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RELATIONS AND EDUCATION

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**SENATE STANDING COMMITTEE ON
EMPLOYMENT, WORKPLACE RELATIONS AND EDUCATION**

Wednesday, 6 June 2007

Members: Senator Troeth (*Chair*), Senator Marshall (*Deputy Chair*), Senators Barnett, Birmingham, George Campbell, Fifield, Lightfoot, McEwen and Stott Despoja

Substitute members: Senator Crossin for Senator George Campbell

Participating members: Senators Allison, Bartlett, Bernardi, Boswell, Bob Brown, Carr, Chapman, Crossin, Eggleston, Chris Evans, Faulkner, Ferguson, Fielding, Forshaw, Hogg, Humphries, Hutchins, Johnston, Joyce, Ludwig, Lundy, McLucas, Ian Macdonald, Mason, McGauran, Milne, Moore, Murray, Nash, Nettle, O'Brien, Patterson, Payne, Polley, Robert Ray, Sherry, Siewert, Stephens, Sterle, Trood, Watson, Webber, Wong and Wortley

Senators in attendance: Senators Fifield, Marshall, Troeth and Trood

Terms of reference for the inquiry:

To inquire into and report on:

the current level of academic standards of school education, with particular reference to:

1. Whether school education prepares students adequately for further education, training and employment, including, but not limited to:

the extent to which each stage of schooling (early primary; middle schooling; senior secondary) equips students with the required knowledge and skills to progress successfully through to the next stage; and

the extent to which schools provide students with the core knowledge and skills they need to participate in further education and training, and as members of the community.

2. The standards of academic achievement expected of students qualifying for the senior secondary school certificate in each state and territory.

3. How such academic standards compare between states and territories and with those of other countries.

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Committee met at 9.00 am

CHAIR—This is the second day of public hearings in Queensland for the Senate Standing Committee on Employment, Workplace Relations and Education inquiry into the academic standards of school education. As indicated yesterday, the purpose of the inquiry is to inform the Senate about current standards and achievement levels in schools, and to examine whether schools are preparing students adequately for the immediate workforce and for higher education.

We will consider such issues as whether basic skills are being adequately imparted, and whether the academic curriculum is sufficiently rigorous to meet the requirements of university study. I remind all witnesses that in giving evidence to the committee, they are protected by parliamentary privilege. It is unlawful for anyone to threaten or disadvantage a witness on account of evidence given to a committee, and such action may be treated by the Senate as a contempt. I also remind witnesses that giving false or misleading evidence to the committee may constitute a contempt of the Senate. Witnesses may request that part or all of their evidence is heard in private. I welcome any observers to this public hearing.

FIELDING-BARNSLEY, Dr Ruth, Private capacity

CHAIR—I welcome our first witness, Dr Ruth Fielding-Barnsley. Could you please tell us where you are from.

Dr Fielding-Barnsley—I am from the Queensland University of Technology, Kelvin Grove.

CHAIR—I invite you to make a short opening statement, after which we will ask some questions.

Dr Fielding-Barnsley—I have prepared a little overview of what I am going to be including this morning. The area that I am going to be talking about is children beginning reading, and are we preparing teachers to teach children how to read, which is my area of expertise. I am going to talk about the 20 per cent of children who are deemed to be at risk of failure in literacy, what we as teachers can do for them, and why it goes wrong. I will cover those three questions.

We have 20 per cent of children with literacy problems. Often, the argument is that Australia is performing very well as indicated by the PISA results, but they are quite misleading in that we have good scores but we also have a very long tail of children who do not do well. It is these children that we really need to cater to. This is my area: the area of learning difficulties. Most children who have learning difficulties have difficulties in the area of reading. Sometimes it may just be numeracy, but most often it is in the area of literacy.

What do we need to know about the 20 per cent of children who seem to be failing—the ones that we need to do something for? In our recent ARC study—I am in the second year of a three-year Australian Research Council grant—we are looking at literacy levels in nine schools across Queensland. It is a variety of schools: some are from low socio-economic backgrounds and some are private schools. I would like to refer you first to the results of our screening tests at these nine schools. If you look at the handout with just a few figures on it, you will see the significant difference between schools with a high SES background and those with a low SES background. You can see the percentage of students with difficulties in pre-reading tests, which cover the

sorts of things that children need to know to make a smooth transition into reading: alphabet knowledge is one of those, obviously. You cannot read unless you know the alphabet, and the other one is phonological awareness. The method that we use for this is a measure of rhyme. Whether children can recognise that words rhyme is an indicator of phonological awareness.

You will see that there is a huge difference in the numbers of children. They are classified as severe—failing both of those tests—or moderate, meaning they have failed one or the other. Obviously 73 per cent of children from one of our schools are failing those prerequisites to literacy, so they are going to be in trouble before they even start.

If you look more closely at the next item, with lots of boxes, you will see the results of the first screening. All of the children in all of these schools were tested. You can see the difference between independent schools, non-government schools—which are Catholic schools—and government schools. You just need to look at the last column there for the percentage of children with low scores. You can see that in one of our government schools—with 102 children in it—in a particularly low socioeconomic area southwest of Brisbane, 73 per cent of the children that were tested failed those pre-literacy tests. And those are true indicators of future reading, so it is not just a random measure.

If you look at the results of the second round of screening you will see that those children that were at risk were then tested for their vocabulary, which of course is another measure. You really need a good vocabulary to take opportunities and understand the instruction of teachers. The mean for the Peabody vocabulary test is 100. So you can see that our schools from the high SES areas are around the mean of 100 but in our low SES area school, which is really in trouble, the children's Peabody verbal intelligence is 89. The other measure is called the Hundred Pictures Naming Test. That is a word-finding test. You do not need to look at the last column because that is a bit confusing, but you can see there that children are really struggling in some of these schools, because they do not have those prerequisite skills in order to learn to read. And we are losing them at that early stage.

So those are the children that I am particularly interested in. There are obviously students in the high SES area schools and independent schools, who may have dyslexia, who will also struggle with reading, but for different reasons. But the same teaching strategies are required for both groups of students, whether they are failing because they do not have those prerequisite skills or because they have dyslexia. So these are the skills that we need to be teaching our teachers, and we need to be making our teachers aware of why these children need the help that they do.

So what can we do for them? I am moving now to question 2, teacher training. This is where I come in; this is my role. At QUT I am a lecturer in special education and I teach a lot of external postgraduate masters courses as well. I teach electives on learning difficulties and teaching students with disabilities, so I probably see about 200 pre-service teachers a year out of our cohort of 800, because not all students elect to do my units. I do not see all teachers but I have a pretty good idea of how prepared they are to teach reading. Something that I have come to realise in the last few years is that one of the problems I see with teacher training is that even though we teach them about inclusion and diversity, they really have no understanding of the true diversity in low SES schools, because obviously our teachers come from middle-class backgrounds. That is who they are; that is who we have.

I do not have any proof of this, but from marking 600 assignments where teachers had to tell us where they were schooled it seemed that about 70 per cent of our preservice teachers actually went to private schools, including Catholic schools. So you can see that we have a bit of an unrepresentative sample that we are working with as teachers. And when they go into these low SES schools, they have no idea what has hit them; they are really at a loss to know how to deal with these children who just do not have the language to understand the instruction.

So there is a big push for teaching phonemic awareness and a lot of teachers are taking this on board. As you will see from my paper which you have been presented with, teachers have a very positive attitude and really know that they must teach phonemic awareness; but they do not actually have the knowledge to support that. So they are teaching phonics in a very rudimentary fashion. But the children, particularly those from low SES backgrounds, are not understanding the instructions. I have given a nice little example there which is almost unbelievable—some children in our study do not understand instructions such as, 'Draw a circle around the apple'. This is not just because they do not understand the terms 'draw', 'circle' and 'around' but because they have never seen an apple.

Now that may seem unbelievable, and it is for our teachers that we are putting out there. I have four research assistants working on language with these children. They did a lesson on fruit. They took the basic fruits. They thought maybe these children had never tasted an apple; but actually they had never seen an apple. So this is what you are working with, and this is what we need to teach our teachers. They need to work on the language, and they also need to work on the skills. We cannot just go in with the skills because the children are not understanding them. There is not much point in teaching children if they are not understanding the instructions.

I am not sure if you have this one with the graphs? Yes, you do have that but only in black-and-white. I have a colour one. On this one you will see what happens after a year's intervention with these children. For all of these schools, not just the low SES schools, you will see that we are doing two interventions: one on language and one on phonological awareness. These are the children that were at risk, who had low alphabet and low rhyme, that our research assistants have been working with across the schools. There is also a group that were identified as at risk who have not had the intervention. In the other tall column are the children who are not at risk in the regular classroom. So you can see that the intervention is doing something to improve preliteracy skills for these children. The children that did not come up to the class level we are still working with this year. We will work with them again next year and hopefully get them up towards the level of the rest of the class. That is just a little illustration that we need to be looking at both language and phonological awareness.

As far as what we are doing in universities in the area of language development goes, I think we are probably doing okay at including that in our courses. But I think a lot of our students are still at sea as far as the skills that children need to be able to crack the alphabetic code go. We do need to work with both of these in tandem. We do need more on phonological awareness.

The paper that you have on teachers' attitudes to and knowledge of metalinguistics in the process of learning to read was one of my research projects. I hoped to follow that up with an ARC funded project to actually teach the teachers what I saw was lacking in metalinguistics awareness. I did put in for an ARC grant, but I did not get it. So unfortunately I cannot tell you about that. It would have been a great opportunity to teach a group of preservice teachers what I

could see they needed to know and then put them into the classroom and see if they were making a difference to literacy standards. That was the plan, but unfortunately I did not get the grant.

A lot of my students are recognising that they are not ready to teach reading. A lot of students ask me in my classes what I would recommend as a really good book for them to take as beginning teachers to teach reading. I am not advertising my own book. The book that I recommend to my students, and which I would recommend to you, is called *Beginning Reading* by Yola Center. She has retired from one of the Sydney universities. I do have my name on the back of it.

CHAIR—Yes, I think that is well and truly in the *Hansard*.

Dr Fielding-Barnsley—So what goes wrong? I am really concerned about full inclusion. This is a problem for children with learning and reading difficulties in that the focus has been taken away from those children because teachers have such an enormous load of children with severe disabilities and ESL in the classrooms. So those children with learning difficulties are really slipping under the net—or getting caught in the net, which is the terminology. That is one of the problems. I know you like quotable quotes—somebody was saying that; I think John likes quotable quotes—so I will quote Baroness Warnock in Britain. She is a great advocate of inclusion. Even she is now saying things like, ‘refusal to address genuine differences can wholly undermine our attempts to meet children’s needs’. We are looking at differences, every child being different, but we really need to be picking up those children that are genuinely different and need more teaching. They do need more teaching and they will not learn to read by osmosis, which is the method that a lot of schools and teachers are using at the moment. That is where the 20 per cent of children slip through, because about 80 per cent will learn to read if you just read to them.

That brings me to the next point about whole language, which is a way of teaching children to read which is much more attractive to teachers. You can imagine if you were a teacher sitting with a class of 30 children and engaging them in a lovely story every day, and 80 per cent of those children would learn to read. It is a lot more difficult to actually start pulling apart the language—telling them about the sounds of language, playing with the sounds of language and making them understand the alphabetic principle. It is difficult, and teachers need to be taught how to do it; and they are not being taught how to do it. That is where we are losing our 20 per cent of children.

