I would say that are in the UK of breaking the cycle and how to get keen, top students into education, into teaching so they themselves will enthuse their own students and get them onto that cycle.

At the moment I am sure you are familiar with the Australian Deans of Science report on who is teaching science, which states that the level of training in the professional qualifications of many science teachers is getting desperately low, particularly in the physical sciences — often less than half of a major qualification in the science that they are teaching. I think this is causing an issue, and it then feeds back if the students themselves are not enthusiastic to go on and do science because the teachers do not have the background insights. I think that circle has to be broken. David will talk about career paths of teachers, but we have to have the facilities to back that. I will deposit those papers with you.

Assoc. Prof. McFADYEN — I will take up on what Mike has had to say. Two of our recommendations can be closely related to the outcomes of the report Mike referred to that was commissioned by the Australian Council of Deans of Science and entitled *Who's Teaching Science.* It deals with how in fact the demand for science teachers might be met into the future. If you look at two of the outcomes of that, and the recommendations are significant ones, they identified these issues: the first was that the remuneration for science teachers and teachers in general is not good, and this was a significant deterrent to our brightest and best people becoming secondary school

teachers. Certainly in the chemical sciences this is the case. There is not much doubt that people who undertake a career in chemistry are disadvantaged compared with their peers who do not. Certainly if we look at our graduates in Melbourne who become teachers, they tend not to be the better students at all.

We believe it is very important, if the discipline in Victoria and in fact nationally is to be advanced, that we have our very best people becoming school teachers. Certainly in Victoria if you look at the age profile of people who have led the development of secondary school chemistry over the last 20 or 30 years you find most of those people are close to retirement, and I think there is a real shortage of potential leaders in the secondary school chemistry community.

How might that be overcome? There have been a number of suggestions, and we have made some comments in our report. One is to provide scholarships to very bright people to become secondary school science teachers. They might be provided at the commencement of the undergraduate course. They might be provided at the point of a diploma of education to entice people to do that. The second, I think, is to seriously look at rewarding our teachers more adequately for the important work they do. We do not believe they are very well rewarded at all. The third issue is that to encourage people who are very well qualified to become teachers we need to recognise their qualifications, so if they have spent four or five years undertaking a PhD, a dip. ed. or whatever, when they commence work as a teacher those qualifications are recognised as, for example, equivalent years of service — so the issue of remuneration is important and, again, some type of scholarship support.

The second point that comes out of the deans' report is that there appear to be — and I think it is true — inadequate professional development opportunities for teachers. Once they commence teaching, the opportunity to refresh their knowledge in the discipline or to further it is diminished. We have made a couple of suggestions. One, and this certainly links into Mike's comment about a learning centre in the physical sciences, is that teachers should be released on an annual basis, perhaps for a period of six months, and there might be the opportunity for 10 or half a dozen teachers statewide to participate in these kinds of programs to undergo what in an academic sense is a period of sabbatical leave where they can either develop curriculum materials or refresh themselves in the discipline. If the kind of centre Mike has talked about were to be established, then there would be an opportunity through that centre to do work of this sort. They are the two aspects we really think should be focused on.

Mr KOTSIRAS — You also talked about year 10 students work experience and a program that offered interesting work experience for year 10 students. Can you elaborate on that? Can you tell me more?

Assoc. Prof. McFADYEN — Yes, there are various programs around whereby year 10 students — we certainly have some in our university — come in and experience what it is like to work as a physical scientist. CSIRO runs programs like that. If those sorts of opportunities were to be expanded, they would be valuable for year 10 students. Of great value, though, would be the kind of suggestion Mike talked about: a dedicated centre where those kinds of students at the year 10 level could go and experience, if you like, cutting-edge chemistry. They do not get the chance to see that in schools. The image of chemistry that is often portrayed in schools is really not a reflection of what chemists do. If you looked at the show on DNA on channel 2 last week you would have seen that the structure of DNA was elucidated by a physicist in a very significant contribution, and chemists played a key role in that. It is, after all, a molecule. Those kinds of points are often lost, particularly with junior school chemistry. Reaching year 10 students is very important as well, and some sort of work experience would be useful.

Mr PERTON — We saw from the material produced last week and over recent weeks by your fellow organisations that 50 per cent of senior science teachers in secondary schools have no qualifications beyond those from secondary schools themselves, and looking at primary education we see that much of this battle is already lost before the kids have reached year 7. We have got a teacher work force of roughly 50 000. I do not think we are going to be able to turn that around quickly. What do we do with the students currently going through primary and secondary who have teachers who are not qualified in the physical sciences or in any of the sciences and may not be all that enthusiastic themselves? What do we do for the next 5 to 10 years until these other measures of yours work their way through the system?

Prof. ADAMS — If we could go along the line of a centre, it is not just a simple building; it actually acts as a focus. It puts a badge on it that says science is important. At the end of the day most school kids, university students — most people — actually like solving problems. They really enjoy it. You have to do something pretty bloody bad to a bright kid who loves playing with things and solving puzzles to actually knock that out of them. That is basically what happens in most schools, and it is not — it is around the world; this is what happens to a lot

of kids in secondary schools. In the disciplines — and things go up and down; and we have seen this in chemistry — where graduates are finding good employment and decent salaries, they do not go into teaching. The people who are teaching them are not chemists, although they might have some scientific background. So the first thing we have to do is get them excited and back into being interested. From a professional development aspect, if there is some kind of centre — personally I would like to see a modern centre; a building with facilities — where they can go to and talk to other teachers in the same boat, professional scientists from the industry, the CSIRO and the universities about what is going on, how it relates to their curriculum and how the curriculum can develop to take those things into account, I think we could get some enthusiasm built up.

Mr PERTON — We had a program in Victoria called the Teacher Release to Industry program.

Prof. ADAMS — Yes.

Mr PERTON — Monash University reported that it ought to have been doubled in size, but this government for ideological reasons abolished it. Your evidence is that such a program would be useful.

