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HOUSE OF REPRESENTATIVES

STANDING COMMITTEE ON EDUCATION AND VOCATIONAL TRAINING

Reference: Teacher education

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HOUSE OF REPRESENTATIVES

STANDING COMMITTEE ON EDUCATION AND VOCATIONAL TRAINING

Thursday, 18 August 2005

Members: Mr Hartsuyker *(Chair)*, Mr Sawford *(Deputy Chair)*, Mr Bartlett, Ms Bird, Ms Corcoran, Mr Fawcett, Mr Michael Ferguson, Mr Henry, Ms Livermore and Mrs Markus

Members in attendance: Ms Bird, Ms Corcoran, Mr Fawcett, Mr Michael Ferguson, Mr Hartsuyker, Mr Henry, Ms Livermore, Mrs Markus and Mr Sawford

Terms of reference for the inquiry:

To inquire into and report on:

The scope, suitability, organisation, resourcing and delivery of teacher training courses in Australia's public and private universities. To examine the preparedness of graduates to meet the current and future demands of teaching in Australia's schools.

Specifically, the Inquiry should:

1. Examine and assess the criteria for selecting students for teacher training courses.
2. Examine the extent to which teacher training courses can attract high quality students, including students from diverse backgrounds and experiences.
3. Examine attrition rates from teaching courses and reasons for that attrition.
4. Examine and assess the criteria for selecting and rewarding education faculty members.
5. Examine the educational philosophy underpinning the teacher training courses (including the teaching methods used, course structure and materials, and methods for assessment and evaluation) and assess the extent to which it is informed by research.
6. Examine the interaction and relationships between teacher training courses and other university faculty disciplines.
7. Examine the preparation of primary and secondary teaching graduates to:
   (i) teach literacy and numeracy;
   (ii) teach vocational education courses;
   (iii) effectively manage classrooms;
   (iv) successfully use information technology;
   (v) deal with bullying and disruptive students and dysfunctional families;
   (vi) deal with children with special needs and/or disabilities;
   (vii) achieve accreditation; and
   (viii) deal with senior staff, fellow teachers, school boards, education authorities, parents, community groups and other related government departments.
8. Examine the role and input of schools and their staff to the preparation of trainee teachers.
9. Investigate the appropriateness of the current split between primary and secondary education training.
10. Examine the construction, delivery and resourcing of ongoing professional learning for teachers already in the workforce.
11. Examine the adequacy of the funding of teacher training courses by university administrations.

The Inquiry should make reference to current research, to developments and practices from other countries as well as to the practices of other professions in preparing and training people to enter their profession.

WITNESSES

Committee met at 9.36 am

McINTOSH, Ms Janine, Schools Project Officer, International Centre of Excellence for Education in Mathematics

THOMAS, Ms Jan, Executive Officer, Australian Mathematical Sciences Institute

GAUDRY, Professor Garth Ian, Director, International Centre of Excellence for Education in Mathematics

CHAIR (Mr Hartsuyker)—I declare open this public hearing of the House of Representatives Standing Committee on Education and Vocational Training. Do you have any comments to make on the capacity in which you appear?

Ms Thomas—The Australian Mathematical Sciences Institute manages the International Centre of Excellence for Education in Mathematics.

Ms McIntosh—I am the Schools Project Officer within the International Centre of Excellence for Education in Mathematics.

CHAIR—Although the committee does not require you to give evidence under oath, I should advise you that the hearings are legal proceedings of the parliament and warrant the same respect as proceedings of the House itself. The giving of false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. Are there any corrections or amendments you would like to make to your submission?

Prof. Gaudry—No.

CHAIR—Then I invite you to make some opening remarks.

Prof. Gaudry—First of all I would like to say a little bit about the people here today, particularly about their backgrounds since that may be helpful to the committee. Janine McIntosh is a primary school teacher and was numeracy coordinator in a primary school just before coming to work for us in the international centre. She also worked as a subject coordinator and senior tutor in the Faculty of Education at the University of Melbourne for two years, and was in charge of a mathematics basic skills course and the testing of that in tutorials for intending primary school teachers. Janine has been responsible for the research that we have put before you about primary teacher education and the various aspects of that, including entry requirements and the content and amount of subjects that at least nominally deal with mathematics or mathematics education.

Jan Thomas, before her work with AMSI or rather in parallel with it, was working in the preparation of secondary school teachers in the DipEd program at Victoria University in Melbourne. She is a former classroom teacher. She has been responsible for preparing the material about the Diploma of Education that we have put before you. Having said that, I would like to highlight, without taking too much of your time, a small number of points that we think are important from the much more voluminous material we have put before you.

We have talked about the mathematics preparation of primary and secondary teachers, with the bulk of the submission dealing with primary. We want to emphasise the importance of the committee, if I may say so, understanding the way in which the term 'mathematics education' is used in education faculties, which is quite different from the common perception of what those terms mean. In general parlance, mathematics education would be thought of as teaching mathematics and education in mathematics. On the other hand, we have found—and we have put this before you—that the universities we have surveyed and the courses that are nominally concerning mathematics or mathematics education are actually not dealing with mathematics in the main; they are dealing with issues such as theories of learning, child development, constructivism, sociocognitive approaches to learning, curriculum planning and gender.

We would also like to highlight the general lack of prerequisites in mathematics for intending primary school teachers. You have the details before you so I will not go over them too much but will simply emphasise that there are a lot of universities that are not requiring any stated mathematics requirements at year 11, or at year 12 either. A number have only a year 11 requirement of a very general type and only four require year 12 mathematics of any type. It is our position that this situation needs to change and that in particular there should be a larger amount of time in the bachelor of education for primary teachers devoted to a deeper understanding of the kind of mathematics that those intending teachers are going to teach.

I would like to highlight and perhaps head off a possible misunderstanding because when a professor of mathematics such as me speaks about these matters, I find there is almost an automatic reaction and a misunderstanding that I am advocating lots of very advanced courses in mathematics. I am not doing that. I am saying that intending teachers at a given level—let us say primary level—should have a deep understanding—much deeper than you get by simply running over the curriculum documents, which is what is commonly done—of how the subject hangs together at that elementary level and extending sufficiently far ahead of that so that the teacher has a firmer grasp of the subject than the immediate confines of what is being taught.

Those are my preliminary remarks. I wanted to just finish by saying that Janine and Jan will be able to give you first-hand answers to many of the questions that I am sure you will want to ask us in view of the experience they have had working directly in education faculties and schools.

CHAIR—Thank you. In an ideal world, how much maths would you recommend that a student entering a teacher course should have before they arrive? What do you see as an appropriate level of maths training in the course as it is structured?

Prof. Gaudry—I preface my answer by saying that in each state there are at least two broad types of mathematics that you can do at year 12. In New South Wales, it is divided into 2-, 3- and 4-unit streams and what is now called general mathematics. I would say that in an ideal world you should expect intending teachers to have done 2-unit mathematics. In a practical world, that may be too high an expectation. I would say you should expect them, for the primary level—I am not talking about secondary here, just primary—to have certainly taken general mathematics and done well at it and demonstrated a good command of the broad range of mathematics that that course covers.