The very last point, which might be important for you to know, is about funding. My teachers and postgraduate students are always telling me that they are underfunded. They know who the children are who need assistance, particularly in the area of speech and language. A lot of children are not getting the help they need. As a result of that, these children are not only missing out on instruction but also socially in the classroom being ostracised from the group because their peers cannot understand what they are saying. Therefore they are not getting that rich dialogue with their peers because they have speech-language impairment and their peers cannot understand them. These are some of the huge problems that we have of diversity in our schools. I think I have put my case and shown you what we can do about it. So the ARC money has been put to good use and is coming up with some very nice results. Those are all unpublished results, by the way.

CHAIR—Thank you, Dr Fielding-Barnsley. I am sure that the whole committee would regard learning to read as the absolute cornerstone of future education, and what you are saying is extremely important. Yesterday we had some discussion of a 1994 report called *Shaping the future*, which looked at students with learning difficulties and how they should be dealt with. In the 13 years since then, has that recommendation been adequately implemented in Queensland in regard to students with reading and language difficulties? How widespread, in your view, is the process of inclusion with respect to taking the children out into not special classes but groups to reinforce how they should learn to read?

Dr Fielding-Barnsley—I think inclusion appears to be working in most schools. There is a push to not take children out of the classroom for instruction. The push is to try and use your specialist staff within the classroom, which really makes sense because you are then teaching the classroom teacher the strategies that you would be using outside of the classroom. The strategies that you use with the children with learning difficulties are good strategies for all of the classroom. It is not that they need different strategies; they just need good teaching. Another problem is that a lot of the learning support teachers in our schools are not trained. Sometimes it is just a matter of somebody putting their hand up if they are interested. You may have heard from Griffith University yesterday that there is a ceiling on the numbers of teachers they can train in that area.

We used to have a lot of postgraduate students doing studies in learning support when there were scholarships and grants for them to study, but now that we do not have scholarships and grants our numbers are down. I used to have about 50 masters students doing my units when I first came to QUT 10 years ago. I now have 12. There is nothing in it for them—they are studying to be learning support teachers but there is no incentive at all for them to study in the area. This is why we do not have a lot of qualified teachers and support teachers in the classrooms. That is one area, I think, where we have not really followed through in that one of the things that the report came up with was that we need to educate our learning support teachers. That is an area that really needs to be looked at.

CHAIR—So, apart from training the teachers, the knowledge in the schools of metalinguistics itself is not strong overall in the department of education?

Dr Fielding-Barnsley—No, not according to my study. This is a tricky one. I am not sure whether all teachers need that knowledge. Does a high school science teacher need to have a knowledge of metalinguistics? I would argue that they should, particularly in science. You will have a colleague of mine presenting to you this afternoon, Stephen Ritchie, who will probably tell you the same thing. Reading levels are interfering in science because of the highly technical vocabularies in science. If you have an understanding of syllables and how words break up into syllables, particularly in science texts, it is going to help those students a lot. That may be the answer to one of the problems we have with the reduced numbers of teachers in science. They are finding it impossible to read the texts and so, of course, are the children. If they have problems with literacy, science is not going to be a subject that they are going to choose.

I have made a note for you this morning. There may be a call for specialist teachers of literacy who really have the nitty-gritty knowledge and are able to take on what we call the hardcore children—the children who just do not seem to making any progress, no matter what you do with them. Four per cent of the 20 per cent just never seem to make any headway. They come

out as being completely illiterate at the end of 12 years of schooling. It would be a really good idea to have some specialists. There are all sorts of ways. This is the book that I was going to use to train my teachers if I had the ARC grant, which I did not get. You can teach a teacher a really good foundation in metalinguistics and how to be a specialist reading teacher in 12 weeks. So if we got those specialist teachers into the classrooms it would really make a difference.

CHAIR—Thank you for that.

Senator MARSHALL—I think you have argued and presented a very good case. Is this now generally accepted as an issue that needs to be addressed? Is this the way to address it? Or is nothing happening to plug this gap?

Dr Fielding-Barnsley—That is not a question I can answer in one sentence, because learning to read is actually very complex. For us it was not very complex, but for those children who find it difficult it is extremely difficult. What happens is that, as academics, a lot of us have tunnel vision when it comes to our own area of interest and research, and we only see that as being the problem. That is why I think our study is so novel: it is looking at a much broader base. It is not just phonemic awareness; it is language. It is so many things that we need to make sure our teachers have a sound grounding and understanding of all the things that they need to cover to help those children who find learning difficult. It is not just phonemic awareness. As long as we keep pushing this, we are going to lose other important areas. It is always a balance, and that is what I always tell my students. When they are saying, ‘Do I teach whole language or do I teach phonics?’ I say, ‘Take the best of each. Read to your students.’ You must read to the children because this is how you develop their language. But they do need explicit instruction in how our alphabetic code works. You cannot just leave it. It is not going to just happen by magic.’ There are no easy solutions. We know what the parts are, but it is a matter of getting everything in there and knowing which children need what sort of intervention. You will have true dyslexic children whose language is actually very good but still cannot read. They perhaps need a different type of intervention to those children who are failing because they do not have the vocabulary or the language to support their learning. There is no easy answer.

Senator MARSHALL—The college told us yesterday that there is a program being implemented now that will require demonstrated professional development in teaching every five years in order to maintain registration. Is that the sort of training that teachers would need to pick up in those five-year blocks? Or is it something that you say really needs to be in the basics for a teacher coming out of teacher training?

Dr Fielding-Barnsley—There are so many things that a teacher needs to know—doing everything in pre-service. We could be giving them a better grounding in the teaching of reading as pre-service teachers. It would certainly be part of their continuing education to do advanced courses, and the teaching of literacy would be a really good opportunity for them. Sometimes teachers do not know where their particular interests lie until they go into the schools. Then, all of a sudden, they may develop an interest in children with ADHD or Asberger syndrome—just a passion for something. That is when they need to upskill. Teachers may go in and say, ‘I didn’t realise so many children were having difficulty learning to read. I would love to do something about it.’ That is a really good opportunity to bring them in. We have what is called a Stepping Out conference at QUT for pre-service teachers who are just about to go in-service. In July they have got one more semester to go and they are supposed to be ready to teach. We do a Stepping

Out conference where we try to cover all of the things that we may not have covered in their four years. I am offering 'Teaching beginning reading; phonics is fun' to our 800 students. It will be very interesting to see how many of them actually realise that they need to do a little more. I cannot tell you about that yet because we have not had it.

Senator MARSHALL—When we look at a lot of the evidence that has been presented, we can see that what we need to do to make education better in this country really comes down to a couple of things. It seems to me that it is about having more teachers who are better resourced and higher skilled.

Dr Fielding-Barnsley—Yes, exactly.

Senator MARSHALL—That is the issue, isn't it?

Dr Fielding-Barnsley—Yes.

Senator MARSHALL—It is not about testing across the board and all those other things.

Dr Fielding-Barnsley—No—we just need good teachers. It all comes down to teaching. We do need the resources, but, first and foremost, we need good teachers. That is our role. We are supposed to be producing good teachers.

Senator MARSHALL—And we do, but we need more of them at a higher standard.

Dr Fielding-Barnsley—We need more at a higher standard, and probably specialist teachers. With courses like metalinguistics, it is like specialising in medicine. You can not expect every GP to know neurology, ophthalmology or whatever, so we have specialists. The same probably goes for education. We need specialist teachers who can work with the children who really just cannot make it in the classroom. I would agree with you: we need more skilled teachers.

Senator TROOD—Do you have any similar studies from across the country? You said this was unique research. It obviously applies to Queensland, but are there any comparative studies across the country of which you are aware?

Dr Fielding-Barnsley—Not in Australia. Professor Margaret Snowling, from York University, and Kate Nation have done a similar study in York, with very similar results, looking at language intervention. Maggie, much like me, has moved: she was a pure phonics lady with a big push, but she has also realised that a lot of the children are slipping through because they do not have the foundations of language. They are doing a lot of work on language and phonological awareness. They bootstrap each other. When you have a well-developed vocabulary, it helps with phonological awareness. For example, if you know lots of words that rhyme, you are going to suddenly realise that words have the same endings, but you can only do that if you have a rich vocabulary. Having strong phonological awareness also supports developing a vocabulary, because of storage—the way that you file words in your storage system, your long-term memory. If you have good phonological awareness, all the words that rhyme go together, and then they are there and you can find them again when you are looking for that word—it is stored phonologically. You can see that they actually support each other. That is what Maggie Snowling is doing.

Senator TROOD—Is there any reason to believe that Queensland might be uniquely disadvantaged here? The results of your studies are indicative of a particular problem in Queensland that might not be reflected more widely across Australia?

Dr Fielding-Barnsley—No. I would say that we have children in low socio-economic areas all over Australia. I worked in Armidale, New South Wales at the University of New England prior to coming to QUT. I worked in some disadvantaged areas in Aboriginal communities out at Moree. They were particularly disadvantaged as far as language was concerned. We only went as far as around the Inala area, west of Brisbane. If you were to go to Arnhem Land or wherever, you would find even more disadvantaged communities where all the children are struggling to learn to read. So it would be indicative of the whole of Australia—maybe not Canberra.

Senator TROOD—It is unique in so many ways.

Dr Fielding-Barnsley—There are more students identified with dyslexia in Canberra than in any other state, but there are reasons for that, obviously.

Senator TROOD—There must be a particular variable there. Perhaps the committee ought to look into that, Madam Chair.

CHAIR—Yes, I think so.

Senator TROOD—I assume that most of the students you are teaching at the university who are saying things like ‘I am not sure how to approach this problem’ would have been taught with a whole-of-language education. Is that generally likely to be a true proposition?

Dr Fielding-Barnsley—I cannot honestly say what everybody is teaching. I am in my own little school of special needs education. I know from what my students tell me that they get a smattering of skills based teaching, because obviously you cannot ignore it. No-one can ignore that teachers need to know. But I do not think it is sufficient. The teachers only realise this when they go out on their long practicum in their fourth year—they do their six weeks and their four weeks—and this is when they start panicking. They are given a classroom to teach and they realise this. They do not realise this until it is too late.

Senator TROOD—There are two questions on this issue. One is their own experience of learning—reading.

Dr Fielding-Barnsley—The teacher’s own experiences; yes.

Senator TROOD—I assume that most of these teachers are likely to have had a whole-of-language experience in reading.

Dr Fielding-Barnsley—Yes, exactly.

Senator TROOD—So one could understand why they are perhaps ill-equipped to try and address other things like how to deal with phonics, for example.

Dr Fielding-Barnsley—Exactly.

Senator TROOD—Is that a fair proposition?

Dr Fielding-Barnsley—Yes, it would be. As I have put in my notes, I did my teacher training in the eighties. The word ‘alphabet’ was never mentioned. I was an early childhood primary-trained teacher. I had two young children and I started to teach them to read with flash cards. When I got to 60 flash cards and my son could not read anymore, I thought: ‘What’s going on here? This doesn’t work.’ But it does work for the majority of children. That is the problem.

Senator TROOD—I see that.

Dr Fielding-Barnsley—It is a good point. So the teachers do not know.

Senator TROOD—So there is a question about how the teachers themselves have been taught. The second question, which you also addressed, is how they are now being taught within the context of their own teacher education and whether or not there is a preference, a bias or an inclination within university curricula to teach whole-of-language or phonics.