The CHAIR — Victor is making a point, we will make — —

Mr PERTON — There is direct evidence that says you actually need these sorts of programs. Going back to your proposition that the best students are not going into teaching — that would be predicted, would it not? The most interesting careers in science involve working in some new process or finding something and experimenting. Is there much opportunity for your brightest students to actually be engaged in doing things in chemistry and being able to teach part time, say?

Assoc. Prof. McFADYEN — I think there are those opportunities. If we had the kind of program we have advocated and if those kinds of people had the opportunity, as we do, every, say, six or seven years to take a period of substantial study leave, that would encourage them to remain as teachers and provide a pool of people who can lead the discipline. To lead school chemistry we need some really bright and talented people. You would not need those people if you were to develop good curriculum material which reflects the way the discipline is going.

Mr PERTON — Can I take up that point? What is your opinion of the Victorian secondary school curriculum in the physical sciences?

Assoc. Prof. McFADYEN — I can comment on chemistry. It seems to me that in developing the chemistry curriculum there are a number of difficulties. One is that you are trying to prepare a program which is designed, I guess, to cater for a very broad cohort and students with a broad span of abilities. I have to say — and I am at the University of Melbourne — that the people who come to us are by and large pretty well prepared. They have covered most of the kinds of concepts we would need to build upon. It is a curriculum which I suppose is more contextual than the one 30 years ago. The one 30 years or 25 years ago was more mathematical and was not taught in context. This is a contextual curriculum. I have some disagreements, but by and large I think the ideas and concepts they look at are appropriate.

But I do acknowledge that in a sense there is a limitation, because we are running a certificate course which is designed to cater for a very broad span of abilities. The curriculum that was offered 25 years ago would certainly be inappropriate today, because a lot of the students coming into year 12 could not manage it — it was more mathematical, more theoretical and not taught in context. I think the trend — if you look at the UK with Salter's Chemistry, which is an alternative to the A levels — has been to move curriculum materials in the direction of making them contextually based in an attempt to interest students in them. By and large the present Victorian course does a pretty good job; the people we see are well prepared.

Mr PERTON — Going back to your proposed centre, a witness earlier this afternoon suggested that having Saturday classes, workshops and laboratories to do experiments would be useful. She said in Queensland — we have not yet followed up how many students do it — the children's parents pay $5 or $6 to take part in a Saturday activity group.

Ms ECKSTEIN — Science on Saturday, I think it is.

Mr PERTON — It is Science on Saturday. We saw a very well-organised program in one of the universities in Western Australia for students to go out mentoring in schools.

The CHAIR — It is at Deakin University.

Mr PERTON — Yes. It seems to me that all your students are probably doing part-time work, whether it is in bars or in shops and the like. Is there the possibility of opening up your laboratories on Saturdays and having them staffed by students with occasional appearances by the leaders of the industry? Little Aths does that for sport, so could we do this for the physical sciences? The Chair during the coffee break asked whether we could make them annexes of sorts to Scienceworks, and whether we could give them the funding to have the additional facilities. Could we have them regularly, every Saturday, so the kids who really like science get the opportunity to go and do something?

Prof. ADAMS — I think it is a very different thing. We do run mentoring programs, in which our undergraduates attend metropolitan schools. They pick the school and make the arrangements, usually in their home area. They will take a class. It might be year 3 or year 4, right through to year 12. They will help out the teachers, for the whole semester, one day a week. Then we do concentrated ones where the students go out to rural schools and will run a class for a few days up there to assist the teacher and bring their experiments in.

The mentoring issue really is not an issue. Yes, the students who want to do science will come in on a Saturday. But to me, why are we educating the whole population, or a much greater proportion of the population in the science anyway? Why are we trying to say: if you want to do that you can come in on a Saturday to do it? The setting up of a laboratory as a one-off of an afternoon or a morning on a Saturday is a phenomenal job. It is not just a matter of running it for 3 hours on a Saturday morning. Someone has to be there the night before or very early that morning to set it up; someone has to strip it down, because that lab will be booked on the Monday. We only have to see the effort that goes in when we run one weekend in a big laboratory for an open day to realise the effort and man hours involved.

You cannot run it on a mentoring scheme simply because health and safety would not allow it. Students cannot staff it, for example. Students cannot be allowed in laboratories without a qualified, full-time member of staff present. If you are putting on instrumentation as well, it is a massive job in laboratories which are probably operating at 8 to 10 periods a week as it is. There is very little slack time. We already have staff working in the lunch hour getting ready for the afternoon, evening or the next day. To be honest, I think we have gone beyond what is available in colleges or universities. It might have worked 20 years ago, but I do not think we have that capacity any more.

Mr PERTON — One of the discussions I have had with schools on a related topic concerns VCAL technology subjects. You cannot buy the equipment that is needed and is used in a modern factory and pop it into a school where it is used between 9.00 a.m. and 3.30 p.m. Somehow we have to break down the occupational health and safety barriers to be able to take children into the factories where these highly developed machines are used, where the engineers are using modern equipment.

I am just wondering, in these physical science fields, whether we can justify building major laboratory facilities that will only be used from 9.00 a.m. to 3.30 p.m. or 9.00 a.m. to 3.00 p.m. and will not be used at night or weekends. Are we not better off in a partnership with a university such as Monash at its new science and maths school building a high-quality facility which the university can use itself but which is also available to schoolchildren and their schools?

Prof. ADAMS — Personally I think the demands are very different from the type of needs. Yes, we need access to teaching laboratories, but if you actually have a laboratory and it is being occupied 6 to 7 hours a day, that is very heavy.

Mr PERTON — Is it?

Prof. ADAMS — If that happens five days a week, it is taking a heck of a load. A laboratory just catering for chemistry and physics and can be used for mathematics as well — you have the building itself, and then, if you look at the infrastructure that is required, if you look at a modern VCE syllabus, we have had students around this year, several hundred of them at the beginning of the year, and they wanted to get on the instruments, they wanted the hands on. This is the kind of thing they really go for.