The second part of your question was, I think, about what should happen inside the education faculties. We believe that there should be at least two substantial semester-long courses in mathematics as a minimum. If you are interested, Janine will be able to speak in more detail about what actually happens but we would certainly be recommending that. That should deal only with mathematics—not with the pedagogy, which, of course, we do not wish to de-emphasise in any sense. That is very important. But we believe that the balance should be in that type of way.

Ms Thomas—If I could add to what Garth said, there is some excellent work being done in the US in the last few years about what mathematics teachers should have if they are teaching in the lower years—so up to about grade 5—middle years and senior years. Leaving aside the senior years, where things are very different in the US to Australia, the other two bands are a very good description of the sort of mathematics a graduating teacher should have if they are going to teach at those year levels.

In a way, how much mathematics they need within their courses is going to depend a lot on how much they come with to start off with. For some students, if they come in with a good year 12 maths and they want to be primary teachers, you are going to be able to work well with them in terms of, 'Okay, you have been using fractions for years, what does it actually mean when you do this?' You can get them to develop a really deep understanding to underpin their teaching. If they come in with less mathematics, they are going to need more mathematics within their teacher education courses. In particular, they need it over the three years of the course to have a chance to build on what they are doing and consolidate their understanding of what they are going to be teaching.

CHAIR—I know that my deputy chair is very passionate about mathematics. Rod, I am sure you have a host of questions.

Mr SAWFORD—I probably have a host of questions, but I will start off with a general one and then ask some specific ones. If you had the power and the resources, Professor Gaudry, what would be the first thing that you would do in reforming mathematics education and teacher education?

Prof. Gaudry—I will answer the first part by saying that I do not suppose I have power—

Mr SAWFORD—I have just given it to you!

Ms BIRD—He does not have it either.

Prof. Gaudry—At the moment, in the International Centre of Excellence for Education in Mathematics, we are undertaking a major project which we believe will have a very big effect on the teaching of mathematics in Australian schools—namely, we are writing textbooks and other materials, and we are setting up a professional development program for teachers in association with those books. That is starting next year in a pilot form for year 7 and year 8. We already have a very strong response from schools. I think we are up to 175 expressions of interest as of two days ago. We expect that by the closing date, which is Friday this week, we will probably be hitting 200, perhaps even more than that. The number that we can actually handle is probably closer to 50 to 70 in practical terms.

My point is that there is so much argy-bargy and there has been so much argy-bargy over the teaching of mathematics—indeed, education generally. I believe that the only way to have a good effect on this is to nail your colours to the mast in the form of materials that are written appropriately for the schools with a very clear content. You take the best writers you can find and you work with the teachers to assist them in using those materials. What we are doing is the first stage of what I hope will eventually become a major national project. We have the resources to do it up to a certain point, to actually produce the materials for year 5 through to year 10. We will not have the time or the resources to go prior to that and we are not going into year 11 and year 12 at this stage either. That is one answer; what was the second part of your question?

Mr SAWFORD—What would you do first? What would you be impressing on the universities, particularly the education faculties? What should they be reforming first?

Prof. Gaudry—They should require that students who are going to be teachers in primary schools have a serious year 12 mathematics for a start, they should spend the time in the courses that I indicated in response to the earlier question and they should move firmly away from thinking that mathematics education is purely a social and sociocultural business.

Bear in mind that, for the past 15 or so years—probably 20 years, actually—there has been a very big push towards self-discovery in classes; in other words, that children should discover mathematics for themselves with the teacher being, as the slogan goes, 'a guide by the side'. I certainly do not believe that. I think it has demeaned the teaching profession for a start and it has certainly demeaned the opportunities that our young people have had to get on top of basic mathematics.

Mr SAWFORD—In recommendation 4, I think, you introduced an emphasis on, and a difference between, scholarship and research. Would you like to expand on that? I think it is a very interesting point that you have made.

Prof. Gaudry—Scholarship means that you are a very well read person and you are writing about known mathematics—so it might be historical, or it might perhaps be a more accessible presentation of quite recent developments, taking elements of that that are appropriate to maybe general public consumption or for use in schools. In other words, you know the subject extremely well—well beyond the confines of an ordinary degree—because of your own involvement and interest in developing your broad range of mathematics. Not just mathematics, by the way, but its links with other subjects. Certainly, in my day, mathematics teachers were usually very well versed in physics, for instance, and so they understood well the historical connections and the actual technical side of the developments of mathematics that were linked with, say, astronomy, planetary motion, more modern things in physics and so forth.

As to research, research means publishing papers in the research journals. We are dealing here with education, and so perhaps I will take the opportunity to emphasise one thing we did say: that there is an awful lot of publication in education that is not worth the paper it is written on, to put it very bluntly. Yet that is what gets rewarded in education faculties; that is what the universities put their whole emphasis upon, and I think it certainly detracts a great deal from the core matter of preparing excellent teachers.

Mr SAWFORD—It is interesting that you are the first group of people to actually bring up that concept of the difference between scholarship and research. I am sure we will get that when we go to South Australia and possibly when we go to New South Wales and that they will reinforce what you are saying.

Ms Thomas—I am not so sure; it depends on—

Mr SAWFORD—which university we go to.

Ms Thomas—Yes. I came from a science background and then went into an education faculty and I do not think most education faculties know the difference between scholarship and research. I am not even quite sure whether most universities know the difference between scholarship and research. An awful lot gets called research which is really about collecting a bit of, often suspect, data. My husband, who is a scientist, has been with me to maths education conferences and he is always laughing about the sample size of one which is being reported as research. It is endemic in education. It is a misunderstanding about what research is—that understanding is something you get through doing serious scientific research. Most of what I have done has always been scholarship and, because I have had a capability of drawing together policy documents, I think I have done some good scholarship, but I have done very little of what I would consider to be real research.

Mr SAWFORD—I am glad that you put it forward.

Ms BIRD—This issue has been raised with us in a different format in that the universities complain that they cannot get high-practising teachers to work at the universities because they are paid so lowly because they do not have a PhD research component. Are you indicating here a concern that scholarship should be given a status within education faculties that makes it an attractive option for experienced classroom teachers to go into?

Ms McIntosh—I want experience to be recognised. I took a two-year recent industry experience contract with the University of Melbourne in 1999-2000 and then was part time in 2001. The position could not continue because I did not have a PhD in mathematics education. I also had to resign from the position that I had at the time and lost long service leave and that kind of thing. I have done it again to take this position. There is not that opportunity to go out and then come back and reward the experience in the classroom.

Ms Thomas—There is no way I would get a position in a teacher education school anymore. I have an honours degree in science, a dip ed and then, because I was particularly concerned about language aspects in mathematics, I did another one-year qualification in teaching English as a second language. So I have all this classroom experience and I have worked extensively in professional development with teachers, but there is no way, in the modern university, that I would get a position in teacher education, other than perhaps as a level A going out and doing a bit of method stuff or something like that.