Dr Fielding-Barnsley—It is a tricky one. As I said, I am not prepared to say what they are being taught because I really do not know. All I know is that I see about 200 students a year in my elective courses. I teach about learning difficulties. They are coming to my courses because they realise that there are a lot of students in the schools with learning difficulties. They want to know more about how to address those issues—and I know what they do not know.

Senator TROOD—I assume what you can say is that telling them to go off and teach whole-of-language is not the solution.

Dr Fielding-Barnsley—No. But, there again, what we are coming down to is a balanced approach. We know that language is important and we do not throw the baby out with the bathwater. That is what we as academics tend to do. We always have to have a radical point of view; it is either/or. It is not either/or; it is never either/or, but we do need both. So that is where we think we need to come together and actually say, ‘Look, the whole language is fantastic in developing children’s language, but we also need to include a skills based approach to the teaching of reading.’ Something is not happening.

Senator TROOD—Where you have intervened to try to address issues on this particular graph that you have provided, clearly the results are encouraging but they are still behind students that are not at risk. My question is: does the kind of intervention that you are practising serve as a model for trying to address the problem; or, because this is a study, is it just too intensive and would not be replicable throughout the system; or could it be the foundation?

Dr Fielding-Barnsley—I would like to think so; that is why we are doing it.

Senator TROOD—Yes, I know. But clearly one of the considerations has to be how intensive it is, how expensive it is, and how much time it takes out of the curriculum. Is this perhaps a unique degree of intervention which, realistically, is not able to be applied throughout the school system?

Dr Fielding-Barnsley—It could transfer to the classroom. These students are taught in small groups of six, so it is much more realistic than Reading Recovery, which, as you know, is a one-on-one intervention. Even if we take out six children and work with a specialist teacher on these two interventions, and even if it does not generalise to the classroom, it is still going to be cost-effective because we are working with six children with one trained person. There is nothing magic or complicated about this. All teachers could be instructed in these methods that we are using.

These children have only 10 weeks intervention, because this is the first year of our ARC study and we took quite a long time to get it organised. As you would probably understand, getting schools on board takes a long time. This year we started right at the beginning of the year so the children can actually get two 12 weeks of intervention, and we are going to swap them so that they get both interventions. Here you will notice—I did not tell you before but I should have—that the control group did not get an intervention at all. This could be just a placebo-type effect here.

This year we have a control group that is coming out of the classroom. We are doing a shared book reading control with them—a whole language intervention with the control group. We are going to be able to compare a purely whole language intervention with a language and a phonological. This language intervention is called ‘Marion Blank’s intervention’. I think you have copies of the LDA article. Marion Blank’s language intervention is elaborated on in the Hay and Fielding-Barnsley paper. It is working from the children at the very lowest levels of language and developing their language, not just a whole language of ‘let’s read to the children’ type intervention. That is what our controlled children are getting. But they will get the other intervention at the end of the year.

Senator TROOD—Thank you.

Senator FIFIELD—Dr Fielding-Barnsley, you have stated quite clearly that it is not either/or when it comes to phonics or whole language; it is not phonics versus whole language.

Dr Fielding-Barnsley—No.

Senator FIFIELD—I also take it that you are saying that there had been an over-emphasis in the past on whole language to the exclusion in some cases of phonics and the benefits of that.

Dr Fielding-Barnsley—Yes.

Senator FIFIELD—You would be well aware that there are a number of very passionate advocates of phonics, whether it be Kevin Donnelly or Professor Colthart or Yvonne Myers from a parent’s perspective, or someone like Chris Nugent.

Dr Fielding-Barnsley—Yes.

Senator FIFIELD—They seem to be of the view that the debate about phonics has not been won. I am sure they would concede that you need to use a range of techniques, but the fact that they are still arguing long and hard would seem to indicate that they are not convinced that the place of phonics in teaching is significant and recognised enough. I know, from some of the

evidence we have had from principals and from teachers, that when you put to them the importance of phonics they say: 'Yeah, yeah. That debate has been had; it is over. You have to do a bit of phonics. You have to do a bit of whole language'. I cannot help but have the feeling that for some of them the debate has been successful to the extent that they feel that they have to doff their cap to phonics to some extent. My question is: can these very passionate advocates of phonics pack up their tent and move on to other issues now, or is it still necessary to highlight the importance of phonics? Is phonics recognised sufficiently as a core teaching method?

Dr Fielding-Barnsley—No. To put it very succinctly—and we often quote this in our journals—phonemic awareness is necessary but not sufficient. That is the piece de resistance, I suppose. Children have to understand phonemic awareness to be able to read. Reading is based on an alphabetic system; it is a code. Unless you crack the code, you cannot read. A lot of children will crack the code because they are smart, but a lot of children need that help. I am part of the phonics camp. I was one of the 26 who signed the letter to the minister that started the whole inquiry. I think I was the only person in education who signed the letter. We all got a lot of flack because we were all psychologists. I am not a psychologist, and that is where I think my views are actually very valuable. I work with the psychologists but I understand what is required in education. I consider that I have a balanced approach. I did read the *Hansard* report where Max insinuated that educationalists do not do good research. Thank you, Max; I do good research. That was for Max.

CHAIR—I think he will get the message.

Dr Fielding-Barnsley—You have hit the nail on the head; it is a token to teaching phonemic awareness. I do not know if I should get into the mechanics of it, but a lot of principals and teachers will say, 'Yes, we teach phonics,' but actually phonics is not enough. Phonics is just matching the letters of the alphabet with the sounds that they make. Most teachers do that. So, yes, we do phonics, but actually it requires a lot more; it requires a grounding of phonological awareness—awareness that the speech sound is made up of individual sounds. Children do not understand that speech is made up of individual sounds and therefore they have trouble matching the letters of the alphabet with the words that they speak. It is a lot more than just phonics, and that is what we are not teaching our teachers. In answer to your question, no, the war is not won.

Senator FIFIELD—Thank you very much.

CHAIR—Thank you. I think we could go on for a very long time discussing this subject. What you have said has contributed a great deal to the inquiry and I do thank you very much for appearing before us today.

Dr Fielding-Barnsley—Thank you very much, senators.

CHAIR—We have gone a little over time, but I thought it was a very valuable discussion.

[9.50 am]

READ, Associate Professor William Wayne, Head, and Associate Professor in Mathematics, School of Maths, Physics and Information Technology, James Cook University

RIDD, Dr Peter Vincent, Reader in Physics, School of Maths, Physics and Information Technology, James Cook University

CHAIR—Welcome. You have lodged a joint submission with the committee. Do you wish to make any amendments or alterations to that?

Dr Ridd—No.

CHAIR—I now invite you to make a brief opening statement and then we will move to questions.

Prof. Read—Thank you very much for having us here in person to make the statement. I would like to follow up reasonably quickly on the written statement that we put in. As mathematicians and physicists, we started identifying problems with the student cohort in the early nineties. Since that time the standard has actually dropped on a couple of occasions, and there is some pretty solid evidence of that. We have restructured the subjects we have taught on two occasions and I suspect that, if nothing happens, we are going to go through it again.

There are a number of issues that could lead to the problems. The first thing I would like to say is that we have spent a lot of time trying to work out what the very specific problem was. We think we have tracked it down. The logic goes like this. You need arithmetic to understand fractions. If you do not understand fractions you really cannot understand algebra. Once you take the abstraction away from algebra, fractions are actually harder than algebra. If you do not understand algebra, then you cannot understand calculus. If you do not understand calculus, the world is closed to you as far as science, engineering and technology goes because everything springs from that.

What is the issue here? Is it the students? Certainly not from what I have seen. They are not making kids any less smart, any less bright, any less intelligent than they were in my day. We do have an issue with the teaching cohort. It is not lack of enthusiasm, though, and it is not the ability to work hard. The cohort of well-trained teachers is ageing and there is a diminishing number of teachers who have training in mathematics—and when I say ‘training in mathematics’ I mean mainstream mathematics, not in an educational faculty. So what is the issue?

The real issue, we think, comes back to the syllabus, and it goes all the way through. There is a lack of reinforcing of the basics; there is a lack of emphasis on the underlying skills that are necessary to transgress through. We have heard lots of arguments; I have certainly heard them and I have tried some of them. If we make mathematics and science interesting, if we bring it into real-world problems—if we do all of these things, everyone will love science and want to go on with it. It is a very compelling argument, but it is false—and demonstrably false. We have had these arguments, we have had all of this stuff and the syllabus happening for a number of years

and yet we have a decline in the number of students who want to do mathematics, the number of students who want to do science and the number of students who want to do engineering. Engineering skills now rank higher, I think, than doctors for preferred immigrants, and those are just core science skills in an application.

You might ask: what have we done to help solve the problem? We have certainly spoken to schools. A lot of the teachers are not happy with what we are saying. However, they are listening and they are prepared to talk about it. I have been invited to speak at some of the schools up north, at the QAMT. Once again, we think the fundamental problem comes down to education faculties and some of the philosophies that are being pursued and changed. I am not criticising their research here; their research is world standard. What I am actually doing is criticising the application, what has actually come out of it. We have tried to engage with them on a number of occasions. We have made submissions to committees like this before. We cannot get that up and running for a variety of reasons, whatever they are.

One of the problems we have is that we keep getting put off with things like: 'The university is just such a small sector. We are teaching students for life. We are teaching students for other jobs, not just to go to university and be mathematicians.' It is interesting that when we had our first meeting with the teachers they came back and said: 'Well, that's not true. Maths B is for university; that is what it is supposed to be. We have got all these other courses for these other things.' I would follow up with the comment: 'Yes, for all the students that come to university, any of them who are going to do science are going to see me and they are going to have to measure up to the sorts of things that I expect. If they sidestep me and go straight into work, which a number of them will, they are going to be supervised by someone who was trained by me and has the same sorts of expectations.' So, to me, it is not a valid argument.

We see part of this as quality assurance. There was no consultation with us about the quality of things we need in those students as they come through. Then we are told: 'You're measuring it the wrong way. Exams are old hat. These things are not relevant anymore.' Well, I am sorry, but if I want to measure something, if I want to measure up a bed for my bedroom, I take my tape measure and I measure it the way that I want to measure it—and, I might add, the way that the rest of the world does. I was on a review of the Bachelor of Social Work and Community Welfare with people who I guess were much more experienced in a lot of these other issues than I am, and I raised the issue about exams because there was all this discussion about exams and how the students went in exams. The comment was: 'No, the examination process is a fundamental part in assessing anything—it tests students under all of these different conditions.' And then a professor from Tasmania turned around and said: 'Besides that, it is the only way these days we can be sure that it is the students' own work. It has always got to be a fundamental part of what we do.' We are saying that we go through these things and they are not meeting our criteria.

Am I speaking from self-interest? To a certain extent, yes. I am a Queenslander; a North Queenslander, and I am very proud of Queensland. I do not like it when our students do not measure up to students from other states. I am the head of a school of maths and physics and I would like to see a few more students come through and qualify in mathematics. But, if I want to be really blunt about it, I do not need that—with all of these problems, more and more of the departments and schools in the university are turning to us for help. We are actually getting more students at the lower levels because the product—if that is the right word—that is coming from

the schools is not good enough. Ten or 15 years ago, a ‘sound’ in maths B was enough for students to come in and do biology and all of the softer sciences. They had enough maths in there to do it. They cannot do it anymore. So they are channelling those students to me, and it is not actually an issue of student numbers.