That equipment can be supplied for teaching purposes, not for research purposes, and it is not that great a capital investment compared with the infrastructure of the building. As part of VICS we have set up our own scientific

instrument company, the Centre for Scientific Instrumentation, which is actually building small instruments for teaching. Principally at the moment it is being used in university teaching, but it is available for secondary school teaching. It is quite basic instrumentation. It is not the million-dollar piece of equipment that a researcher needs.

The other thing, and I will come back to this, is that when we in the past have indicated that we are looking at getting secondary school kids interested and enthused in science — they are not big sums of money — but industry will come along, provided you get the profile. The problem is with any particular discipline — if you take chemistry at RMIT: while it has a lovely department, plenty of people, lots of students, it is not big enough for industry to put a great lump of money in for its secondary school contacts — and Melbourne is not — but if you could take it across the state. When the chemistry department at RMIT moved into its new building four years ago Agilent put a million dollars worth of equipment in. That was worth it to it because of the exposure to future users of their equipment.

That is not the only company; there are lots of companies that would do that kind of thing. Teaching equipment is big — you do not need many companies to do that. Varian, which has a factory just down the road, is one of the few original Australian instrument manufacturers. It loves getting into bed with school exercises. It was on the original advisory panel when we set VICS up. It will put members of staff up; its members of staff sit on program advisory committees; it wants to know what is going in education — that is where its future is.

Mr PERTON — What is the pathway each of you have taken to get to where you have? What was the crucial turning point for you, or what is it that built you up to the career you have undertaken?

Assoc. Prof. McFADYEN — I guess it goes back to the sorts of things that I was interested in as a 10-year-old. I was interested in machinery — how steam engines worked, how it all happened and how you made sense of it. I was never into fantasy or Harry Potter; I was into machinery and how things work. I asked why planes did not fall out of the sky, what kept a satellite up there and if gravity is there, why it did not plummet into the earth? I was asking those kinds of questions.

Mr PERTON — What was the pathway from when you were 10?

Assoc. Prof. McFADYEN — I did a science degree at Melbourne, then I did a PhD at Melbourne. I was a teacher for a period. Then I spent some time at the Peter MacCallum Cancer Institute. I ultimately ended up at the chemistry department of Melbourne University.

Mr PERTON — How long did you teach in schools?

Assoc. Prof. McFADYEN — I taught in schools for a year. I was a primary schoolteacher at one point as well. I have moved around. I have a fairly diverse background.

Mr PERTON — But what have kept you in school rather than taking the opportunities you have taken?

Assoc. Prof. McFADYEN — Salary would be one.

Mr PERTON — What sort of salary?

Assoc. Prof. McFADYEN — It would seem to me that if you are a practising schoolteacher in chemistry, you ought to be able in terms of salary enjoy the kind of remuneration someone would enjoy at level C at a university, which might be $80 000 to $85 000 a year.

The CHAIR — What about industry? I have looked at a lot of chemical labs and I have to tell you that the image that I see is a bit different to what you have portrayed. What is the salary range of industrial chemists and those going down the supply chain in the chemistry industries at normal labs — at Biota, for instance, just to pick one? Academic salaries are not necessarily indicative of industry salaries, and that is why I make the point.

Prof. ADAMS — Graduate salaries — it is always difficult because you can see the salary when they leave and enter industry, but the problem is what happens afterwards. What you find with industry — it is something we have address also — is that while we have trained a chemist we have not necessarily them as a chemist for life. I do not have a problem with that. They might go on the bench and work in research or testing for 4, 5 or 10 years.

Ms ECKSTEIN — What would they get doing that?

The CHAIR — What is the entry level? Is it $45 000 or $50 000?

Prof. ADAMS — It is about $40 000.

Mr PERTON — That is less than entry level for teaching.

The CHAIR — They would be leading up to, say, an industrial chemist.

Prof. ADAMS — The majority do not take that route; the majority do not stay in science. It is not just a teaching thing. Most science graduates are by definition numerate. They are trained in analysing situations; they are trained in problem solving. They tend — apart from life and people skills, which is a very personal thing — to make very good managers and decision-makers. So they do find it easier to track on the business side. Except for the very big companies that have professional science tracks — and I think of the old companies like ICI, where you could be on £100 000 a year as a scientist, which would be a track with the very senior management — most just do not have that career opportunity.

There are ceilings at different levels of the industry. But the opportunity to go on the management track is there with education. One issue is whether we should be encouraging the very brightest of kids to go into teaching and why they should go into teaching. A lot of people would like to go into teaching provided the salary and career path is there. They do not have to end up with a $100 000 a year thing, but there has to be something there to attract them in the first place.

The CHAIR — In fairness, the salary of a principal is above $100 000 currently. A teacher at the top of the level is on around $68 000 or $70 000 — that is, without extra duties and with 12 weeks holidays. The entry level is about $46 000. So the salaries have changed significantly since you were there. That is why I was just after the comparators. If I can move on from what you are saying because I am trying to get a grip on what you have just said to us.

You began earlier by saying that every nation acknowledges that you need to have the sciences, particularly the physical sciences, well looked after — you need a group of scientists in there to keep the industry going et cetera. However, you just said that most scientists — presumably after they have learnt the trade — move into management. I am not quite sure how those two go together. Do we need more managers with scientific backgrounds or do we need more scientists?

Prof. ADAMS — Yes.

The CHAIR — What is the determining factor?

Prof. ADAMS — I think those two are the same things. If you had a population — —

The CHAIR — Are you saying there are ramifications down the track for the education track? That is my point.

Prof. ADAMS — Yes. If you have a population that has a higher level of scientific training than a population that has not, even if the majority of those scientists go into management, their knowledge of science assists their decision making; it assists in the way they approach research investment. That is a very serious thing in Australia. It was a very serious thing in the UK when the UK was comparing its economy and its industrial performance, for example, with Germany. In Germany engineers and scientists could go on a very high salary track and take part in executive decisions; in the UK that was very rare. Therefore the research investment during the 1950s, 1960s and 1970s in Germany, because people who were making those decisions, ensured a very sound technological base at a time when the UK was almost pulling out of manufacturing and innovation. The UK has tried to pick that up again over the last 10 years, but it is having to put a lot into it.