Mr SAWFORD—My last question is on a more practical basis. In a former life I was a school principal, a consultant and a demonstration teacher. I may have been one of the few in primary schools that actually had a background in mathematics. One of the things I soon learned, particularly when I became principal, was that very few teachers had mathematical strengths and

the ones that did often had weaknesses in other areas. If you divided the primary school curriculum up into, say, 25 hours a week, five hours ought to be mathematics. I do not mean numeracy; I mean mathematics. A lot of my experience in primary schools has been that, if you took away all the nonsense stuff, five hours became very small. This idea that primary school teachers can cater for all aspects of the curriculum is a nonsense. They have never been able to do this. I have never seen it in 25 years. I had a position as a consultant where I was able to go all over Australia and overseas and see primary schools in operation, and I have never seen one teacher who has been able to do expressive arts, environmental studies, language, a foreign language and mathematics.

Ms BIRD—And physical education.

Mr SAWFORD—I have never seen it. It is very difficult at some schools to point out to teachers that they have limitations and that they ought to be working on their strengths and cooperating with other teachers who have other strengths. I do not necessarily support the idea that everybody be a mathematics expert in primary schools. I do not think it will ever get there. The reality is that you want language experts as well. You want people who have a spirit and the language of expressive arts as well. You need all of these people. I think the demand from the community these days is that they have the best physical education project. We have terrible physical education in our schools. You only have to look at the size of the kids. We do not have very good expressive arts. Some schools specialise in music. Some do this, some do that. There is that sort of a mixture. The question that I am putting—and I suppose it is to Janine—is what is your experience in terms of a realistic expectation for teaching mathematics in primary schools? Should we be looking at a balance of people rather than an individual person taking on the mathematics that is required in a modern society?

Ms McIntosh—I think we need to set a minimum standard. I do not think it is too much to expect every classroom teacher, 25 teachers in a school of 400, to be able—

Mr SAWFORD—No, I am not asking—

Ms McIntosh—I am not disagreeing with you.

Mr SAWFORD—I know what you are saying.

Ms McIntosh—I think what we need to do is recognise that there will be people within that school who have that strength and that they be given the time and the resources to cater to the rest of the school. I was fortunate at the last school that I was in that, by the third year that I was there, I was given a day a week to be numeracy coordinator. I would visit classrooms and work with children and do that kind of thing. Our program improved out of sight in those 12 months. But, for the first two years, I was fighting to get that time. It was the management of resources that was the most difficult—assigning money to the physical presence of another person in the classroom or another person on staff who might have that experience.

Ms Thomas—I had an experience as a parent where grade 5-6 in this particular school was divided up. One group of teachers, who liked teaching maths, taught the maths and the other group of teachers, who were keener on the language side of things, taught those, and that was working extremely well. It was recognising that, at the upper end of primary school, just

dividing them up differently for language and mathematics could work. It worked well in that school and I think that sort of flexibility within schools to use teachers where they like to teach is good, rather than this attitude of 'everything has to happen in the individual classroom', particularly at the upper end of primary school, which can be quite damaging.

Mr SAWFORD—In fact the best schools around Australia all do that naturally, which is interesting. The thing that I wanted to talk to Janine about was this idea that everyone has a minimum. I was a convert of that when I was a young teacher. I do not actually believe that anymore. I think you have to lift the bar, and I think this is really perhaps what Professor Gaudry is saying.

Ms McIntosh—I agree.

Mr SAWFORD—I think we have to address the issue of lifting the bar. We may have to do the other one as well, but if you do not lift the bar then nothing changes; it just becomes mediocrity. That is what I am saying.

Ms McIntosh—No, I do not disagree with you at all. I think a teacher who is confident in their subject knowledge, who has really good subject content knowledge, is going to be much more confident in doing it, they are going to have a more positive attitude and they are going to get that through to the children. Children pick up really quickly which of their teachers does not like maths, just by the—

Mr SAWFORD—It is a bit of a worry. I went to a conference earlier in the year where there were 150 secondary maths and science teachers. I asked them, 'How would you introduce the concept of quadratic equations in a concrete way to year 5 children?' Not one of them could do it. You only need cuisenaire rods to be able to do it. You would know how to do that, put the block and the unit together. You can explain it, and little kids can see it. I could not believe that 150 Australian secondary mathematics and science teachers had never known how to do that. They could not look at a graph and understand that you can get year 5 kids to predict gradients and constants and all the rest of it as everyday concepts, knowledge or experiences.

Prof. Gaudry—Yes.

Mr SAWFORD—There seems to be, in a part of mathematics, a language but not an understanding. How do you deal with that?

Prof. Gaudry—I can give you my personal answer. My answer is to take familiar examples where you can and to express everything in ordinary English first, to keep away from the formalisation for a decent period of time until the ideas start to form, and then the formalisation—it may be some equation or other, say—will flow naturally out of that. I fear that oftentimes the equation comes first; the thing is turned around. Then, if there are applications, they are used as illustrations. People in universities do this too, and they do not use ordinary English. I have spent years and years in first-year classrooms at university telling students to say everything in ordinary English for a start and to relate it to everyday experiences. There is a very important theorem in first-year mathematics called the mean value theorem. Basically, in ordinary words it says this: if I travel between here and Albury, say, and my average speed is 80 kilometres, then at some point I am going to pass through 80 kilometres. It is a very simple

statement, isn't it? You go up and down with your speed and, if you average 80 kilometres, you have got to have done 80 kilometres at some stage.

Ms BIRD—Tell that to the health insurance companies with their average increase in prices!

Prof. Gaudry—Yet the students, and many lecturers, do not put it in those words. It is just insane.

Ms Thomas—It crosses over a major concern that I have got. When we get graduates in the DipEd courses, yes, they have good content knowledge but they have never thought about how they actually learnt fractions. It has become automatic to do a lot of things that they are then going to have to teach in secondary schools. The only way you can work through that with them is in proper methods courses that look at the teaching of mathematics, where you are there with them and you are saying: 'Now, when you've got kids learning about area, what is it that they are actually measuring? Show me how you can do that.' Even with maths graduates, it is quite hard to get them to say, 'Look, you're measuring this; you're measuring the surface,' because they have not thought about it. It is automatic response stuff.

Actual method studies in the secondary DipEd courses are absolutely crucial to them being prepared to go out and teach. Increasingly for the universities, particularly to save money or where they have small enrolments, I am reading descriptions of generic methods courses. The only real methods experience they are getting in the actual disciplines is when they go out on their school experience. It is so difficult to get good supervising teachers in the schools that they are just not getting that experience. So DipEd courses that are moving to generic methods should just not be allowed in my view. They are not preparing graduates to teach adequately. They need that core knowledge to be able to explore how you go about actually teaching and developing a maths background. Just have a look at some of the DipEd courses at the moment. They are very worrying in their descriptions about what they are doing.

Ms BIRD—This is fascinating. My background is English teaching and I do not envy maths teachers. I have two sons who got out of maths in high school as quickly as they could. They detested it. One of them is in science and has no problems with the maths in the science subjects, so that says something to me about what we are doing with maths in our schools. First of all, I am interested in going back to the discussion about minimum standards. I am a little bit baffled about why you are requiring senior secondary maths for primary school. It is a whole new level of maths that often is repeated in first year maths courses at university. I have so many young people say to me that first year maths at university is just the HSC all over again—it is exactly the same stuff.