I also have some evidence from some of the other end users, the ones who are not academics, the ones who cannot be sidelined by comments like, ‘You live in an ivory tower, you are not real.’ They reinforce my opinion that it is the same thing: when people pick up students from high school with a maths B, they expect certain basic skills, and they are not seeing them. Bogden Skomra, the research consultant from QAL, is quite vitriolic on some of these things; amazingly so. And to a greater or lesser extent, because of some of the political sensitivities, people in CSIRO and people in lots of different areas are commenting, and they are passing the comments on to me because I am the head of a school of maths, physics and IT. As a mathematician, I am interested in problems but I am also interested in solutions. I would be a pretty bold and big mathematician to say I had a solution to this, but I have a few comments that I need to make. The first and foremost thing is that this really is a quality assurance thing. We have to be involved. Universities and genuine end users have to be involved in the process of defining the level, the quality, of these students. I think we have to start adopting Australia-wide, worldwide standards.

There has to be some common set of core skills that everyone understands and represents. Because of some of the issues and the fact that these people will not listen, I think that assessment has to be independent of education faculties and basically of education departments. If you produce a fine ball bearing you can throw it out there into the marketplace and anyone can measure it. That is my comment.

We have to address the current situation in Queensland—and this is Australia-wide—where we have a declining base of teachers who have any mathematical experience at all. I am not certain what the best approach there is, but certainly things like diploma courses are ways and methods for teachers to upgrade to begin to come to terms with some of the things that they have to teach in the maths subjects. Let us not forget that in Queensland, to my knowledge, there are a lot of places where the teachers have no basic mathematic training but someone has to teach the subject. We need ways to assist the upskilling of those people to the right standard. There needs to be a syllabus put in place that people with minimum training can actually use. The maths B syllabus is a wonderful document. If you read that document, and if every student satisfied that, there would be no need for a university or anything else. Every student would be competent in just about everything, but in my opinion it is a very hard thing to teach from. We hear from the teachers that they are frustrated in doing some of the things that we actually want them to do because it does not go with the underlying philosophy.

We need ways to reward excellence in teaching—good teaching. There are plenty of awards for academics for good research, but we need ways to reward good, effective teaching at the classroom level—involvement, interest, engagement, all of the standard sorts of comments. I will ask Peter if he has anything to contribute.

Dr Ridd—The only thing I would like to add is that you really should be in no doubt that we are not seeing the past through rose coloured glasses—things have changed. We can look back at what we used to teach and things have had to be removed. It is not because we wanted to. In

physics for example, we get to what would have been completed by the end of first year by halfway through second year. With the increase in the number of students coming to the university, the universities are taking people somewhat lower down the spectrum. In this case we are not talking about those people—because we run special courses in lower level maths and lower level physics. We are talking about the same prerequisite or even higher now in the maths because we actually require a higher level to get into some of our early proper maths courses. Often we are told by people in education faculties that the students can just do other things. They may not be able to do everything that we want, but nowadays they are trained to do other things. The problem is that they are not trained in the basic things and the basic problem is really with the algebra.

I would like to reiterate what Wayne was saying about the quality assurance thing. We are the end user for a very significant number of students in maths—maybe not in physics but it goes into engineering and it goes into a wide range of things. At the moment we have the situation that most academics at university do not even know this inquiry is on. They do care about it, but they really feel that there is almost nothing that they can do about it. There is nobody in the education system who is listening to what the academics want. We need a survey to be done of all the first-year teachers in engineering and physics, but not just that. Our own submission has actually been signed by people in the environmental sciences and earth sciences and you also got another submission from people in biology and the rest of it.

CHAIR—Yes.

Dr Ridd—So it is wide. It is just a shame that in the university non-education faculties do not pay more attention to this because it is important for us. I think that is all I would like to say.

CHAIR—Thank you for that. We did advertise the inquiry widely and I assure you that those senators who are with me today and other members of our panel do take it very seriously and that was part of the reason why the reference came from us in the sense that we wanted to see what was happening. From what you are saying, Professor Read, if the students are not arriving at university with the skills and ability that they need, in part that reflects on the teachers who have taught them because the teachers themselves have not been educated or trained to have that ability or skill in mathematics. It goes back quite a long way and I note your comments that there has been a significant decrease over more than two decades in this. Yesterday we were reminiscing, in a way, about our abilities, or not, in the areas of pure and applied and calculus and general maths—the maths which were operating at year 12 level some considerable time ago. Obviously, if that standard has dropped that is a serious cause of concern. Your JCU colleagues from the biology department said in their statement that the reporting of school results is of little use in judging students' abilities in maths. Would you agree with that?

Prof. Read—Yes, certainly. I meant to bring a copy of a paper we have just had published where we have analysed the results of students and compared their entrance scores—their grades in maths B compared to how they actually do in the subject. It is interesting. The three things we looked at were OP score, grade in maths B and basically whether or not they had done maths C. If they had an OP 1, 2 or 3 that had some influence. The rest of it did not matter. We had students in there who had a sound in maths B who passed and we had students in there who had a very high in maths B who failed.

One of the other comments that comes up is that we are accepting such a wide range of students. To be honest with you, is that not part of our job? Are we not supposed to be giving opportunities to people? We have subjects in place for that, but the OP cut-off on the mainstream subject is typically around 10. The bulk of the students are OP 7 and above. The syllabus for that subject is very similar to the old maths B syllabus, with just filling in the holes.

The other issue we face with a lot of this is the heterogeneity. There is no fixed syllabus—they can pick and choose on a lot of different things. We have that old syllabus there and most of those students struggle, whatever we do. It is the basic understanding. I will give you a classic example. Up until a couple of years ago I taught the first MA1000 class. I had a very bright student there—a Queenslander who had been to ADFA. I was manipulating a trigonometric expression and solving all of this. When you have 200 students behind you and they go quiet, you know something is happening—either there is a prank on or whatever. I turn around and they are all just looking ahead.

This student was down the front. A lot of students will not talk—they will not engage. I walked up and said, 'What's the problem? Have I misspelt something? Have I made another mistake? What is it?' He said, 'No.' I said, 'What is the issue? Is this difficult because there is a complicated expression there?' He said, 'No. It's the way you keep moving things from one side of the equation to the other.' That is basic algebra. That is what the issue was. Every year, with every class—sometimes right up to third year—as soon as you start doing these things and assuming that it is a skill they have, it is, 'Whoa! Slow down, egghead.'

Going back to the teachers, there is an issue there. I have seen attempts to stop them doing the sorts of things that would improve these skills. With some of the assessment now they are not allowed to get students to practise these things. I think there is a big misunderstanding in mathematical ability. People do not have to love mathematics the way I do, but everyone has a certain basic level of ability and skill, and you get proficiency. Once you are proficient and you can answer nine out of 10 questions, you feel good.

Mathematics is one of the few areas where students can get 100 per cent. How easy is it to get 100 per cent in an English subject? It is almost impossible because of the difficulty of the subject and the interpretation. With mathematics you can do all of those things by drilling, by learning, by practising these things. I think a lot more students respond to that. You get all of this pretty window dressing, where there is nothing of substance in it. You look at games like this little puzzle that people are always playing where you line the numbers up. That is basic arithmetic and it is challenging and interesting. It is in the newspapers and people are playing it all the time. That belies the argument that practising things and doing something until you perfect it is poor educational practice. It is some evidence that is suggested.

CHAIR—Yesterday we heard from the department of education. They were very happy with their assessment of their externally moderated but basically internal final year assessment process. In both New South Wales and Victoria there is an HSC; we have a VCE in Victoria which is a combination of tasks during the year but also a final assessment exam. That is common across the state and it is externally marked. Do you consider that the promulgation of this internal assessment is something that has contributed to the lowering of standards?

Prof. Read—Yes. I have to be very careful here. When we changed over to the Radford scheme or whatever it was in the early seventies, where the end of the old senior exam system disappeared, there was still a 10- or 15-year window where the students coming through were just as good as they always were. Certainly, in the current climate, it is a lot easier to hide from the reality by not having a common exam. Just as a comment, when I get a student from New South Wales or Victoria who comes in and does MA1000, they slide through. It is really straightforward to them. It is good in one sense because they are the ones we actually get to go through. Even if they go to engineering and all the rest of it, they ace first year. They are the ones I look to to get 100 per cent in the exam. That is an issue. The big negative with a common exam in the old days was that everything hung on the exam. When you combine it with other assessments but you still have it as a measure, I think that is a positive.

CHAIR—Certainly all schools in Victoria work towards it. Would it make more sense for a central authority to determine whether subjects like maths C need to be made available to all students? Whether or not they choose to take it is another thing, but should it be available?

Prof. Read—Yes. One of the big problems we have is that not enough students are doing maths C, and once again the universities have to take their fair share of the blame for that. We were the ones who pulled those prerequisites out. I think anything that would increase the participation in maths C is good. Once again, maths C was a bit of an indicator and not because of their result. It was an indicator because they had done more mathematics.

Dr Ridd—The problem is not just with maths C. In fact, even in maths B since 1992 there has been a 10 per cent decline in Queensland in participation in a time when the population has grown by maybe 25 per cent. So you are talking about probably a 30 to 35 per cent reduction in people doing middle level maths.

CHAIR—Why do you think that is?

Dr Ridd—I have no idea why that is. Certainly what I could say is that what is being tried in the schools to try to make it more ‘relevant’, and some of the modelling type stuff which does seem like a good idea, is not working. I think that people are being turned off by maths somehow or other, and that is why they are not going on to year 11, let alone into university maths. But there is a problem.

Senator FIFIELD—Thank you very much for your submission. Have you had discussions with the maths teachers association? They came and gave evidence to us yesterday. I am wondering whether the faculties of maths, which do appreciate the issues you have outlined to us today, actually sit down with the various disciplinary associations in the secondary school sector.

Prof. Read—We do not do it in a formal way. Because of some of these issues, four or five years ago we tried to get involved with the QAMT. We got involved with the local branch at Townsville, and I was an invited speaker at the Cairns branch to raise and discuss the issues. To be honest, although we got people coming to our talks and listening, we were effectively sidelined in it. I will give you an example. Once again, this is from someone who is hard-working, who is not out with the daisies. He gave a talk on Pythagoras’s theorem, showing how you could prove Pythagoras’s theorem by cutting up paper into triangles. It was interesting. I went up to him at the end and said, ‘That has reminded me of a really lovely proof of

Pythagoras's theorem using squares and drawing the triangles and cutting it up, and you make other triangles and they prove Pythagoras's theorem.' I went on, 'The algebra really sits on top of it, so you could pull the algebra out and show that as an aside.' He said, 'Yes; we don't want to do the algebra stuff; they don't like that.' Once again, with this compelling drive to make it so interesting that everyone is going to be 'switched on', we are throwing the baby out with the bathwater.

Dr Ridd—That is right. I think there is a degree of disagreement between a significant number of the maths teachers and us. I do not know what proportion it is; it might be a lot less than what might be represented by the maths teachers association.

Prof. Read—To get back to your question, I am not certain of the mechanisms. I am a mathematician; my job is mathematics and I teach mathematics. I consult for industry; I understand the needs, the places where mathematics—I do research in mathematics. But when it comes to influencing a social structure like the Queensland teachers, the ways I can try to get in there and make my presence felt—I have tried everything I can. They just do not want to listen to us. To be cynical, I think the reason is that, in a sense, we are the authority. Even if I cannot say it as well as they can, if I sit there and say, 'This is not good enough', they cannot ignore that.