I do not think Australia has a good research investment strategy from its industry, and I think one of the reasons for that is the technology level of the general population moving through. As I said right at the beginning, you have to do something bad to stop schoolchildren wanting to solve problems and move into science. Yet that has happened in so many countries around the world.

The CHAIR — I will leave it there. I am still not quite sure there is a direct link. I am not quite sure what you are saying about where our economy as a nation, and particularly as a state, needs the expertise — whether it is in research or whether it involves the skill level in selecting winning research or promoting it. I am not quite sure where we are up to in this debate about why we need to have more chemistry graduates coming through. I can understand the general picture, but when you unpick that into the specifics of either a skill centre or the sorts of disciplines we teach or how we should teach them, I am still not quite sure where our primary purpose is tracking back.

Prof. ADAMS — I will stay with chemistry. We are training a certain number of chemists. We know we have some very bright students who enquire about going into teaching. The brightest of students, the ones who would really like to get into teaching, can do exceptionally well in the industry. They may not be the average, but if you look at the brightest, they are not there. If you want to get those into teaching, they have got to get more out of it. Otherwise they would be in it, and they are not in it in general, so it is not offering them more.

We also have the issue of how do we cope with the teachers that we currently have. Somehow we have to find a way of enthusing them, getting them to talk amongst themselves and getting them involved with scientists as to what is going on. They may be quite a long way behind in terms of what is happening now in science. There has to be some forum for doing that, and something like the centre can work.

Mr PERTON — But aren't you talking about deeper cultural issues? If these problems are replicated — I do not read well in many languages other than English, but if I read the American papers or the English or Canadian papers, it is the same story. Having a look at what has happened to the German economy and the French economy, my suspicion is the same issues arrive; so we have deep cultural issues, whether it is the world of movies or television alike.

Deakin tells me it has doubled the size of its forensic science course this year, it has had a run. Are we going to solve these problems by building a facility where kids who have some propensity will come and learn or all children will come and learn at some point, or do we have to do something much more fundamental at the cultural level? Maybe that is beyond federal and state governments.

Prof. ADAMS — I think that the change, the big change, going back to my point earlier cannot be done immediately because we already have in place 50 000 teachers. What do we do for them? How do we get them more excited by science? There are some very good teachers out there, and I think they need to be involved in this as much as, if not more than, those in universities. A lot of very exciting stuff has been going on in industry. Most people like to tell school kids what is happening; let us get them involved. To change that culture, we have to get it back in the school.

It was interesting to hear David's background on that. I left school at 15. I was at a grammar school in the UK and I could not stand the bloody place. I hated it! I walked out and became a technician. It was in the 1960s in the UK, and what with TAFE colleges and so on, we were doing evening classes. I went and studied science at evening class, and the people I worked with really sold me on doing science. It was fantastic, and that enthusiasm has to be given back to kids. It could have killed them, as it did me, sending them to grammar school. Giving it back is worth it.

Ms MUNT — I have a simple question. We went to visit GTAC and it is a terrific program and it works really well. It has Melbourne University there and the high school and it has the research institute all in the same facility. Where would you put your dedicated teaching laboratory for chemistry? All the staff have to line up, you know, to make it work.

Prof. ADAMS — I think it should be city based.

Assoc. Prof. McFADYEN — It has to be centrally located. Mike made the comment that there has to be a facility to take things out to regions; I do not think we can expect rural people to come in, so it has to be centrally located in the metropolitan area.

I could make another comment about that. I think there is a propensity when initiatives like this are set up that it is usually done with soft money. The argument is that perhaps they will be self-funding or self-sustaining. I thinking in what is an educational institution, to use facilities of that sort is not a realistic prospect. In many respects I think the provision of good quality people on a continuing basis is as important as the facility itself. That also has to be

part of it. Mike made the comment about equipment. We are not talking about millions of dollars in terms of the equipment to run something that is useful. The people and the cost of the people on an ongoing basis are also very important indeed. I would have thought, in answer to your question, it has to be centrally located, somewhere where people can get to it.

Mr ROOK — The other thing we might add is that we could use it during the day for school kids and also in the evenings for professional development by teaching staff to be school teachers so we are getting the best use out of that.

Ms MUNT — Yes, which GTAC has because of its position and because of all the people who are around it, so I am just wondering if there is any other location you can think of that would work so well for chemistry.

Prof. ADAMS — I mean, we have had comments made about using our current undergraduates as mentors because everybody gets something out of that. There is a tremendous pool of retired teachers out there if you want to do this cheaply. There are people who are really enthusiastic — industrialists, teachers — who would love to get their hands on something like this, get back into laboratory work.

The CHAIR — I assume VICS has put a submission on this to government either at budget time, or it is preparing one.

Prof ADAMS — A submission to government for a new dedicated load?

The CHAIR — A budget bid, yes.

Ms MUNT — To build something?

Prof. ADAMS — I am sorry, no, we have not.

Assoc. Prof. McFADYEN — We have not put forward a submission as such at this point.

Mr PERTON — So what do you reckon, is it $5 million or $10 million to build a new facility?

Prof. ADAMS — Ballpark, I would think $10 million?

Assoc. Prof. McFADYEN — No.

Ms MUNT — But GTAC was $5 million, I think.

Mr PERTON — If it is a laboratory — —

Prof. ADAMS — A laboratory complex with a couple of classrooms, modern, state of the art, if it is a complete new building — $5 million or $8 million.

Assoc. Prof. McFADYEN — Yes, and the comment I made earlier, that whatever happens I think there has to be an attached associated staffing base, because that ultimately — —

Ms MUNT — It is the recurrent costs.

Assoc. Prof. McFADYEN — It is the recurrent cost that ultimately is an issue. We are running them — they are happening today; we have VCE workshops in Melbourne on food chemistry for unit 4, so we have groups of year 12 students analysing food. That is all being done, I guess, on what we would call money because it has come through VICS that is essentially soft. It is very difficult to maintain these sorts of things without recurrent funding. I think that would need to be an important component of it.