The reality is that you do not want a kid who has pulled out at year 10; you want them to have their higher school certificate or whatever the equivalent is to go into teaching. If they have dropped maths I suspect they are somebody who should never be let into teaching maths because it reflects an attitude to the subject more than ability. Does that make sense? I understand that you are going for HSC level entry and you do not want someone who has dropped maths coming and teaching maths. You make the comment in your submission that students are often reflecting an academic boredom with the university courses. How much of the two maths subjects in university courses is boring them because it is stuff they have done before? Could that time be

better utilised? It does not necessarily mean doing higher level maths but perhaps addressing some of the issues that you have raised.

Prof. Gaudry—You are right. The reason for saying they should have year 12 mathematics at a good level is really to try to make some progress in ensuring that you are not getting maths phobic people. If there is another way to do it that is fine, but that is what we have got. You asked about first year maths in universities. Education students do not take first year mathematics in the maths department at all. I do not want to pursue that particular point except to say that generally they should be taught their mathematics by people who thoroughly understand the subject, and that is generally not the case in education faculties. Yet for reasons of keeping the money in your own faculty you do not let them out of your grasp because otherwise you are going to have to pay money to the service department that is going to teach them.

Ms BIRD—That crosses to secondary teaching education and has been raised with us as well.

Prof. Gaudry—Yes. We have had developments in some places of BEd secondaries which are requiring little or no involvement with the discipline department at all. That is an issue. You have asked a more general question about teaching of first year mathematics. There is a lot of repetition. You are absolutely right. I personally think there is too much and I have tried to make some changes in that direction.

Events caught up with us, though. I think the University of Melbourne is the only exception now that has any prerequisites for entry to first year. There is recommended knowledge but that is a different thing. Students really insist they can get into your first-year class without having done the appropriate background subject in, say, the HSC or the VCE. I have been nullified by events in that regard. Now we have to cope with a very wide range of backgrounds, much wider than before, and it is not desirable. I agree 100 per cent with you. I think it is always exciting to do fresh things. It is not very exciting to keep running over old ground.

Ms McIntosh—A related issue is that we have a lot of underqualified teachers teaching in the primary school, anyway. With a year 11, you can do a Bachelor of Early Childhood Education that has no mathematics content and very little mathematics education subjects and teach to 12 years of age. Once you are in the school, you can teach anywhere you like. The other issue is teachers teaching out of area within the early secondary school. It is not seen as the desired option, if you really aim to be teaching up the other end of the school—you teach in year 7 and 8 maths under sufferance and you do not really enjoy it. The third group of people are primary teachers teaching in early secondary school—these middle school groups. They are totally unqualified to do so.

Ms Thomas—I think mathematics and English share a lot of the same problems, frankly. They are the two core discipline areas for students to be able to progress in the world, and I think we are doing a very bad job in mathematics and a not much better job in English, particularly when you want teachers who like to read and can engage with students. The course I was involved in was one of the few courses that interviewed everyone who we thought we might be taking into the course. You will be pleased to know that to make sure we were getting well-rounded people, one of the questions that we eventually started using to particularly weed out the PE jocks who only ever read the back of the *Sun Herald* was, 'What have you read in the last month?' It was a very enlightening question when you are trying to get secondary teachers who

are good at their own discipline area, but you really do want those who have broad interests and read well and read outside of a very narrow scientific, sport or whatever focus. It was a wonderful question to use in an interview.

Ms BIRD—I actually think there is a real crisis going on, and we have seen it with the English subjects, and I see some talk about going back to basics. I really struggle with the fact that I think young people are living in a different world. That world is fast-paced and information is instant. It is shaping the way they learn in a way that I do not think the pedagogy in universities have yet caught up with, and that is problematic. I am not saying the way they learn these days is the best way. Having a 16-year-old who will not sit in science but spends all day on the internet looking up science related subjects, there is a mismatch going on—a quite dramatic one.

I think the problem is that the classroom is destroying their interest and love in maths, science or English, and with that is the massive shortage of teachers, not so much in English but in the maths and science areas—an increasing shortage. I agree with Rod that we need to set the bar higher. Do you see an inherent conflict in our ability to do that at a time when we need more people going into those teaching professions and given the fact that young people are still not yet convinced that teaching is an interesting or viable option?

Ms Thomas—Some interesting data came out of the review of teacher education on the percentage of students doing the different methods. One thing that worried me about that at the time was that we were getting about three good applicants for every DipEd place we had in Victoria. There was high demand for DipEd places, and a lot of the universities were just selecting on grade point average rather than where the need was for particular discipline areas. I think also there really should be something put on faculties of education to ensure they match their intake with the areas of shortfall. It is ridiculous producing endless teachers of sociology and commerce if the jobs are not there. I think some of the selection processes end up in a profile within education faculties that does not meet the areas of emerging need for particular teachers.

Mr MICHAEL FERGUSON—I think this discussion has been very useful. Professor, I particularly like your comments relating to methods versus understanding. That is a critical factor in mathematics education. Maybe, because of the cyclical nature of this—the chicken and the egg—where you have students being taught under a current mind-set or environment where some teachers might not understand what they are teaching, it is more difficult to get students into teacher education who understand their subject and become maths teachers. It is very difficult. But I really liked what you said, because maths is a toolbox for problem solving and for understanding the world; it has its own language.

Prof. Gaudry—And for having fun.

Mr MICHAEL FERGUSON—And for having fun, too. There is no reason why it cannot be all of those things. It really saddens me that maths, as a science, a field of study or a discipline, seems to have really lost a lot of its prestige over the years. I hope that somehow through your centre of excellence you can put forward some constructive proposals. Would you say that we as policy makers should be addressing some of your concerns along with science? I see the same challenges in science as well. As a teacher, I used to teach my kids that maths and science were married.

Prof. Gaudry—Yes, I agree with you. A very quick caveat: we do not like being rolled in with science in discussion, because we then tend to get completely forgotten. But let me turn to your question, which is about science, and say the following: I had a fair bit to do with curriculum issues in New South Wales. In particular, behind the scenes I did a certain amount of prodding on the question of science in years 7 to 10—maybe this relates to what you were saying. I also looked at the reference tests that they run in New South Wales in year 10. I was utterly dismayed because I found that in the science syllabus they did not talk about atoms or molecules. Four years at school and you are not engaging with one of the most basic scientific concepts! There are all sorts of peripheral blather, but no engaging with the substance; and the kids are interested in the substance. I do not think children have changed. They have probably become more intelligent because of all the stimuli they get; they have a much broader understanding of what goes on in the world than we had. You have to work your butt off, and you do not make much progress in making these points to people who are setting curriculum. They want all the discursive stuff and not to engage with the substance. I do not think many kids in New South Wales could write down a chemical equation, for example, at the end of year 10 to illustrate what happens when your car rusts.

Mr MICHAEL FERGUSON—A lot of them would not be able to recite their multiplication tables.

Prof. Gaudry—Exactly. Do not misunderstand me; I am not saying we should go back to boring basics and not relate it to the whole rich variety of things that they ought to be related to. That is the absolute opposite of what I am saying. What I am saying is that somehow the perception has got into education faculties and curriculum bodies that you had better not engage with the substance, because it is going to be too hard.