Dr Ridd—I think they also feel a little defensive, too. I am not critical of the teachers at all. I think the teachers do a very, very good job. The problem comes down much more to the problems in the syllabus and in fact in the lower school. It really does go right back to fractions; that is where the problem starts. I have made some very critical comments in the media about education, but I am very, very careful to set aside teachers and to not criticise them at all. But, inevitably, some of them really do take it to heart, and that is one of the reasons why we get a bit of disagreement from that quarter.

Senator FIFIELD—Senator Troeth referred to subjects as they used to be in secondary schools when you had pure maths and applied maths as separate subjects. When we were talking yesterday to the maths teachers and I asked them, 'Do you think that perhaps we should go back to a time when you had pure maths and applied maths?' their response was: 'With pure maths, the objective then was basically to turn kids into calculators; we now have calculators, so there is no need to teach pure maths anymore. Applied maths, maths in the world and how you can actually use maths, is the important thing.' What is your reaction to that?

Prof. Read—First and foremost I am an applied mathematician, but let us get a bit real here. Mathematics is mathematics; the underlying principles, the fundamentals, are condensed together and taught in as quick and as encapsulated a way as possible, and we call that pure mathematics. The engineers, the physicists, the biologists all take those four skills and make their applications from them. I like to work in applied mathematics because I, too, want to see some real-world things out there. I would like to think that one of the things I have done has influenced something very, very practically. But sectioning off pure mathematics and saying that it is a waste of time is like saying, 'We only use 10 per cent of our brain so let's cut out the rest and throw it away and just stay with the 10 per cent.' Teaching methods and the way people learn are totally different. Back in the good old days students sat there with their mouths shut and wrote, but now they interact. Students will tell you—you can start to pick the different learning types. From a mathematical viewpoint, my experience has been that students learn in

two ways. Some need to see the bigger picture and break it down—when I say ‘the bigger picture’, I mean bits of the bigger picture, and then they break it down. Some work axiomatically. They take the axioms and work their way up. That is the pure maths way and that is the applied maths way. To be a good applied mathematician, a good engineer, you have to master this. You have to have some of the underneath skills but you have to master it. A well-rounded person coming out of the schools needs bits of both. It comes back to the theorem proof stuff. Why do we prove things? What is the use of a theorem proof? We know what the answer is. There are a couple of intrinsic reasons. It gets people used to logical argument, putting something down, whether it is in English, mathematics or whatever. Mathematics is a language. It was interesting to hear the lady speaking about phonetics and things like that.

It is a language; logical argument, understanding. And, yes, learning the proof off by heart when you cannot understand it, and sooner or later the penny drops. I hated proofs when I was at school. I refused to do them, and it was not until I got to about second year that I suddenly started realising how all of these things actually fitted in. We throw away that and we do not know what we have lost. We have pulled out 10 per cent of the brain and thrown it away; everything is still functioning, but what have we lost? We do not find it until we end up in a dark room and we cannot see, and we suddenly realise that it is not a dark room—we have pulled out that bit of vision. There are lots of things that were in the old syllabus that were there for a reason. It does not mean that mathematics has not changed. It is a wonderfully dynamic time for mathematicians and physicists with technology, with computers and the way things are changing. Once upon a time my professor during the war was worked on working out moments of inertia for Spitfire crankshafts. It was a mathematical job—pencil and paper, flying fish calculator. When I first went to university we were throwing away the books telling you how to do these things numerically and correctly. In the days that I have been there, we have actually got PCs now that occupied a full room back then. The first set of stuff that I learned to do in mathematics, we have thrown away most of that; we are moving on to new things. But we cannot do anything if students do not understand calculus because calculus measures rate of change.

Dr Ridd—The idea that only the applied is good and the pure must be bad is really ridiculous. You cannot do the applied until you have done the pure stuff, and it must be automatic in the same as I am speaking to you without thinking about these words—they are just coming out of my head. You have to be able to do algebra and basic calculus like that so you can apply it to physics, whether you are an applied physicist, which is what I am, or you are an engineer or whatever. It is often thrown around that we have got calculators nowadays so we do not need to do fractions; we do not need any of these things. But that is just wrong. In order to be really proficient you do need to be able to do these basic sorts of things.

Prof. Read—For very practical reasons, too—as I show in one of the examples I give the first-year students. Most of them go to nightclubs, and I ask them a simple question: how many people here have spent over a hundred dollars—say \$150—in a night at a nightclub? You will get 20 or 30 kids put their hand up. Work it out: how much alcohol is that? At \$5 a shot, that is 30 or 40 shots of rum, whisky or whatever. You can drink that much? What has happened to that whisky? It has either been watered down or you have walked up there with a \$50 note and been given change for \$20. None of the class can work out in their head what their change should be—simple, basic applied arithmetic.

CHAIR—We were talking yesterday after the meeting about the change machines at supermarket checkouts. They do not need to calculate the change because it comes up on the machine in front of them and they count that out and give it to the customer.

Dr Ridd—I was saying to Wayne on the flight down, ‘Don’t talk to them about how bad their mental arithmetic is because the senators will not believe just how bad it is and you will actually lose credibility.’ But it really is really, really bad.

CHAIR—Don’t ask us!

Dr Ridd—Just simple things like fractions—if you ask them to add a half plus a third they should be able to do it in their head—five-sixths—but they will not be able to do it.

Prof. Read—Again, here is a little test for second and third year. You ask, ‘A half plus a quarter?’ and you can draw a pie chart for that—it is pies, bits and pieces, bang. You ask, ‘A half plus a third?’ and you will see half the students sit there and start to think. Some of them will come up with an answer, and unfortunately, in a maths class, most of them are wrong. You ask, ‘A third plus a seventh?’—starting to make the numbers a little bit bigger—and you will see a group there who cannot work it out. Out will come the pencils and then they will start playing with it. They are the ones who when you start to do the algebraic manipulations do not understand.

Dr Ridd—If you cannot do that addition of fractions, you cannot do algebra.

Prof. Read—One of the things that is distressing with this is that, if you have a class in first year, you can actually fix the top 10 to 15 per cent pretty quickly—when you tell them they cannot do something, they will do it—but there is an enormous belly of students who cannot do that. We try. We set up quizzes and tests so that they can practise that proficiency, but they struggle; they really work. They do not know how to think; they do not know how to learn those sorts of things. Once again, in the big subjects—I mean, we are not a super-large university; there are service subjects as well—the syllabus is dictated to us by the other departments and we have to teach those things. A lot of those students find it an incredibly frustrating experience and say, ‘I’m glad I’m finished with mathematics.’ And yet the hardest bit for them to get, which is the logic and the abstraction, they have that. Maths is made up of a little toolkit: algebra and things like that. Then there is logical reasoning and, hopefully, a little bit of mathematical nous in there. But with all of those subjects, all they require is the toolkit. You pick the ones who really do not have the abstraction et cetera really quickly.

So you have the belly of students who are struggling and working hard. Most students are good students. Yes, they might party and they might have part-time jobs, but they are just the same as you and me. They have a different attitude on some things and require different training, but it is the same thing. We are telling them something they do not want to hear. They say, ‘I didn’t have to do this at school. Why do I have to do this now?’ They struggle their way through and will eventually get through those hurdles. There is nothing we can do other than finally get them through the material. Their experience is negative. No wonder they do not want to touch science or get involved in engineering and some of the other things.

Senator TROOD—Most of your students come from Queensland schools and have Queensland backgrounds, don't they?

Dr Ridd—Yes, most of them. There are significant numbers of overseas students as well.

Prof. Read—And, typically, in first year mathematics we have probably half a dozen interstate students.

Senator TROOD—Is your proposition to us that the ones you see from interstate are generally better prepared and have fewer problems of the kind that you are talking about?

Dr Ridd—Yes. A classic example is that the square root of A plus B equals the square root of A plus the square root of B—not true. Those sorts of issues are never there with the interstate students.

Senator TROOD—What about the overseas students? Are they similarly reasonably well prepared?

Dr Ridd—If they are from another English-speaking country, it is probably bad, but if they are from Singapore or a country with some sort of Chinese background or culture—Taiwan or maybe Korea, although I know that is not Chinese—they will probably do okay. The Singaporeans are without doubt the leaders when it comes to mathematics education. There was a big hoo-ha on the latest TIMSS—the international exams in maths. Australia did all right; it had not gone down; it was as good as Canada or the UK, as though that is much to shout about. But the Singaporeans were as far ahead of Australia as Australia was ahead of the Palestinian National Authority. We can do so much better than we do. I have one course in physics and probably two-thirds are international students, a lot of whom are from Asian countries. It is quite remarkable how much better their maths is than people from Australia, not just Queensland, in fact.

Prof. Read—What about Adi's children, in Indonesia?

Dr Ridd—Yes. You see other things. I had a student who had to go back to Indonesia. The kids were in grade eight. Adi was very worried because he knew that they would have a lower standard of maths when they got back to Indonesia, because they had gone to Queensland schools. I found that very hard to believe, so I got him to give me the book that they would be using in Indonesia so that I could compare it with what my student—my kid, in fact—was doing at the same level. Although the book was written in Indonesian, I could still read the maths. There is no doubt that they were doing things like fractions two years earlier and there was far more repetition. This was in primary school. I think we are a long way behind. We do well compared with Indonesia because we spend a lot of money, but, basically, the problem is the syllabus, in fact. The syllabus is not there.

Senator TROOD—When you say 'we', do you mean Queensland?

Dr Ridd—I am saying Queensland certainly, but even Australia as a whole. They have a slight advantage interstate because they are slightly older when they come in, but that does not make up for all the difference we see between Victorians and, say, Queenslanders.

Prof. Read—We have some preliminary interstate type comparisons. At one of the conferences last year we got someone from Wollongong, someone from ADFA, who has people from all across Australia, and Sean, Darcy and me. We put together a basic test, sent it out and pulled it together. It is interesting; the New South Wales lecturer said, ‘I cannot give this test to my students in the top class. ‘This is basic’. So he gave it to his intermediate class. The ADFA bloke said, ‘We’ll get mixed results on this. I know that, as soon as I’ve got Queensland and Western Australian students, there are going to be issues in bringing them up to speed’. He also said, ‘We’re seeing issues across the board from every state’. He said those were the two key issues. In that same test for the maths B—and this is the OP10; the bulk of the class is OP7 and above—the average mark was eight out of 20.

Dr Ridd—I think Queensland has gone further down the track of modern education, if you want to use a slightly derogatory term. You have only to look at some of the syllabi. The worst syllabus that I have seen is the new physics syllabus. I was on the panel for the Queensland Studies Authority that developed it. I was opposed to almost everything in it, in fact, mainly because it does not say what you have to teach. In a document that was close to 40 pages long, there was only one page that was devoted to what you were supposed to teach. It does not say, ‘Thou shalt teach Newton’s second law. You will do conservation maths’—none of that detail. You look at a Singaporean syllabus, and it will tell you exactly what you have to teach. The teacher is allowed to teach whatever they like. The assessment system is absolutely crazy. They have gone away from marks; you are not allowed to give marks and add them up. You make this ridiculous holistic judgment. There is too much emphasis given on assignments where you have no idea how well the kid has done.

Prof. Read—Or how much the parent has done.