Mr PERTON — But what sort of money?

Assoc. Prof. McFADYEN — I would have thought you would need, to support probably two people to run something like that, something like $150 000, $160 000 a year with on-costs, that kind of thing.

Mr PERTON — Then you have material, depreciation of technical equipment.

The CHAIR — How many kids going through — 10 000 or 20 000 a year?

Assoc. Prof. McFADYEN — What you could probably do is, for a minimal charge, recoup your recurrent expenses for consumables.

Ms MUNT — Yes, you could make a charge.

Assoc. Prof. McFADYEN — Certainly with those kinds of things, if you are to keep costs down, you cannot support sustained salaries.

Ms MUNT — I think GTAC takes about $5 per student, but you have to add on for the kids transport costs and this, that and the other; so it gets to the point where it might be $10 or $12, which is getting higher for some kids.

The CHAIR — You referred to the York science teacher training facility. Can I just ask you this: in the teacher training facilities of your universities do the primary and components of the secondary teacher education courses do the science components in your institute or departments, or are they taught internally to the teaching faculties?

Assoc. Prof. McFADYEN — I can comment on Melbourne. As far as the prospective primary school teachers are concerned, they do Bachelor of Teaching (Primary) and they do their science education, if you like, as part of their Bachelor of Teaching (Primary). They spend a small amount of time but not very much. We have started a BSc/B Teacher combined four-year degree. They have come through our chemistry school, and to teach chemistry in a school anyone who would do a graduate diploma in education at Melbourne would need to have done a couple of years of chemistry with us.

The CHAIR — Is that the same with RMIT?

Prof. ADAMS — We have very small science secondary teaching. We teach chemistry and other sciences to phys. ed. teachers, who will take science as a second subject, but you would not want them teaching — I am not criticising them as physical educators but they are not science teachers.

The CHAIR — So that is done in your chemistry faculty?

Prof. ADAMS — Yes.

Ms ECKSTEIN — And they would have a subject major?

Prof. ADAMS — Yes, in science.

Assoc. Prof. McFADYEN — It is a subject major in science, which makes them junior science teachers.

The CHAIR — Victor made the point before and I am not sure because I didn't do the reading, but is it true that 50 per cent of senior science teachers do not have any science education post secondary school?

Mr ROOK — I would be surprised at that.

Prof. ADAMS — The figures are in the deans report.

The CHAIR — I have not got a copy of it.

Mr PERTON — I have an online version of it.

The CHAIR — I am wondering whether you are aware of that.

Assoc. Prof. McFADYEN — I do not believe it is as low as that. I can comment on chemistry. Pretty well most people teaching senior chemistry have done some chemistry. They may not have majored in chemistry, but they will have done a year of chemistry.

The CHAIR — Can I just ask one other question which is something I have been thinking about: the schools that I have been to in my electorate, the bigger secondary schools with 900 to 1500 students seem to have

very advanced science and chemistry departments, pretty well resourced, and they tend to do a fair bit of practical kind of activity.

It seems to me that while not underestimating your position on a science centre — and the gene access centre is terrific, and I am sure it will be fantastic to have one for the physical sciences or chemistry — is there an argument to be made for clusters of schools to look at perhaps specialist science centres of VCE, whereby one school in three or four secondary schools are specialising in sciences? It would boost up their teaching staff and equipment. Is there any argument for that viewpoint?

Prof. ADAMS — It is very difficult to work in practice.

The CHAIR — Perhaps in metropolitan schools?

Prof. ADAMS — One of the reasons our centre works is that it does provide that focus and that forum. With the cluster group you get the rivalries between the different schools coming into place. Then it comes to funding. Who will decide the funding?

The CHAIR — Putting that aside.

Prof. ADAMS — If we could put funding aside, there are a lot of things we could do.

The CHAIR — That is a model that might work for some areas?

Assoc. Prof. McFADYEN — I do not know. I could not comment.

Prof. ADAMS — I think this would be very difficult. The other thing as well, and it is certainly a major concern in chemistry and in the physical sciences in general, is that we go to a number of schools and they can have very large numbers of students doing chemistry — 200 kids at year 12 in one school. The number of those going on to do chemistry or science at university — you can count them on the fingers of one hand. They want it because it will get them extra points to get them into law or medicine or into the biosciences.

The CHAIR — That is another issue.

Prof. ADAMS — What the devil are we doing that they are all quite willing to study chemistry and physics, do very well at it, but do not want to take it up as a career?

Mr PERTON — I did physics and chemistry to get into law.

The CHAIR — That has given us a lot of thought! I thank you all for your attendance today. It has been most interesting.

Prof. ADAMS — I would like everyone to do chemistry. All bank managers should have a chemistry degree.

Mr PERTON — My only regret is that I took economics instead of either engineering or science.

Prof. ADAMS — Everyone should regret that.

Witnesses withdrew.

CORRECTED VERSION

EDUCATION AND TRAINING COMMITTEE

Subcommittee

Inquiry into promotion of maths and science education

Melbourne — 18 July 2005

Members

Mr S. R. Herbert
Ms A. L. Eckstein
Mr V. J. Perton
Mr N. Kotsiras
Ms J. R. Munt

Chair: Mr S. R. Herbert
Deputy Chair: Mr N. Kotsiras

Staff

Executive Officer: Ms K. Ellingford
Research Officer: Mr A. Butler

Witnesses

Mr A. Brimson; and
Mrs C. Brimson.

The CHAIR — Welcome to the inquiry. We are looking forward to hearing what you have to say. We have read your submission and seen the pictures of what you have been doing with the schools. It looks pretty exciting. Perhaps you would like to talk to the terms of reference or your submission for a short while and then we will open it up for questions.