I would like to take a moment to comment on the internet because this is often brought up. We have a brave new world in which we all use computers and the internet; we are bombarded with information. In response to the sorts of remarks you have made, I would say that we all run the risk—I think I do, personally—of drowning in it. I feel that I would genuinely drown if it were not for the fact that I have a firm grasp of what I would call corner posts of knowledge. If you establish well the corner posts of your knowledge in, say, chemistry, physics and biology, and you know what makes certain key things tick, then you can use the internet intelligently; otherwise article A, article B and all those through to much more than Z are going to leave you utterly bewildered as to which piece of information is worth pursuing. If you want to use basics, I would use it in that sense of cornerstones of understanding and knowledge that allow you to branch out and to use good discretion when you are bombarded with lots of information.

Ms BIRD—My point on the internet is that they find it enjoyable learning. It has an entertainment value, which then prompts them to want to know the basics. So it is more a methodology comment than a content comment.

Mr SAWFORD—There are also a lot of contradictions there. Learning is the impact of mind on mind, not mind on a television screen. If you do not have that knowledge and taxonomy of educational objectives, there is a very low skill. A lot of people like to put it forward as a high skill but it is a very low skill. Interpretation and exposition translation are the skills. Knowledge is very lowly. I think we sometimes confuse learning with knowledge. That is a very big mistake in education.

Mr MICHAEL FERGUSON—I have just one more question. Professor, I think in one of your recent comments you alluded to the University of Melbourne's test for mathematics understanding. In the notes prepared by our secretariat, they link that with ACER as a partnership through which they have developed this new test. Do you think that there is merit in that test? If so, is that one way of providing a prerequisite for mathematics across all teacher training in universities?

Prof. Gaudry—Janine is very well informed about this. I will pass the question to her.

Ms McIntosh—My experience with the Melbourne University basic skills test predates the ACER involvement, but when I was delivering the test to 140 first year primary students half of them would not have been able to get 80 per cent on the test.

Mr MICHAEL FERGUSON—And 80 per cent was the measure, was it?

Ms McIntosh—Yes. We are looking at a test that my year 5 and year 6 children would have been able to cope quite well with. The kinds of questions were: converting 3/8 to a decimal, writing 42 tens as a decimal numeral, what nine times 120 is, what 3.5 divided by 0.1 is. We used to run it again. In the second basic skills test, again 50 per cent would not be able to get 80 per cent.

Mr SAWFORD—That is pretty bad because that is numeracy not mathematics.

Ms McIntosh—We could have that conversation too.

Mr MICHAEL FERGUSON—All the same, it is a measure.

Ms McIntosh—In between that, they would have tutorial assistance and often one-to-one time with me. A lot of it was confidence. A lot of it was just getting them over the hurdle of being maths phobic and not enjoying that subject. Having an entry test is one thing; knowing whether that entry test and the subsequent teaching have worked is also necessary. We need to have some kind of formal understanding of what a teacher comes out with. I did a lot of work with decimals with my Master of Education. In using the work that I have done on pre-tests and post-tests with children, I have found teachers with the same misconceptions.

Mr MICHAEL FERGUSON—But my question was along the lines of your demand for better prerequisites for entry to teacher training. My question is: what are the merits of using a test like that or a modified test like that for students applying to become teachers?

Ms McIntosh—It gives the lecturers—the education faculty staff—a starting point for where they need to work with those students so that they are actually achieving something by the end of their course.

Mr MICHAEL FERGUSON—I am talking about it as a hurdle—

Ms McIntosh—To get in?

Mr MICHAEL FERGUSON—not as a help to the student. I am talking about it as a hurdle. You are the ones who have proposed a prerequisite in mathematics.

Prof. Gaudry—I would say ideally it could be a hurdle, provided that you can produce enough teachers. This is going to be the practical question that follows on, but in an ideal world, yes, it could be used to sort out whether people have got sufficient basic skills in mathematics to realistically expect to handle a primary school class in due course. At the moment, Melbourne—I do not want to harp on about Melbourne too much—do have their test and they do work at trying to get students up to an acceptable standard with a lot of work by people like Janine. It is not done pretty much anywhere else, I think, and that is very worrying. It is a compromise, admittedly.

Mr MICHAEL FERGUSON—But it is better than nothing, right?

Prof. Gaudry—It is better than nothing, and of course it recognises the fact that we do have to produce teachers, primary teachers in particular, and to do our best to get them up to an acceptable standard.

Ms CORCORAN—My question is probably almost a repeat of what Michael was saying. I have written down a statement that I think you made earlier on. I just want a clarification. I thought you said at some point that any student going into teaching training should have year 12 maths, and it is linked to your recommendation that the selection process should exclude candidates who have negative attitudes to maths learning. I see those as two separate things. My first question is: do you have to have year 12 maths to get into teaching training? Is that what you are saying?

Prof. Gaudry—That is what I am saying, yes.

Ms CORCORAN—That is different, though, from the printed statement here about excluding students who have negative attitudes to maths learning.

Prof. Gaudry—I explained before that it is a way of picking up students who have maintained an interest in mathematics. So, to put it the other way around, a student who has not taken mathematics in year 12, on the balance of probabilities, is running away from mathematics.

Ms CORCORAN—That is what I really wanted to test. I know that Sharon ran a similar line too, but it might be that there are other things they want to do as well. I am not convinced that you are not interested in or do not have a positive attitude to maths simply because you did not do maths in year 12. I agree that you have to have teachers with good, positive attitudes towards maths, but whether that is measured by having done year 12 maths I guess is—

Prof. Gaudry—It is the best we have at the moment; that is all I am saying.

Ms CORCORAN—Okay.

Prof. Gaudry—It bears on the last question about whether there might be other ways of doing it. If you sat down and thought about it and you had the resources to do it, I think there might be other ways of doing it.

Ms CORCORAN—So that year 12 test is a pragmatic test?

Prof. Gaudry—It is a pragmatic way, yes.

Ms BIRD—Can I also clarify that, because of the way schools program, it is very difficult not to do maths, because it is almost on one line by itself. The only other options on that line will be vocational training subjects, so it is very difficult—you are looking at an academic high school qualification—to avoid the maths.

Mr SAWFORD—Isn't this a bit of a recapitulation of what you were saying before, Jan? You were saying: 'Attitude to mathematics is just as important as having the knowledge skill. I would rather have a student who had a positive attitude. You can always teach someone with a positive attitude.'

Ms Thomas—Exactly.

Mr SAWFORD—Because someone who hates mathematics and is highly skilled at it is a useless teacher.

Ms Thomas—One of the points I was going to make was that I do not think nearly enough use is made of interview in selection into teacher education programs. Obviously you are dealing with big numbers, so you have to have some sort of initial cull, but you can pick up an awful lot about attitude to core subjects and things like that. I also think that with any cohort of BEd primary teachers you are going to find a very tiny percentage who have such negative attitudes to teaching mathematics or another subject. They should be counselled out of teaching before they get to the end of four years.