Dr Ridd—Yes. My son does physics at school. When the assignment comes back my son ought to do pretty well at that assignment. The teacher has no way of knowing whether my son has done it or whether I have done it, even though I have to sign a thing saying that I have not helped him. I will not go any further because I might perjure myself. You can see that the whole system in the syllabus is corrupted—although I think in Queensland the system of internal examinations with external assessment had worked quite effectively for quite a long time—and because of that and the fact that you actually have no idea what is going on in the class, it is no longer working and finally I am going back to the idea that we do need to go to some external exam where the universities have some, not a lot, of input into what is there. Because then it, de facto, becomes the syllabus.

Senator TROOD—You have partially answered my question but perhaps you could just clarify this for me—and Professor Read in relation to mathematics as well. Part of the impression I got from your earlier evidence was that if people taught the syllabus then we would not have a problem. In other words, if you see Pythagoras in the syllabus you say, ‘That’s good. We need Pythagoras’. But you are saying that if you teach it by cut-out shapes rather than by equations, then that does not get us very far. The fact that it is there is helpful. Similarly, in relation to physics, if Boyle’s law is there then that is a good thing but if you do not teach Boyle because you do not have to, then of course you are not getting where you need to go.

Dr Ridd—That is right.

Senator TROOD—So is the problem that the syllabus is not being taught? I think you have partially answered this in relation to physics, or is it that it is being taught in ways that are not rigorous enough?

Prof. Read—It is a double issue. Why doesn't the government announce to people that all they have to do is eat well, exercise and they will live a healthy life? That covers everything, doesn't it? The syllabus covers everything. You can find something in there that covers everything an applied mathematician could do. I am a mathematical modeller; that is what I do. There is a little section on mathematical modelling that I am very uncomfortable with. I would not go out and state that to people that that is what I do, because I know of the limitations that I have—that is after 25 years experience. In the breadth, by making it as wide as that, you can pull holes wherever you like. That is the first comment. The second comment is that, by stopping doing the basic things that are required, by not underpinning it with specific structure examples—that is, this is what you teach; the students must be competent in solving quadratic equations from first principles as well as using the formulae—there is very specific detail. You can do whatever you like. I was being a little bit facetious in my comments about the syllabus but, by bringing in all of these grandiose statements, all of these things that sound wonderful, it is the same false argument as before.

It sounds good, it sounds like we are covering everything, but when you come down to the evidence it is not there. The reality is simple. There is stuff there in some of the examples they do on Markov modelling. One of the schools rang up with one of the questions on Fibonacci sequences. I looked at it and it took me about 15 to 20 minutes to work out where it was going. There is a lovely little result in there that I thought was really quite neat, but you need to have done honours in pure mathematics to pull it out and understand it. I thought 'How in the hell are these students are going to do it?' They sit and write out a Fibonacci sequence for half an hour which does not practise fractions; it does not do anything. It shows nothing about the nice mathematical result. By putting in all of these things with teachers who have no idea of what they are supposed to be doing with them, you have students learning these things off by heart. That is the problem—too broad a syllabus which covers everything; no specific detail; no well defined things that you can measure, and that is it.

Every time we try and measure it, they change it. The system does not work anymore and, once again, there is a philosophy here and it amazes me. I understand that we are all sensitive about mental issues. We do not want to be thought of as being substandard mentally in some way. But in every other endeavour you watch the Olympics, you watch the finals of the 100-metre sprint and see the fastest man in the world on that day. Do you sit there and say, 'All the rest were also-rans, rubbish, et cetera'? Is anyone concerned about that? No, it is a good open and honest competition. Everyone who competed is valued for their competition. Some of those issues are underlying a lot of this philosophy. We do not want the ivory tower syndrome and only the best one per cent et cetera either; we need to bring out the fact that excelling in some of these skills is fine, a great thing to do, just as it is to win a race or to have the Cowboys win on the weekend.

Senator TROOD—I have one other question. You said you have been forced to restructure your courses twice over the last couple of years. What have you been required to do; cover different material?

Dr Ridd—That is not over the last couple of years; that is probably over the last 15 years and we may even have to do it again, looking at some of the results from the first year maths cohort. You end up saying, ‘This section of work which we would like to cover we really cannot, because we are having to spend too much time picking up usually basic algebra or basic calculus or very basic trigonometry.’ So we use three weeks there so three weeks has to go at the end. We will pick up the bit that will hurt the least and it gets the flick and goes into second year. It is as simple as that. We have had the situation where we had what we call normal maths. We then introduced a lower level maths subject and then that lower level maths subject effectively had to become the high-level maths subject. Then we even ended up whittling away at that. This, as I say again, is not because of the low OP score of the people coming in; it has actually normalised. The very low OP1s are doing the even lower level maths. This is with people who have a high in maths B; they have not been able to cope.

Prof. Read—When we first started this back in 1993, the engineers were having trouble with their first year maths students. More students than was acceptable were failing. So we rejigged it and brought in a remedial subject. Initially, it was to bring the lower level engineers up to speed so that they could then get back on track. Through the mid-90s that folded and, in the end, we just had to throw away those subjects.

That subject became the premier subject and about 2000 we started having problems with students who could not fit into that so we have got another subject to slot underneath there. This subject here—this is the one—now we have a high on that—high on maths B. And if you have got a sound or otherwise you can do this subject—the lower level subject. We now have students who have a sound in maths B who are struggling to pass the lower level subject.

Dr Ridd—This is a subject which starts with things like half plus a third. That is where it starts and they are having difficulty getting through to the end of the course.

Prof. Read—We face a double whammy here. At the end of the day all of the other disciplines are coming to us for solutions. They understand and fully admit the problem but how do we have a pathway for these students to come up to speed?

CHAIR—Do you think the other faculties have some of the same problems?

Dr Ridd—Certainly the other subjects do. The biologists are having problems and they do not require very much at all—the geologists and the engineers have problems. Any of the numerate disciplines—the chemists for sure—

Prof. Read—Commerce and economics too.

Dr Ridd—It is right across those areas—sure, they can sort of use a calculator but even then, believe me, they cannot even use the calculator accurately in many cases and they cannot do any basic algebra.

Prof. Read—This is one of the problems and calculators are a symbol of it, in a sense. If you understand arithmetic I can show you how to use a calculator in about 15 or 20 minutes—a bit of practice and off you go. But if you do not understand arithmetic, you need to be shown time and time again how to use a calculator. I have got one staff member now who is seriously suggesting

that at the start of this lower level subject we spend two or three lectures teaching students how to use a calculator. You think about that. Calculators came into the schools in grade 4, and once again it is putting a bandaid on the sore. The real issue is the underlying skill.

Senator TROOD—What would the level at which you are now teaching your first year mathematics be equivalent to in the high school teaching of, say, 10 or 15 years ago? At what stage would you have covered the same kind of material?

Prof. Read—First semester. In the—

Senator TROOD—What level?

Prof. Read—In the traditional subjects the first part of first semester was bringing high school students up to speed—‘this is real—now you are not given a page of paper—you have to do this.’ This was covered in a few weeks and then we went on to new material. That now is spread across three-quarters of first year.

Dr Ridd—So basically our normal first-year class is re-covering stuff that is done in maths B and probably with a bit from maths C, which most of them will not have done. So you are really re-covering it but the lower level course barely gets you to the end of what they would have done—

Prof. Read—It really goes to very simple calculus differentiation.

CHAIR—Thank you. That has been fascinating. There are just two things I would like to say. Regarding your example of the Olympic athlete winning the 100 metres, we were told yesterday that it is totally unfair to have a snapshot of one student on one day at one point in time and that what you should be looking for is presumably the 10 other races that he would have run in order to moderate across those. Also, we did see a document yesterday from the Queensland College of Teachers which had the categories on which teachers are assessed and brought up to speed for their provisional registration and then proper registration. There were 10 categories and language, literacy and numeracy were one of them. And the others were—bless their hearts—community and carer cooperation and diversity and all the rest of it. Certainly as a former teacher I was quite appalled, I must say. So I can see where your difficulties come from. Certainly your willingness to appear here has been very much appreciated, so thank you very much.

Dr Ridd—Thank you very much.

Prof. Read—We thank you very much for the opportunity to be here.

Proceedings suspended from 10.44 am to 11.04 am

LOGGIE, Mr Stephen, Principal, Queensland Academy for Science, Mathematics and Technology

BRITZ, Professor Margaret Lorraine, Executive Dean, Faculty of Science, Queensland University of Technology

RITCHIE, Associate Professor Stephen Michael, Associate Professor of Science Education, Queensland University of Technology

CHAIR—Welcome. Do you have any comments to make on the capacity in which you appear?

Mr Loggie—The Queensland Academy for Science, Mathematics and Technology is a new senior secondary school that opened this year. It works in partnership with the University of Queensland to provide learning opportunities for the best and brightest maths and science students in the state.

CHAIR—You have not provided us with a submission. Do you wish to do so at the moment or will you simply speak to your notes?

Prof. Britz—We have prepared a two-page brief just describing who we are and our agenda. There are a number of points I would like to make from our discussions and from the discussion with my staff.

CHAIR—That is fine. If you would like to do that now and we will consider that incorporated into the general papers.

Prof. Britz—We will make sure that the two-page submission is actually in your hands very soon.

CHAIR—Thank you.

Prof. Britz—I would like to start by saying that, as a person who has been engaged in tertiary education for a very long period of time, we do see some wonderfully creative, talented, curious, dedicated students emerging from our secondary system. I think we need to emphasise that because whatever the experience is from primary education through to secondary education, science does excite and motivate students to seek careers in science. Whatever is happening out there, something must be working somewhere. However, what I have observed over time—and my staff in the mathematical, physical, chemical and biological sciences would agree—is that there is a divergence in the expectations of what university educators want coming into tertiary education and what actually happens within the primary and secondary systems.

I have a couple of examples of what our tertiary educators want. We want students coming in who have what we would call the hard wiring of the knowledge base: having the fundamentals in the sciences which we think count—in the mathematical sciences and in chemistry. I am sure different educators would say that they would want different traits. But we also want some traits

which we would say are the generic skills—basic literacy and communication skills—because that is what employers increasingly want and what we need to build on in tertiary education when students walk through our front door.

Because of the expansion in the tertiary education sector in general but also in science, we have been facing challenges in science faculties for years. To survive financially we need to look at the numbers of students who walk through our doors. Consequently, we have changes in both the secondary system and the tertiary system. This means that our expectations of what we want in our incoming students have changed significantly. We see fewer and fewer hard-wired students, but we see a large number of students who come in with a diversity of experience from their secondary schools. That diversity means that they may have done some science education, which does not necessarily enable them to walk through our front door and do what we expect of them. Perhaps that means that tertiary education should change, and it actually has.

Because we need to fill our numbers, we tend to delve deeper into the entrance scores, the OP scores or whatever. In Queensland, one statistic I was looking at the other day was that, of a 25-point scale, some of our tertiary institutions are taking in students with a published OP score of 19, where one is high achievement. We are saying that, to fill our numbers, we need to delve deeper. Consequently, we have problems in both a lack of hard wiring in the basic knowledge of the disciplines and a diversity of experience that students walk in with—sometimes with subjects that we may call ‘soft science’ and often with minimum qualifications in English and one form of mathematics. That means that we face the challenge of remedial action in the first year in trying to catch students up so that they leave their tertiary experience able to be registered as practitioners in their fields or meet registration with the chemical institutes, the microbiological institutes and the engineering institutes to say that they are qualified to practise in their art.