Mr BRIMSON — We have been operating for about four years now. We run a program in physics and now we are introducing mathematics into our physics. Most of our work is in the rural part of the western region of Victoria. We extend from Bacchus Marsh to Ballarat, which are in country Victoria, and then when we get into places like the Wimmera, that is rural Victoria because that is the heart of the wheat belt. We operate in a large number of schools, with sizes of anywhere from about 30 students to 600 to 700 students. The idea of bringing physics into the schools is because a lot of students do not have access to physics. My wife has covered it in a report here that she will pass around.

We found that in a lot of schools physics is not taught simply because they do not have physics teachers in the schools to teach it. Especially when you start heading out to rural parts of Victoria it thins out quite a lot. Unfortunately physics is not the big thing of the day now. They do chemistry and biology but certainly not physics. The area we are interested in is physics because it is more of a hands-on thing, where students can actually put something together and make something work.

We have a fairly extensive physics program. I have an electrical and engineering background. All the equipment we have we build ourselves. We purchase no equipment at all. We build our own machines. We have anything from robots to rockets. We teach about rocket science and use principles of angular momentum. So we are using proper physical science. We also use the introduction of mathematics, in geometry and trigonometry. Because students cannot connect science with maths and they cannot see a practical use for it, they tend to shy away from things like algebra and trigonometry — I know I did that at school — but because they are putting something together physically and making it work, they can see a practical application for the use of mathematics. We are finding it more and more now.

I will give you an instance: in some secondary schools we have worked in, I have had students in year 8 ask me where 5 millimetres is on a ruler. That is quite astounding. They tend to work in centimetres, so when you use '5', they immediately think of 5 centimetres, and we say, 'No, 5 millimetres'. In engineering they do not use centimetres. It might be all right in a trade where they work with materials, but certainly in engineering it is always millimetres because of the discrepancy in measurements. They always make sure they use millimetres, so we use millimetres. We have found that some students have real trouble with arithmetic and so a component of our science is to introduce maths in a simple way and have a practical use for it.

I will get my wife to read the report. We have detailed as much as we possibly can but we are not here to try to bring down the education department. We just see so many inadequacies in parts of country Victoria, especially in our work. We have worked with the Department of Education and Training and the country education project, which I think is both federal and state funded, and I have also done quite a large amount of work with the University of Ballarat.

Mrs BRIMSON — Tony and I are both involved in this. Tony is the brains; I am just the helper. We went into it because we have a great heart for the children. We have children ourselves. Our son is hands on, our daughter is an academic; so we have a mixture. We see a lot of children, especially up in the rural areas and the country — probably down in the cities as well — who just feel they have no hope. At a lot of the schools we have been into there is a lot of IT, a lot of computer-literacy, computer-generated things, and if the children do not feel that is their forte, they do not want to get involved in that and they are not adequate at it, they feel failures and are out on the street standing on street corners making trouble for everybody else.

That was one of the reasons that we went into this. We wanted to give the kids hope again. Tony is a very intelligent, very capable person. He has a lot of skills, and the skills are being taken into the schools to give back to the children. It is something Tony learnt the hard way and something he can share.

We found that there is a lack of communication nowadays between the schools and industries. Industries have nothing to do with schools anymore — unless they are in IT and have computers and want to boost their schools and their names in business by giving some computers to the children. As to our remedy, I will just go through the

overview. We found that there is a lack of communication between schools and industry and commerce, and that a lot of children lack motivation and ambition.

When you ask them, 'What are you going to be?', they say, 'Oh, IT; I will go into computers'. Some teaching methods and attitudes in promoting science are negative. There is a large amount of biology and chemistry in the schools. Most of the science teachers are involved in that. There are very few physics teachers, very few who know — and they do not feel comfortable, and that is not having a go at the teachers. But as one of the men was saying before, it can be a stepping stone into another career. The teachers do not feel comfortable with physics because science and biology is sort of separated from the physical part of science, so 99 per cent of the teachers in the schools are biologists or chemists.

There is a very limited involvement by teachers in areas of research and development and follow-up, probably because they do not have a lot of time and they have a lot of meetings and things. We have found when we have gone to schools that all the teachers are involved in meetings and they do not have the time to do the R and D. There is a lack of or nil funding available. All our programs have been funded by us. We have had very little to build these programs; it has come out of our pocket. It has made it very hard, but whether or not we get funding it will still go ahead because it is important enough.

We found, too, that there is a very big imbalance between the practical and the theory. We found a lot of theory — a lot of writing on the boards — but no practice. The kids lose interest if it is all writing on the board and in the book. They are not interested; they want to see it put into practice.

Our objectives, our outcomes, that we would like to see and that we are aiming for is to form links between schools, industry and commerce by providing programs that enhance skills for teamwork and current trends in the workplace so that what they learn can go straight into the workplace. With one of our programs, the robotics, the children use their hands. They use physical things to put things together. It is not like Lego; you put together the nuts and bolts, and the nuts and bolts are all named — everything is named as you would find it in the work force. They have to work in teams.

Mr BRIMSON — And also the manuals too.

Mrs BRIMSON — They have to follow a manual which is diagrams, so it goes from years 4 and 5 up to year 10. They had to work in teams with the robots. They do not get to pick the teams; we pick the teams, or the bad person in the team picks the teams. They do not sit with anyone who works with people they have worked for before, and they have interaction together. They might be very set apart from each other in the beginning, but by the end of the robotics program they are working together, they are interested together and they are cheering each other on. It stimulates us just to watch the kids have a good time.

Mr BRIMSON — I would like to say something about our robotics program. We started a program with the University of Ballarat some three years ago with our robotics. The idea was that it was a partnership formed between the Department of Education and Training, the University of Ballarat and ourselves. We built and designed our own robots. They are tailored on the industrial robots, not on the sort of thing you see on the TV, like the *Star Wars* kind of thing.

Part of our robotics program is to teach young people that in industry today there is quite a number, I do not know how many; I think there are seven big robots currently operating in the world in that industry, putting cars together and up to all types of equipment. Our robotics are mechanically operated, they have electric motors and they are properly designed robots. I design these robots and they perform a function. My wife was saying before that we have students who put these robots together. They have to follow a manual. The components have proper names, and they have a proper tool box that puts the robot together. There are four in a team, and we have a team challenge at the end, and the robots then build something for them. We talk about robots in the classroom, where they are in industry today and what they are capable of doing. That is only a small part of our program.