The great thing about graduate programs is that teachers come in with a degree already, and if it is any sort of decent degree they have other options. But these BEd programs where you find out in their third or fourth year that they do not know their maths, they are totally negative about it and they have not done enough subjects as part of their BEd course discipline areas to be able to shift easily into another degree and change track—I think we produce some very bad teachers that way, with some very negative attitudes to teaching core subjects. It can be also the students with serious language problems. They probably should not be there in the first place, because they are so negative that they just cannot engage with those discipline areas.

Mrs MARKUS—My questions probably relate more to some of the things that you have already talked about, Janine. First of all, you talked about the challenge you had when you moved from one job into another job. One of the recommendations here is:

Positive steps should be taken to improve career paths for highly skilled primary teachers. Salary structures for people with strong mathematics backgrounds should reflect market forces ...

It goes on:

Experienced teachers of mathematics, especially those who have successfully completed accredited professional development, should be rewarded and remunerated.

In an ideal world, what would you like to see happen to encourage people like you to move in and out of the mathematics field, from university back to schools and so on?

Ms McIntosh—The portability of those kinds of conditions would be an encouragement for people to actually take the step out and go and find out about working somewhere different. They could go and do a two-year stint in a university and then come back and be a classroom teacher. The other thing is that, to gain promotion within a school, a teacher very often has to move out of the classroom. That to me has a negative effect on the teaching of mathematics. You might be in an administrative position, but you are not dealing with children.

Mrs MARKUS—What would you change in the school system?

Ms McIntosh—I think things plateau out after a certain point. You have to either move to the side or move away from teaching. I think money is one thing. To get people to take on different positions you are going to have to encourage them by doing something like they have done in the United Kingdom, where teachers were paid £10,000 for teaching in areas where there was a need in mathematics and science.

Ms Thomas—At the moment we have a situation where somebody does a very shonky BEd and turns up as a maths teacher, teaching alongside somebody who has a good degree in mathematics, a DipEd and about $25,000 more HECS, and they are on the same scale in salary. There are some real anomalies relating to people who have good skills in the discipline area, particularly the starting salaries in schools.

Mr HENRY—I apologise for coming in late. I hope you have not addressed this more fully earlier in your presentation. I would be interested in having you enlarge a bit on these professional development schools you have spoken about and how they might be helpful in developing teachers in Australia.

Prof. Gaudry—Janine will probably add to what I have to say. First of all, I mentioned earlier on that the work we are doing in the international centre is to produce what we think will be very good materials and attach professional development to those materials. We are actually going out next year in our pilot program to somewhere between 50 and 70 schools and working with teachers. Because it is year 7, quite a lot of those teachers will not be strongly trained, if at all, in mathematics, by the way. So we are hoping that both the quality of the materials and the quality of the people we have are going to have a big impact. There is great enthusiasm, by the way, from the schools that are in this. They are saying to us that this is the best proposal they have seen for years.

PD has been a bit of a joke. Rod will know this first-hand, no doubt: a lot of PD is done late in the afternoon or on weekends as a one-off and is more likely to do with bullying policy than how to teach a subject effectively and all of those things. Even though we are decently funded in our international centre, we are not going to be able to carry that through the whole country or anything like it. But we hope that, with success in these initial phases, we will actually be able to offer a program of PD related to our materials that employing authorities will be able to take up.

You have to have money coming from that in due course once the staff get established. Then some of the PD that does go into schools—and it is not a trivial amount, I believe; in New South Wales it is quite substantial per capita—could then be used selectively to improve the teaching of maths.

Ms Thomas—The key thing that might be really valuable to those of us who have been in teacher education would be knowing that we had schools to which we could send our student teachers where they could actually see maths being taught well.

Mr HENRY—It would not be a separate centre as such; you would be selecting from existing centres where they are prepared to make an effort to make this professional development program work?

Prof. Gaudry—I hope I am answering your question. We are going out first of all with our own people—Janine will be doing some of it. We are picking up people we know in regions, for example, who are going to work with us as well. We cannot do it all ourselves, even on the 50 to 70 scale. We envisage it developing through local people taking up the program as it goes. That is looking down the track a bit, of course. But we think that there is a good opportunity there and it could have a pretty good effect in due course.

Mr HENRY—The way I was reading it was that you actually had a specific centre that was for the purpose of professional development, in terms of professional development schools—that is, existing schools that are nominated as having an excellent approach to mathematics, for example.

Prof. Gaudry—We have yet to select them. We have a large number of schools that have put themselves forward and we are going to do our very best to cover a wide range of Australia for a start, including the rural and regional areas. It is going to be quite demanding for us but we are determined to do it. In some cases we will have clusters. In a town where there have been a number of schools that have put their hands up then we will be able to do that a little bit more efficiently than if we go to Broken Hill or somewhere like that. That is the general idea, anyway.

Mr HENRY—Earlier in your comments you made a remark about professional development focusing on bullying. Surely classroom management is an important part of professional development.

Prof. Gaudry—Sure. Anything I say, because I usually say it pretty straightforwardly, runs the risk of being misinterpreted in some way. I am not saying that at all. I am talking about balance here. I think an objective observer, looking at what has happened over the past 15 or 20 years, could see that there has been a very marked shift away from teaching substance, the actual practice of teaching. I think, by and large, that the professional development money is being used more and more for classroom control. Important though that is—and certainly some of the money should be used for that; I am not for one moment saying otherwise—the balance is not good.

Mr HENRY—So we need a little bit more focus on subject matter.

Prof. Gaudry—That is right.

Ms McIntosh—A teacher that has good subject and content knowledge and is engaging their students with activities and investigations and leading them on a journey, and doing it well, is going to have less of a problem with classroom management.

Mr FAWCETT—Can I ask about your approach in tackling subject matter. My two daughters had two different experiences. One had a teacher in primary school who was a mathematician, and they got into times tables and everything. All the kids, even the ones who were normally a bit disengaged, really got on the ball because they were challenging and interesting ways of tackling times tables. The other one went through with someone who was a teacher but not a mathematician, and in year 5 we were teaching her the time tables at home because she was not getting it. A lot of the kids would not go. So I encourage you on that.

The second point is one that touches a little on Stuart's point about professional development. When you have schools that specialise in music, drama and things like that—in South Australia we have one school that is set up as a specialist science and maths type school—what kind of role do you see that having in terms of both the education of students who are keenly interested in mathematics and also the career and professional development opportunities for maths teachers?

Prof. Gaudry—On a personal note, my children went to Brighton high school in South Australia and that is a music specialist school. At the time, certainly when my first child went there, it was an absolutely superb school from all points of view. The music was just fantastic but so was just about everything else. Sadly, I have to go on to say that I think it has run downhill. I think it is nothing like what it was. I saw that through my own children, who are spaced four years apart. By the time my son was going through it, it was a shadow of its former self. It was because the attitudes from the centre had changed. The person who had been the principal there was what I would call a classical, first-rate headmaster with his own subject area, which was French, and a very broad and lively interest in all subject areas. It was just fantastic. Subsequently, somehow the centre decided that having somebody who was basically a football player was much more important. So those values that I just eulogised were not there, and different attitudes crept in. Perhaps I dramatise the point, but my first daughter's German teacher, who was an absolutely superb teacher, was virtually crying when he spoke to me about the changes to the school.