We have seen that divergence in our expectations. One suggestion I would like to put forward is that we need to do something about that in the short term. We cannot change educational systems instantaneously. So I see a short-term issue in terms of what is coming out of our systems and some longer-term issues which may be of greater interest to this inquiry.

We very strongly appreciate that a year 13 somewhere may be channelling students into science and technology, but then we are soft as well because we do not stream our students. We do not say these ones are highly qualified and therefore we can shove hard things at them in university. We simply cannot afford to do that. We just cannot afford multiple replicates in first year university for small cohorts of students. The funding issues are really quite important.

We are also critically aware of what students want and we appreciate that attitude and community values influence the way that students function throughout their secondary education and into their tertiary education. Secondary students lead complicated and busy lives. I was out talking with high school students about a week or so ago as a principal for the day and I asked them how they fitted in work, their community inputs as leaders within their school, family life and, of course, their growing sexuality because that is when the hormones kick in—their after-social lives. When they come to university, they want to fit in study, which is not the primary thing that they want to do; it is one facet of their lives. They transfer that to their tertiary study by wanting, quite frequently, the easiest route to study, the easiest mechanism of delivery. The tertiary sector must develop innovative ways of delivering which essentially means the easiest

way of transferring the essential knowledge within their courses, not necessarily the best educational experience but the easiest way that we can actually handle that.

One sentence that I thought was interesting was that we agreed that talented students who are motivated love learning about the context of science. They love learning about it in primary school but they somehow get switched off in their middle school experience. That difference between getting them excited, hard-wiring them, and then getting them excited about science careers, or indeed having science as part of the portfolio of skills when they leave their secondary experience, is a difficult scenario.

A lot of people will try to prophesise about what jobs are going to be out there and why people should do science. We actually do not think that will work. I have tried that on many occasions and we do not think it will work because of those attitudes and community values, and the nature of whatever generation it is—Y or whatever comes after Y. I think there is something more fundamental in terms of societal values there—and that is getting deep and meaningful from a professor who is involved in science education.

I have made my commentary on teachers. Stephen's experience with secondary teacher training implies that the quality of students who are going in and out from science teaching is actually quite high. They often seek higher education qualifications through a Master of Science rather than a Master of Education. So they see themselves very strongly aligned to their discipline, or many of them do. I think we are really trying to work out how the middle-school educational experience turns people off and does not hard-wire them. It may be a mixture of the curriculum, the content and the quality of teaching.

The other point I think we need to make is that science teachers do have it pretty tough out there. They often face evolving curriculum and the evolutions mean that they need to then teach in a different way and assess in a different way. If you teach in context, you then have to assess differently. And then students come to university and they are used to a different style of assessment and then we are asking them to be hard-wired. Some students actually find it very hard to translate because of what we do, which may not be best practice, and what we expect as students come in. I think that summarises some of our discussions and thoughts that we had prior to coming here.

CHAIR—Would you like to add anything to that?

Prof. Ritchie—I do not think that I would like to add anything at this stage because I think Margaret has covered it very well, and the paper too summarises the points. I am happy to answer questions.

CHAIR—Very good. Stephen?

Mr Loggie—I would just like to pick up on some of those comments. As a principal who has recently transferred from the primary field into the senior secondary, the dynamic of the way the program is delivered is substantially different. I think that the focus that worked very well for me as a primary school teacher was one of switching students onto the wonder of science and to have the focus very squarely on inquiring and really giving the students the opportunity to engage in what we were inquiring about.

Moving up to the senior secondary students, and very gifted students at that, we have seen in our work with the universities that it is very possible to connect these students to the cutting edge of their particular disciplines. That is a wonderfully motivating place for them to be. The gap to me appears to be in the middle, where most high schools are dealing with programs that are structured around text books that are not contextually based. Many of the classes are conducted in rooms that are not special science facilities, by teachers who are not specially science trained. We are working hard to address that.

CHAIR—What is the proportion that goes on from that middle school setting to the upper school classes in secondary teaching? Are the ones who emerge the winners, in the sense that they are hard-wired to do it from the start?

Mr Loggie—They are certainly hard-wired, and I would agree with Professor Britz when she says it is often about aspiration. Many of the students who continue to take on the challenge in mathematics and science in the senior school have a great sense of where they are going in their lives, so they are prepared to sign up for subjects that they often do not know much about because they know that is the vehicle for getting there.

CHAIR—You spoke about the necessity at university to catch up some of the students in science and basic scientific concepts and we have heard that from the maths area. What are your views on that?

Prof. Britz—We face that in mathematics in terms of even high achieving students who enter university. The example is from optometry, which we were talking about the other day. OP1 students who enter university have very good maths qualifications, but they then cannot translate that into the context of what their new discipline might actually be. It is not just the ones who are ill-prepared; it is often high achievers who are hard-wired but they cannot contextualise. So there is a gap there. We find that the hard-wired really gifted students who we see coming through need to be challenged when they first come to university. What we need to do is structure curriculum which actually recognises that some come in with the bare minimum of maths, but also with very poor chemistry concepts as well. If you are going to study any of the biological sciences then the people who teach this say: ‘But you actually have to understand the chemistry of life. It is not just understanding that there are organisms that do different things; it is really understanding how they function, how their genes work, how their biochemistry works, why they might look the way that they do.’ Often that is chemically based.

In my various positions, I have actually tried to work out how you take someone from virtually a zero knowledge of any science. In Victoria, for example, in 1997 when I was briefing Jeff Kennett on this, the most popular science subject was indeed psychology. He made some remarks to the effect that that is why everyone was advising him at the moment. But students could creep out of the system with the minimum of maths and a science which did not actually teach them much about basic functionality in the sciences which we need. So we had to structure curriculum which is catch up in first semester, but try to actually excite them at the same time. We are trying to do things which are a bit different at QUT to maintain the interest. Then you have to ask, ‘By the end of their first year experience if they have caught up in six months on something like a gap of five years of educational experience, is that feasible? Will they actually then achieve to a level that is the bare minimum that is required to go into the specialisation that

they are now passionately engaged in and want to do?' Sometimes the answer is yes, but sometimes the answer is no.

CHAIR—I have not actually asked this question before, but you are probably aware that Melbourne university has now put in place an entry degree, if you like, before people proceed to a specialised degree. What is your institution's view on that?

Prof. Britz—I should actually confess for my sins of the past. I was indeed Assistant Deputy Vice-Chancellor Research at the University of Melbourne before moving up here and I maintain a professorial and adjunct appointment with the University of Melbourne.

The reason those moves were made is actually quite different from what a lot of universities would choose. It is a large risk and a gamble in terms of looking at how you can provide generic education which provides skills for the renaissance man or woman, which is really what Melbourne is trying to do there, and to properly address some of the issues I was talking about in terms of having more space within a curriculum that essentially goes over five years. The fault in the system, of course, is that you then have to pay for your education at that higher level. That is the gamble Melbourne is taking in terms of whether Australian students will choose to do that because brand Melbourne is a lot better than, say, brand whatever university you wish to choose. So there is a risk there. That is why I mentioned year 13.

CHAIR—I was going to ask you about that. So that would be at the end of secondary school?

Prof. Britz—Yes, it would be at the end of secondary school.

CHAIR—What could you see that being used for?

Prof. Britz—We have seen frustration with our academic staff in Melbourne; at VUT, where I was previously, and at other universities. The frustration is trying to get up to the attainment at the end of first year. In my view it is impossible to provide that richness of experience which is based on both acquiring basic knowledge and being able to integrate that in a way which means that you can then put it into context within your discipline. I personally think it is a big ask at tertiary level to achieve that.

Having a year 13 might be in order. We all, because of the rules of education in the tertiary sector, had to have three-year degrees. We cut down four-year degrees to three-year degrees. That happened in agricultural faculties and in a lot of professional courses. Perhaps we need to rethink that. Perhaps we need to recognise that, yes, there are elite students coming out who we need to then capture, excite and professionally train. But perhaps we need to look at that first year experience at university as being something where we need not only to excite but also to train and contextually teach them—to take them from what their experiences were to where we want them to be in their professional lives. That is just a different approach.

CHAIR—It is a very interesting concept.

Senator MARSHALL—I would like to hear a bit more about that. I got the view from the last witnesses that there was significant disappointment with the knowledge base they were getting but that there was a reluctance from them to acknowledge that. The world is changing

and the fact is that the standard that used to apply, which I guess was how their courses were developed in the first place, really is not going to be delivered anymore. Is it really about the tertiary level saying: this is what we are going to get and we have to now adjust our courses to accommodate that? Whether it is longer degrees, bridging programs or lead-in courses to the degrees in the first place, which will go through some of those basics, we may simply have to face that reality—rather than having this constant conflict that says, ‘You are not delivering to us what we expect and we expect something that secondary education simply is not going to deliver in contemporary society.’

Prof. Britz—Absolutely. I said before that there is not only the short-term issue but also a longer-term underlying issue in terms of what the primary and secondary training experience delivers. That is going to take quite a lot of rectification. That is based on a philosophical stand, a curriculum stand and the way that education is actually delivered. I think I went back into the tertiary sector in 1989 with an organisation called the Western Institute. We were a Dawkins experiment in cross-sectorial education. We were planted in the western suburbs of Melbourne. We were critically aware that, basically, the high schools in our catchment area were not going to turn out Nobel Prize winners instantaneously. These were immigrant families. We went through all of the issues of, ‘Let’s look at what is coming in and let’s look at what we need to do.’ We came in with a different attitude because we realised that the educational experience was going to be different and that there were going to be challenges in those particular schools in that quarter of the population of Melbourne.

We actually addressed that head on—and most universities do actually do this—we ran summer schools; we ran repeats of subjects in the break between first year and second year for students who had just failed to look at what the gaps were in their knowledge base. So we ran classes in the summer time and we structured the curriculum to enable that catch-up phase. We then ran remedial courses to help students from needy backgrounds who were willing to go to tertiary education and who wanted to study science. We bent over backwards to actually address that.

Most university academics, and my own staff, are very highly engaged in mathematical sciences. They recognise that students are frustrated when they come in because they do not have the background, and they know that they do not have it. They really want to achieve in the maths and physics but they just do not have that background. I think we need to actually address that question head on now for the tertiary sector. It is time to stop pretending and it is time to actually look at the interface between the secondary education system and the tertiary system in a very complex matrix which varies across each State.

Senator MARSHALL—Do you think there is a difficulty with the tertiary sector actually acknowledging that the sole purpose of secondary education is not simply to deliver people into university education?

Prof. Britz—I made a point in our two pages which is very much along those lines. I think my colleagues in this room would recognise that science education, in terms of turning out people literate in science who can take part in the community debate because they actually do have a smidgen of the knowledge, is a really good thing.

That is part of the skills people leaving high school should actually have. They should have a broad education in terms of them being citizens. I have never thought of those students as being only university fodder. They each have their own wants, desires and needs; and it is up to us to actually provide a multiplicity of educational experiences—whether it is tertiary education, the TAFE sector or other forms of training in their lives. The difficulty is trying to meet those professional accreditation processes. I jokingly said years ago that if we were training nurses then yes, I want a really good bedside manner—because we had nurses who were very sociologically oriented in their training. They said, ‘Why do we need to teach them biosciences, Margaret?’. I said, ‘When someone puts a needle in my vein and they have to work out what the dose is or make sure it is right, I want them to at least have basic arithmetic and understand fractions.’ Twenty years later I would still stick by that.

Senator MARSHALL—Was that delivered? You are starting to worry me now.