One of the other things, very quickly, is that my wife said something about the lack of physics in schools. We are operating in one school within our region — I will not name the school — but we have another program that a student put together, and it is all part of VICS. One of the teachers actually said to me, 'This is amazing. We do not do this in our school. We only have one science teacher', and, from memory, that was a chemistry teacher.

Ms ECKSTEIN — So it is a secondary school?

Mr BRIMSON — Yes, and it has about 800 students in the secondary school. I said, 'How can you teach physics?'. He said, 'From textbooks. We have tiny things we put together — a battery, a globe and few other bits and pieces. But we do not do this sort of stuff at all'.

Ms ECKSTEIN — I used to do that in grade 3.

Mr PERTON — But you were growing up in Germany, weren't you?

Ms ECKSTEIN — No, I was teaching it.

Mr BRIMSON — We have put together a new program. We have a thing called harmonographics. It is a machine that draws those fancy things that look like spirograph, but our machines are very big. One of the machines stands 2.4 metres high. We use the principles of pendulum motion, and we teach about forces of energy. And we have a program where students can actually build one of these machines. The cost of the actual machine is about $8. We have a lot of programs. We have no problems with the schools wanting to take our programs, because we have worked in over 30 schools, and we have been back many times to some of those schools.

The education department has paid us to go into schools, but the sheer cost of building these projects is enormous. We are finding it extremely hard. Even the fact that we use our own vehicle to transport this material too and from schools, one of the problems is that schools like us to go to them. They do not like them to come to us, if you know what I mean. To get a school to come to a program you have to get the bus, the driver for the day and all of those kids into a bus. You have to get teachers. It is a huge exercise. What we do is go to the schools with the teachers. If the teacher says to me, 'Look, I know nothing about physics' that is okay. They become part of the team, and they enjoy it. At the end we will give them any backup material they need. We are more than happy to do that.

My wife was saying before about putting people together. My wife picks the teams. One of the reasons we do that is because we tell them, 'One day when you leave school you do not get to choose who you work with'. When I went in to do my apprenticeship it was a very hostile environment to me; I did not know these people. I knew all my mates from school, but I did not know the people I was going to work with for four years of my apprenticeship. So that is the idea behind breaking these people up and putting them with people they do not normally get along with.

The CHAIR — I might get you to wrap it up, and I will open it up to questions.

Mrs BRIMSON — Okay. One of the things we found through going into schools is that we do not talk the same language. We have not got the big words; we are just normal, everyday people.

Ms MUNT — Trust me, that is very refreshing.

Mrs BRIMSON — I do not know. I am going to say something and I do not know if I am going to set everyone against me, but I have always been taught that if you are going to say something, say it plainly; do not use big words. We have found a lot of snobbery in some of the schools because we are not teachers, we are presenters. One teacher said, 'Have you got a degree?' and Tony said, 'No'. I said, 'Do not be put down by that. Do you know what he is doing?'. She said, 'No', and I said, 'He knows more than you, so he is a teacher'.

We are not in this for big dollars, we are in it to help kids, and I think that is what everyone is here for. We have been in the schools; we have been down at ground zero, if you like. These are the problems we have found in the schools and we are now trying to remedy them in our way. The way we see it is that we want to get this to as many kids as we can. We want to give them back hands-on skills and give them back hope in a physical way. Not everybody wants to be an engineer or an IT technician or a rocket scientist, but everybody wants to be able to do something. A lot of kids out there are not academic, but they are very hands-on and have the brains to do it. I see a great way forward for this. As the other gentleman said, a lot of teachers out there are now retired and out of the work force. There are a lot of old-style physics teachers who would see a great way forward in this and to getting back to a hands-on role. We like our teachers to be 100 per cent involved. If they do not know, then the only way to learn is to get involved. We have seen teachers come in and sit on the outskirts of a group. We drag them in and say, 'Come on, get involved'. They join with the groups of kids and become part of the team. You see teachers on their hands and knees with the robots, getting into it and joining with the kids.

With mathematics, if someone had said to me, 'We are going to learn something to do with trigonometry', straight away I would have said, 'Not interested; I do not want to know'. We presented the children with a rocket lesson. They do hands-on measurements, so they are taught how to use and make a complete circle without a compass. They learn all these things, and at the end of it we say, 'Who likes maths, because you have just used maths?'. They cannot put the concept of maths and hands-on things together, and until they do that you are not going to get anywhere with maths and science. We present it in such a way that they use maths, and at the end, when we tell them that that is what they have used, they see where they need it, they see its relevance in their everyday life and they become interested. It is the only way to stir their imagination.

We find that the things we take in stimulate the kids and get them interested. We do the Bright Futures camp. Kids come in and put their names down for science because they do not want to do abseiling. They look really bored when they come in but at the end they do not want to go out for a break; they want to stay in and keep doing it. So the interest is there, but the kids have just not realised it. We have to let them know that there is more to science than biology and chemistry. There is stuff out there that is really hands on.

It all goes back to funding. There is lots of funding for computers. There is lots of funding for biology and chemistry. There is very little for physics, but given the chance that is where our future lies. We need to get back the kids' interest and to give them hope, and that is what we are here for.

The CHAIR — Thank you very much.

Ms MUNT — I notice that you live in Ballan. Thank you for coming all the way down to present to us today. I really enjoyed your presentation, and congratulations on all the work that you are doing for the schools up in your country areas. It is terrific.

As you said, there is a lot more to maths and science than university courses. There are all sorts of other applications as well. My brother was a fitter and turner. He went on to be a tech teacher and he engaged a lot of the kids in maths and science, basically through hands-on applications. The kids then went on to do apprenticeships and be involved in maths and science in a different way to those who went to university. It definitely has a very practical application. You talked about funding. My question is: could you charge the schools a bit more? Do you think they would pay if you asked them to pay more?