Let me come to my point. My point is that I would hate to see—and I fear that it may be happening—schools become specialist schools to the detriment of other things. Brighton high school at its best was the very opposite of that, as I have just explained. So, yes, it is good to have something that is very special about you but everything else needs to be pretty damn special as well.

I think the last part of your question was about the role that those schools can play in helping other schools and in serving as a model. Certainly Brighton high school served as a model. There is no question about that. It was extremely well known for what it did in music. It set a standard for a start. It is not a direct link that I am talking about here, but it certainly set a standard and aspiration, and there are of course other music schools in South Australia that competed with Brighton for a place in the sun. But going into your question a bit more, yes, I think they could do, and I suppose what I said about PD relates to that. Our pilot schools will become leading lights in this. We hope they will be. That is why we call them pilots. It is not just a pilot in the

testing sense; it is a pilot in the leadership sense that they will become exemplary in due course for other schools.

Mr FAWCETT—So have you at this point engaged with the school down at Flinders in South Australia?

Prof. Gaudry—I had a little to do with it. We have attempted it.

Ms Thomas—I think it has lost its way. I would be prepared to talk to you about that later. As to the core question about the role of some schools as centres for professional development, there are a couple of schools in Victoria that were actually funded under the Kennett government. One of them has now got a you-beaut space centre for science teachers to do professional development in that sort of area. Another one is specialising in genetics. So there have been some fabulous opportunities developing for science teachers in a couple of schools that I know of in Victoria.

In general, science teachers have a huge amount of support. If you look into it, you see that in Victoria they have got teachers at the zoo, teachers at the museum and teachers at the marine sciences centre and they have now got these specialist schools. There is a huge amount of support for science teachers. The same thing has not been happening for maths teachers in terms of being able to set up some schools that have got exemplary programs whereby teachers can go and observe classes and work with other teachers. I think we really do need to start thinking about how you separate the maths from the science. They are different areas of the school. If you try to do science and maths together, it is just so easy to do laboratory based things and other things while not realising just what you can do if you can actually have a maths laboratory too with all sorts of things that can happen in that sort of environment, both applied things and other things. Has somebody talked to you about the Holmes group of schools in the US?

Mr SAWFORD—No, not yet.

Ms Thomas—The Holmes group of schools grew out of the really big prestigious education schools in the US—Harvard and others, including the University of Utah, where I was privileged to spend five months at one stage. The Holmes group of schools have their own professional development schools. They work very closely with the teachers in them and student teachers go into them, so there is this very close link between what is actually happening in the school and what is actually happening in teacher professional development and teacher training. The teachers get a lot of professional development to help them supervise the students that are coming out of the educational faculties of those really top schools—and it is not cheap. There have been various imitations in Australia to do with more school based practice, but they have been done without the funding to enable that really close interaction between the education faculty and the teachers in the schools. So there are good models around whereby you not only improve your teacher training but also improve what is happening for the teachers on the ground. I would certainly recommend having a look at the way that professional development schools work in the US.

Prof. Gaudry—David, may I come back to your point and say one thing about the science and maths school. I would be pleased to talk to you at a greater length separately. When I was speaking to the principal there some months back, I asked him what they did in foreign

languages. At that stage these children had entered the school at around the middle years, 9 and 10. He said, 'If they're interested in that they go to Saturday school.' I have to say I was appalled. First of all, I am passionate about foreign languages but, putting that to one side, I do not think it is healthy for schools to be specialising so much that there is no opportunity in the curriculum for the students who are likely to have an interest in foreign languages to pursue them in school.

Ms LIVERMORE—We now have year 3, 5 and 7 benchmark tests which include a numeracy component. Are you detecting that that is having any sort of effect or positive change in attitudes towards mathematics teaching where schools are under more pressure and demand high-quality maths teaching to ensure that they are doing what they need to do for students to meet these tests?

Ms McIntosh—There are two things that happen as a result of what are called the AIM tests in Victoria. They are called various things elsewhere. The first thing is that teachers will teach to the test. So in the weeks leading up to the test, the year fives and sixes are separated, if they happen to be in the same class, as was the case in the school that I was in. There is intensive going over past papers and getting in there and getting stuck into it. The other thing is that it takes someone with a mathematics background to read the data. I had to run sessions for my teachers to understand the box and whisker diagrams that we would get, to understand the graphs. I had to say: 'This is where the cohort was last year; this is a different cohort two years ago or this is the same cohort year 3 and year 5. What are we doing well in and what are we weak in?' It takes someone with that specialist knowledge to understand the movement. The other danger is that if we are comparing year fives in 2005 with year fives in 2003, if we are not doing so well we can say, 'It's a different cohort; it does not matter.' If we are doing well, we can still say, 'It is a different cohort; we can't do anything about it.' So we need to train teachers to look at that kind of data. That would be the kind of thing I would be expecting in a teacher training course.

Ms LIVERMORE—So it is not encouraging a raising of the bar.

Ms McIntosh—In some schools I think it is. In some schools that are using it, yes, it is.

Prof. Gaudry—I would like to make a comment by recounting a small story. It came from one of my close colleagues in the United States who is a very good mathematician. He spends his time now teaching in black ghetto schools. He is a very good teacher; there is no question about that. He is very successful. Because he is an academic, he is a natural Democrats voter. It is sort of rusted on. He said, 'I really hate to say this, because it goes right against my grain, but there is one thing that has had a very positive effect in the United States and that is the nationwide testing that Bush introduced.' He hates Bush. I should not say this, but he does not like Bush at all. That is obvious. But he did concede that.

It can have bad effects. People can get so totally bound up, just as we have parents who are coaching their kids to within an inch of their lives. That is very unhealthy too. But it can have a beneficial effect in focusing people's attention at least on some very basic things. These are very basic tests. They are not testing at the highest levels. TIMSS does. If you look at the TIMSS tests you are able to say whether the kids are performing at a high level or not. The ones in Australia are close to remedial but not absolutely remedial.

Ms Thomas—We are tabling some extra material here today. One of them is a paper that recently became available. It is an analysis of the amount of mathematics in some of the Asian teacher education preparation courses. I saw at least one person was quoted as saying it would be good to look at what happens in some Asian countries. This paper looks at what happens in some Asian countries. The other thing we supplied here is a supplementary analysis we did on the year 8 TIMSS data because it is widely reported that Australian students do well on the TIMSS data. When you look at the comparison against the top five countries, it is a very disappointing picture.

Ms LIVERMORE—My question was very much about whether it is driving a higher performance in teaching.

Ms McIntosh—The more attention that is paid to it at the sector level the more it will.

Ms LIVERMORE—My next question goes back to the universities. You advocate very strongly an increase in the minimum number of mathematics subjects or mathematics studies that trainee teachers or teaching students undertake in their courses. From your observation, do education faculties have the capacity currently to meet that increase that you have advocated? You would all be involved in the restructuring of courses or restructuring of faculties to achieve that. Is that going to take all day to answer?