Prof. Britz—There are huge gaps in terms of coming into the tertiary sector. You would be surprised about basic fractions.

CHAIR—I think we were pre-warned by the previous presenters.

Senator MARSHALL—We have all been out practising our fractions in case you ask us a question.

Prof. Britz—Yes, I was looking up basic theory of logs in case I was asked today.

Prof. Ritchie—It is interesting because when nursing was conducted in hospitals, typically without superior qualifications, nurses could do those calculations because they were trained within that context—that is, here we are in a hospital; we have these particular skills to develop and yes, it is relevant to us so we will learn it and we will master it. The problem at university is that students do not see the connections and they wander in or wander out. They do not have a deep sense of commitment to the profession at that same stage. We are saying neither that students are incapable of doing these things nor that the graduates cannot do them. But, at the relevant time, there are some skills that students may not be able to demonstrate because of that contextualisation which might be lacking.

Senator MARSHALL—I must admit that, when I take my own children to the hospital to get doses of things, I always recheck the calculation on the formula first.

Prof. Ritchie—You see.

Senator FIFIELD—Mr Loggie, your academy is a secondary school. Is it years 7 to 12?

Mr Loggie—No, it is just years 10, 11 and 12 which is the last three years of our schooling.

Senator FIFIELD—Is that the only school of its type in Queensland—the only secondary government school that specialises in maths and science?

Mr Loggie—We are one of two academies which opened this year and the third and final academy opens on the Gold Coast next year. Each of the academies is positioned beside one of

the major universities in Queensland, and for that reason there are plans for only three at the moment.

Prof. Britz—We should emphasise that it is an elite program with the Baccalaureate, which is the international qualification. There are also schools which specialise in certain areas. There is the Cavendish Road State High School which I was at last week. They are known to have a strong science specialisation. There are several high schools within Queensland which are known to do that. There are also six centres of excellence which have been created to look at the educational experience and professional development of the teachers from primary through to secondary. Queensland University of Technology is linked with one of those up in Gladstone, because we recognised some difficulties in people being attracted into the mining industry there. So there certainly are specialist schools, but there certainly are very non-specialist schools too.

Senator FIFIELD—Is the Queensland Academy academically selective?

Mr Loggie—Yes it is.

Senator FIFIELD—I have long thought that the secondary school sector should be capable of walking and chewing gum at the same time—that is, capable of not only providing a good grounding in the disciplines for all students but also having avenues for students who have a particular aptitude for or interest in a particular discipline.

Mr Loggie—I think that opinion is very much caught up in the charter of the academies. We do not seek just to provide opportunities for our students alone, because we are capped at taking 450 students maximum across those three year-levels. Our work is very much about working with the universities so that we can develop projects which can be replicable in all state schools. Both the partner and the academy will play a role in growing the skills of the students and the teachers to take advantage of that work.

Senator FIFIELD—In secondary school education system in my own state of Victoria is probably the most monochromatic one in Australia. There are only two fully academically selective government high schools. They have centres of excellence—well, in name only; they are not really; there is nothing the equivalent of your academy. So I am delighted that these academies are being established.

Mr Loggie—I think we have realised that, particularly in our larger centres like Brisbane, it is a case of differentiate or wither. Parents are very discerning in their choice of secondary school for their child and so schools are faced with the challenge of developing a very clear sense of identity which will attract their students and guarantee their viability.

CHAIR—So there are two in Brisbane and one to be on the Gold Coast?

Mr Loggie—Yes, that is right.

Senator TROOD—Are they all in science or are they across different disciplines?

Mr Loggie—They are in different disciplines. Ours is in science, maths and technology. There is a department for QUT called ‘creative industries’. That is not a *Fame*-type school; it is about

fostering creative thinking in students. Certainly there is a relationship to the creative arts in that, but the drive is very much about being creative. The academy that will open at the Gold Coast next year is called Allied Health and it will take advantage of the health faculties that Griffith University has on its campus at the Gold Coast.

Senator FIFIELD—I just hope we never hear of a SOSE academy. That would be truly awful.

Mr Loggie—I can assure you there are no plans for that.

Senator TROOD—What percentage of students coming into your school are a source of concern to you, in terms of whether their level of secondary education fits them for the kinds of courses you want to put them in? What percentage would be of concern in any one year?

Prof. Britz—If we have an intake of, say, 200 students, we would have a tail end of around about 30 students who we have identified as of large concern. We do stream those students, but they go to a different campus. So they have virtually a one-to-one educational experience but it is otherwise more like a high school experience. Then they come into our mainstream programs at Gardens Point. The drop-out rates in universities, which might also indicate those who you might have concerns about, would be up to 25 per cent. Up to 25 per cent of the first year cohort might disappear. That is for a variety of reasons. Often it is because of financial reasons rather than lack of preparedness.

We have large concerns for up to 25 per cent of our normal cohorts, although we appreciate that with high OP scores or high entry levels you normally have a very high success rate because they are very well qualified to cope with tertiary studies. You would then have the great unwashed in the middle which is between that 25 per cent and say up to 90 per cent in their scores coming in. There seems to be no correlation between the entry score that they get and their later success both in programs and in life later. Obviously the tertiary sector must be doing something right in actually taking the students concerned and assisting them in their educational experiences. But as I said there are the 25 per cent at the very lower end—the top end is often a breeze to work with, and in the middle you then have to run those remedial catch-ups or programs to actually assist them to achieve at the top 20 per cent level.

Senator TROOD—I assume most of your students are coming from Queensland secondary backgrounds. Is that right?

Prof. Britz—Yes

Senator TROOD—In relation to preparing that cohort as opposed to those who might come from interstate and perhaps overseas, is there any recognizable difference between their preparation for these kinds of programs?

Prof. Britz—I will start with the last, which are the overseas students. Generally entry is from the students who have either undertaken their secondary education in Australia or a foundation year of studies. They will come over, they will enter a college of some description—we had one linked to QET; the University of Melbourne had a foundation year as well. They are actually trained in languages and in their discipline area. So they come in better prepared because they

are very focused, they know what they want to do, they do the subjects which best suit their entry into a degree of their choice and they target some of the elite degrees and professional qualification degrees.

Regarding students from interstate, I am critically aware that there are differences between states, having moved up from Victoria only about 18 months ago. You do see differences in the curriculum, in the mode of delivery and in the assessment, which is why I made that comment that tertiary educators who have a couple of hundred first-year students in front of them cannot necessarily do the type of contextual teaching, which is a small group experience, in secondary schools. The differences in the quality of the students coming in locally are as diverse as they would be coming from interstate because of that diversity of experience that they have had both within the Queensland system but also the diversity across Australia. And that is what we have to target our remedial action to.

Senator TROOD—And is it generally true across all of the disciplines? You have maths, physics, chemistry, biological sciences as well. Is it more or less uniform across all of those natural sciences?

Prof. Britz—I think the mathematicians—do not tell my staff this—have got the highest understanding and the highest standards that they are actually trying to achieve. In the chemical sciences I have been personally aware of the skills gap for a number of years but our chemists would still like students to have much higher skill bases. In the biological sciences we assume there is no prior knowledge in the biological sciences and we start from scratch when the students walk through the door. I did that 30 years ago at Melbourne University because I came in with physics, chemistry and mathematics and no biology. That is the theory; the reality is that someone who has done biological sciences does a lot better. Physics students are such a rare breed that we treat them quite specially and really try to help them. We also have an elite program where a lot of our dean scholar students who come in with very high scores are accelerated through their program. A lot of them actually choose physics as a career. So they start from a poor knowledge base and you try to excite them about physics. You teach astrophysics—not that they are going to turn out to be astrophysicists—because they are actually attracted to that and by the way we teach the fundamentals. So, yes, we cheat as well—we actually contextually teach to get the basics into them. I think it is well documented in the maths area that there has been a lot of activity over the last 15 years of raising awareness in that. I think the chemistry example may be less appreciated, and for the biological one we just make the assumption that we teach from scratch.

Senator TROOD—Mr Loggie, do you test the students coming into your academy? Obviously it is a selective school, but do you have any qualitative data about their particular educational experiences before they come to you? What I am interested in is whether these are just naturally gifted students who have what it takes and who have perhaps a natural inclination for the natural sciences or whether they are students who have been particularly fortunate in the teachers that they have experienced over a period of time. Do you have any data on that kind of thing?

Mr Loggie—Yes, senator, we do. All of the students who nominate to come to the academy sit the HAST test—that is, the Higher Ability Skills Test. That is conducted by ACER. We use the results from those tests, combined with an interview we conduct and an academic review or a

portfolio review, to make our offer of a place to that student. What we look at through that process is not only their current skills base but also their capacity to be successful. So it is a combination, if you like, of their IQ and their current skill level. The reason for that is that through this testing we have identified a large cohort of students who are underachievers but who have the capacity to do much better than they have before. Their stories that they tell us are quite similar—that is, ‘I’ve been in class but I’ve been bored. I have not been challenged, and I want to do something about that.’ Of the 150 students who moved into our year 10 program, there would be about 25 per cent who would tell that story. It is a long journey back for those students when you drop them in a highly-rigorous academic program because their application to their work coming into the program often leaves a lot to be desired.

Senator TROOD—What distinguishes your curriculum from the program that years 10, 11 and 12 students would otherwise be doing if they had remained where they were?

Mr Loggie—We offer the international baccalaureate curriculum. As well as being a very rigorous curriculum—and by that I mean that it takes about 240 hours to deliver the international baccalaureate curriculum to senior school students whereas our current curriculum takes 188 hours so there are additional teaching hours involved in the program—it also combines perhaps a more classical approach to subjects than does the Queensland curriculum in some respects. Across any discipline, we have broken that up into a number of focus areas—for example, in lots of the sciences and mathematics—to give students the opportunity to experience the discipline in a way that would best serve them and their interests whereas the international baccalaureate curriculum, because of the additional teaching hours, tends to hold a discipline together and give them a broader experience of that discipline.

Our students are challenged to do subjects from a broad range of areas. There are six areas within the international baccalaureate. So whilst my academy specialises in science, maths and technologies, all the students do a second language, they all study English and they pick a business or psychology unit within the social sciences area as well. At the end of the day, we are very confident that this will produce students who have moved a long way on their journey to become scholars because the assessment regime that is created through that is very compatible with that that the universities put in place. It is easy for us to make those alignments in both the content and the assessment procedures. Because they also spend time on the university campus, we are confident that it will not be a shock to them. Hopefully our students will not be amongst the 25 per cent of students who drop out.

Senator TROOD—They are all obviously students who are going to university. When they enter at year 10, do you seek from them an indication of the kinds of professions into which they might be going?

Mr Loggie—Yes, we do; and as a principal I then do my best to challenge them about those assumptions that they have made in that area. There are still very high profile professions that draw students towards them, such as medicine, but I see it as my role to capitalise on the opportunities to work with the university to give them experience in biomedical and engineering subjects and across the range of faculties that we have available to us prior to giving them an in-depth experience in the profession that motivates them the most. Hopefully that way they will not find themselves halfway through a university course saying, ‘This is not for me’.

Senator TROOD—I hope there are some teachers there—that there are people interested in teaching.

Mr Loggie—There certainly are.

CHAIR—Thank you very much. That has been very refreshing and an interesting insight into your view collectively of what you do. Best wishes from the committee.

Prof. Britz—Thanks for the hearing.

Committee adjourned at 11.46 am