Mr BRIMSON — No, they will not. Most of our funding comes through either DET and CEP — the country education program.

Ms MUNT — So you do not charge the schools or the students directly?

Mr BRIMSON — No, we do not.

Mrs BRIMSON — A lot of schools do not have a lot of funding, especially when you get up into the country areas.

Mr BRIMSON — There is Murtoa.

Mrs BRIMSON — Yes, Murtoa. That is why we make things as cheap but as professional as possible. If you saw some of the things, you would not believe what they are made from. To be honest, I have never scrounged so much in all my life. I go around and get offcuts of PVC and things like that. They are professionally made because Tony comes from an engineering background.

A lot of the schools do not have much funding, and what they have has to be spread over the whole school science curriculum. So we are trying to get in at a realistic price so that if CEP or DET or anyone phones us, we tell them that we have been into schools which fund it themselves, but we do not like to overcharge because that defeats the purpose. The children are not getting anything, and that is what we are all about.

Ms MUNT— There is another question that I really want to ask. The people before you were talking about outreach programs to all areas from a central location for chemistry, physics, maths or whatever. How do you think that would work? Could you fit in with that, and do you think it would have an application in rural areas?

Mr BRIMSON — Outreach is certainly the way to go into the rural areas of Victoria. Just to give you an indication, students travel up to 1½ hours to school from where they live. In rural Victoria the high schools are

usually centrally located, so students have to take two or three buses to get there. We have worked in Murtoa and Warracknabeal and students were coming to school from Dimboola. That is a huge distance. Our daughter travels from Ballan to Ballarat every day, which is about a 25-minute journey, but these students come in on two or three buses. They are saying that we need to wind up our robots program by 2.30 p.m. In fact, we have had to start the day early because the students have to travel such great distances.

You cannot get a lot of students to come in to do things. Schools prefer that you go there. The CEP tends to line up a number of schools. We do the Bright Futures camp in the Grampians every year — and that is coming up this August. On the days when we are not working on science and physics at the camp, we are taken out to other schools. We are put up in motels and move around the area presenting our program. We would have already been to a number of those schools in the past few years anyway, so they know that we are coming with a new program, and that is how they prefer it to be.

Mrs BRIMSON — There is a new science centre down in Bacchus Marsh called Ecolink, but it is 99 per cent about ecology. We were thinking about using it to get to the clusters within Bacchus Marsh — the smaller areas. That is okay, but you cannot have people from Horsham coming all the way down to Bacchus Marsh. It is not viable for the schools; it would cost them too much. Then Ecolink would charge for them to get in. So it is more viable to go out to the places, or have a couple of places that we go to. We go to another place up in the Wimmera that smaller schools from the area can come to.

Mr BRIMSON — They can also bring in students from other classes, so it is all there. They might say, 'Can we fit a few more students in here?', and we say, 'Yes, no problem; get them in'. You will get teachers coming in as well. Because you are there, they like to come and have a chat with you about different things. They might even talk about programs they are interested in that they may have seen on the Internet. You are actually there to talk to them, so you have those communication links as well. That is what we found.

The CHAIR — I guess I could ask whether you had one of the more substantive Meccano sets as a child.

Mr BRIMSON — Yes, I did.

The CHAIR — I thought you might. You had Australia's biggest Meccano set with motors and everything. I had a decent one myself; I was always buying parts for it. It is sort of heartbreaking when you pull them apart, isn't it?

Mr BRIMSON — My mother used to find the nuts and bolts in the vacuum cleaner.

The CHAIR — I can imagine. What you are doing is terrific, and it is one of a number of things that are happening. How would you expand what you are doing across more schools into the metropolitan area? Is there a role for greater advocacy of more practical demonstrations and hands-on stuff in schools? Is there a curriculum area there? Should it be heading to the universities? What do you think? How do you get from what you are doing across the system?

Mrs BRIMSON — I think some of the older people back then had got the skills. There are a lot of teachers coming out of universities who want to get into science, and one of my thoughts — maybe it is very naive — is that a new way of going would be in physics, where they could come to do PDs. We are not the only people doing this sort of thing, I imagine. They could come in and learn hands-on things. and those retired teachers or those part-time teachers or those teachers who cannot get into a school could go out with it and go out to different areas. You could cover a bigger area.

We are only two people, and we have reached 35 schools — more than that with going back to different schools two or three times. If we had maybe retired teachers coming in and learning to do some of the projects and taking them into other schools we could reach a wider community.

The CHAIR — What do you do? Do you pass it on to the Science Teachers Association to spread the sort of thing you do amongst its members?

Mr BRIMSON — We have STAVCON. With STAVCON?

The CHAIR — Possibly.

Mr BRIMSON — With our robots, we have over 2000 students who have actually put our robots together, to give you some idea of the actual number of students in a large number of schools. We do not have much connection with anything other than DET. Being in western Victoria we really do schools in that cluster, in the western region, which were appointed to us. It would be anywhere from what, Balliang East, to Myrniong, Bacchus Marsh and then you are heading out towards Ballarat.

Ms ECKSTEIN — The Central Highlands.

Mr BRIMSON — The Central Highlands. It is in the Central Highlands region, and then once we get as far as Horsham the CEP — the Country Education Projects — takes over,. They would do schools beyond that. Then we go to Warracknabeal, Marnoo, Murtoa, Stawell, the Grampians. We cover such a large area.

Mrs BRIMSON — The only reason we have not gone this way is because nobody has bothered to contact us. We are members of STAVCON and things. Also, we do not know the funding system on this side.

The CHAIR — Perhaps through this committee you will have been given a bit of an airing and others may contact you and take up some of the things you are doing. I congratulate you on your enthusiasm and your commitment to young people. Physics in schools is not something we have had a lot of submissions on or discussions on. It has started, I am sure, a number of us thinking about that. We will look further into where physics is going, and if we have further questions, hopefully Andrew can contact you and we will pick up on that. Thank you very much for your participation, and keep up the good work.

I declare this meeting of the subcommittee of the Education and Training Committee closed.

Committee adjourned.