Prof. Gaudry—They certainly could do it. If you look at the positions being advertised in education faculties—and there seem to be more positions being advertised in educational faculties than in quite a number of others—they seem to be relatively, at least, able to recruit new people. The problem is that when you read the job description it does not bear on the subject matter at all. It is all general stuff. So it is a question of how you allocate your resources and what you decide to place your emphasis on, and the emphasis is not right at the moment. They could get very good people in, I believe. They need to make much greater use of people within their mathematics department—that is, the mathematics department of that university—who have the interest, inclination and the skills to provide courses in the sort of mathematics we have been describing here, the stuff that is appropriate to the level at which they are teaching.

You may ask: how many such people are there? There are people around—not as many as we would like—but they are often languishing, not being allowed to teach these courses for reasons of keeping the money to yourself, all of those undesirable influences that we have in universities for people desperately hanging onto as many courses as they can and teaching them in some form or another, even though it is a very undesirable type of course.

Ms Thomas—There is also a very large number of teacher education places held in universities that have very little of the discipline of mathematics. We have recently been trying to save the mathematics department at the University of Canberra, where teacher education students used to be able to do a major in mathematics. That is no longer possible, and keeping any mathematics presence at the University of Canberra at the moment is becoming problematic. The other one we were involved in writing submissions for to make sure they stayed alive last year was the University of Western Sydney, which has huge numbers of teacher education students. A huge number of teacher education places in universities have very little of some of the core disciplines that should be being taught as part of those courses and in conjunction with

the teacher education people. That was a very strong recommendation that came out of the 1989 review of what should be happening in maths and science teacher education.

Most of what was in that review is still as current today as it was then in terms of content, hours and the need for discipline specialists to be involved in working with education people. At a certain level the course is being taught within the discipline part of the university, so it is a big problem when you have diminishing mathematics departments or perhaps no mathematics in universities that have huge numbers of teacher education students.

Mr SAWFORD—I have one last question about balance. We have talked about skill and attitude in scholarship, research and education. A whole range of factors, including in mathematics teaching, seem to have drifted in one direction without the other. In primary education the last impetus of new ideas that I remember in mathematics teaching came from Zoltan Dienes, who came across to South Australia to work with Ned Golding, the master of method at Cowandilla Primary School. I remember that when I first met Zoltan I was 24 years old and I actually thought I was a superior teacher in mathematics—and would have been regarded as one, because that was the reason I was appointed to the school in the first place. Within about 10 minutes he suddenly discovered—and I suddenly discovered, along with my other colleagues—that we new sweet nothing about mathematics and teaching.

This fellow was the impetus for new ideas, new mathematics and teaching at that time. A lot of people misinterpreted what he said and got on the periphery, but he was the first person, along with Ned Golding, who taught a few of us as young teachers what mathematics teaching was all about. It was like being dead in a subject that you knew you were reasonably good at and could do and suddenly you are alive and in outer space because of what he was presenting. It was the mid-sixties when that happened. There has been no other major initiative in mathematics in this country since Zoltan Dienes spent that time, and he spent a lot of time. He initially spent six months and then he spent more and more time. I do not remember any other initiatives coming into mathematics teaching, particularly in primary school, because they would have affected middle school, since that time.

There is this drift that we have had of going to research but not scholarship, of going to skill but not attitude, of going to intuition but not insight, of going to synthesis but not analysis—this out-of-balance stuff that has happened in education. Jan, I remember those reports too. People are saying that we ought to get the balance right, but nothing changes. In fact, I think it is getting worse. You need a new initiative or a jolt or a Zoltan to get that impetus of new ideas to have change. That is a necessary prerequisite for change: you need an impetus of new ideas. Where is that going to come from?

Ms Thomas—I hope it is going to come partly from what we are doing. The reason I ended up—

Mr SAWFORD—Am I deluding myself in some of what I am saying?

Ms Thomas—No, and I have used a lot of Dienes's ideas. I got really concerned when I started teaching in an inner urban school. I thought I was going to be a chemistry teacher, because that is what I had graduated in, but here I was in this inner urban school with these year 7 kids, very few of whom could do any mathematics. I had worked with a wonderful guide, too,

who taught me a hell of a lot about teaching, but I realised that what really engaged these kids was when you showed them how a subtraction actually worked and when they understood how it worked. It was about teaching them core skills, and as soon as they started to realise that these numbers could make sense then you could start moving on and doing the fun stuff with them.

At the moment, most education is about trying to get kids to have 'fun' all the time. It sets the teachers up for failure because they cannot possibly compete with all the other things that are going on in their lives out there. What kids really want to feel is that they are learning something. Once you get teachers who can teach kids the fundamentals and then start showing them what fun they can have with applying some of this, how useful it is and where the nice careers are, then I think you start to make some progress. But in this integrated curriculum the kids have no clear vision about where they are going. They want to know the trajectory they are on.

Their teachers also want to know what map they are following. A lot of what we are doing is giving teachers a map for understanding what the core mathematical ideas are that they should be teaching. Then they have a repertoire of other stuff out there that they will be able to enrich that curriculum with. We cannot just go on talking in jargon and generalities without having some clear objectives about what we are trying to do.

Prof. Gaudry—I will try to answer your question. First of all, there have been rather negative influences in the intervening years, the main one being the National Council of Teachers of Mathematics standards in the United States of 1989, which promoted the sort of self-exploration type of ideas that I derided earlier. There has been a very big reaction against that in recent years, in particular in the United States. But the problems are appearing and are very deep-seated around the world—would you believe in France. For me, France was always considered the epitome of the highest possible standards in mathematics in their schools and so forth. They are having the same educational wars as the Californians had up to about two years ago. There have been influences and they have certainly been very bad ones because they went completely overboard—by the way, just the same as the new math went overboard in its own way many years ago.

Things have happened in the United States—the California framework, for example. It would be worth having a look at that to see what they are doing not just in maths but also in English. It is very highly regarded by lots of people. In Massachusetts, for example, people like us, including some very good mathematicians, have become personally involved in this and are working with teachers, which is what we are doing too. We have terrific collaboration going on. There is quite a bit going on internationally which perhaps has not emerged in the public domain as much as it ought to. I have done my bit, I suppose, to publicise some of these things.

I come to your question: how is it going to change? This is stating the obvious, perhaps, but there is a very big political challenge here. We in our work are going to produce the goods, we reckon. We hope we will get people onside and we will get them to believe in the value of what we are producing. So there is no big-stick approach to it at all; it is involvement and all that sort of thing. Looking at it from a national perspective, and I refer to education generally here and not just mathematics, political leaders really need to start taking things by the scruff of the neck and, in particular, pulling into line some of the education faculties and some of the curriculum authorities. I have spent more time on this than I dare tell you, as a private citizen, but really you

do need political leadership, ideally across the political spectrum, for change to occur at the national level, and it needs to affect all aspects of education, not just mathematics.

CHAIR—Thank you for appearing before the committee today. It has been an informative session. The secretariat will send you a proof copy of your evidence as soon as it is available, and the transcript will be loaded onto the web site. Is it the wish of the committee that the document tabled by the Australian Mathematical Sciences Institute be received by the committee as an exhibit and included in the records of the committee? There being no objection, it is so ordered.

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

That this committee authorises publication, including publication on the parliamentary database, of the transcript of the evidence given before it at public hearing this day.

Committee adjourned at 11.04 am