Chapter 3

Quality Teaching

3.1 The single most important influence on academic achievement is the quality of teaching. Quality teaching engages students and is the key to higher learning for all. Quality teaching requires that those entering the profession are committed to their vocation, have a strong academic grounding relevant to their field of teaching, including theories of teaching and learning, and have the capacity to grow in knowledge and skill as they promote growth in their students.

3.2 The committee points out that this chapter contains ideas and evidence which is closely related to the following chapter on curriculum. It is often difficult to separate the issues which arise from a consideration of both, but consideration of teaching quality requires its own space.

The importance of quality teachers

3.3 Teaching is a highly complex activity. There are many variables affecting the quality of teaching, most obviously the students. The fact that some students do not achieve academically may not be due to poor quality teachers, but research has unambiguously shown that the teacher is the most important influence on the performance of students.

3.4 Ultimately, there is a need to properly define the meaning of quality teaching. The Organisation for Economic Co-operation and Development (OECD) has stated that qualifications, experience and tests of academic ability form only part of the picture. Other important indicators include personal attributes, relational attributes, teacher leadership, professional attributes and capabilities, continuing professional learning, and professional standards and certification.[1]

3.5 The lack of an encompassing definition hinders the recognition and rewarding of excellence in teaching. Specifically in terms of academic achievement, however, the committee has to agree with the loose definition supplied by Dr Grant Kleeman from the Australian Geography Teachers Association:

> Some students thrive by engaging with other students and with a teacher in discussions and debates. Other students thrive by essentially sitting there summarising the text book, if you like, and the factual recall of information.

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1 Organisation for Economic Co-operation and Development, *Teachers Matter: Attracting, Developing and Retaining Effective Teachers*, OECD Publishing, 2005. Also, Dr Glenn Finger et al, *Submission 46*, pp 1-2; Australian Council for Educational Research, *Submission 38*, p. 6; Australian Literacy Educators' Association, *Submission 26*, p. 2.

> An effective teacher is the one who can cater for those diverse needs within the classroom by using a range of instructions and strategies.[2]

The training of teachers

3.6 Teacher training is undertaken in two ways. Most trainee teachers, and nearly all those intending to teach in primary schools, take a four year Bachelor of Education degree (B.Ed). Those with ambitions to enter secondary teaching very often take the option of completing a one-year Diploma of Education course after completion of an undergraduate degree. Subject specialists need to have this background for reasons that will become clear later in this section.

Content and theory

3.7 The committee found a great deal of dissatisfaction expressed with the B.Ed, mainly due to the poor grounding offered in some universities' subject disciplines. There is, admittedly a paucity of research in this area, but the evidence in regard to mathematics teaching has been fairly well surveyed. The Australian Mathematical Sciences Institute submitted that some universities with large numbers of education students have very few mathematics academics, and few B.Ed primary degrees require that their students take sufficient courses in mathematics content over the four years of study. Most B.Ed students have either a weak or non-existent record of mathematics study in years 11 and 12.[3] The aversion to mathematics among some primary school teachers is referred to elsewhere in this report.

3.8 The committee believes that there is a case for reviewing the academic rigour of B.Ed courses in view of the fact that what has been found with mathematics is probably true also of other disciplines. The committee also notes that matriculation entry-level standards for the B.Ed are very low in some universities, and that a great deal of basic 'catch-up' work in the key learning areas needs to be factored into course content and course structures.

3.9 Trainee teachers are, for good reasons, mostly concerned with issues of classroom management, and other anxieties of this kind, but the results of a poor grounding in teaching theory and content knowledge can affect performance in the classroom for much longer than is required to gain confidence in classroom management. The committee was more concerned about this than the fact that trainee teachers often felt ill-prepared or under-prepared for teaching upon completion of their course. It was claimed that this was usually due to an overemphasis on educational psychology and theory with too little instruction on the practical arts of teaching. As one witness stated:

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2 Dr Grant Kleeman, *Committee Hansard*, Sydney, 17 May 2007, pp 58-59. Also, Mr Robert Johnston, *Committee Hansard*, Sydney, 17 May 2007, p. 62.

3 Australian Mathematical Sciences Institute, *Submission 42*, p. 1.

> Many teachers are arguing that they get very little useful information from the academic education teaching they receive and that most of it gets thrown away once they are in the classroom and are dealing with the realities of the day. I do not know how many of you have dealt with primary age children, but can you imagine 30 of them in front of you? Theory goes out the window very quickly.[4]

3.10 The committee is troubled by the tenor of this reported criticism. A lack of understanding of teaching theory is one reason why quality standards are not always what they should be. It notes a long-standing anti-intellectual attitude amongst some in the profession which often surfaces with a deputy principal or head of department telling a new teacher on the first day to 'forget all that stuff from the Dip Ed. Your training starts here.' The failure to relate theory to practice, when this occurs, is a serious weakness in any teaching method course.

3.11 The President of the Queensland Secondary Principals' Association, Mr Ian Ferguson told the committee of a variation on the comments above:

> [Graduate teachers] were quite critical of aspects of their teacher training courses in terms of the relevance of some courses they were doing which seemed to be developed at the whim of the tertiary educator because they liked it or were keen on it. We found that the [graduate teachers] wanted more relevant courses. They valued their internship or their prac training, their time in the school, so highly.[5]

3.12 The committee is wary of drawing too many conclusions, but it did gain an impression that 'whims' of education faculty academics or elements of dogmatism may not be uncommon. A great deal of evidence to the committee was purely anecdotal, with submitters and witnesses drawing on their personal observations and experience.

3.13 The committee also became aware of the importance of subject content knowledge. It was implicit in a number of submissions and in testimony. It was noted that in evidence given to the House of Representatives' inquiry into teacher education in 2005 an Australian Research Council (ARC) researcher made this point:

> The research indicates that you cannot use what are known to be effective teaching techniques unless you do understand the content deeply. If you do not understand, you are forced back on to the worst didactic textbook, going-by-the-rule book sort of teaching. A deep understanding frees you up to use good pedagogy, to discuss ideas, to relax, to open up the discussion, to throw away the textbook and to throw away the work sheets because you

4 Professor Igor Bray, *Committee Hansard*, Perth, 2 July 2007, p. 23.

5 Mr Ian Ferguson, Queensland Secondary Principals' Association, *Committee Hansard*, Brisbane, 5 June 2007, p. 36. Also, Dr Ruth Fielding-Barnsley, *Committee Hansard*, Brisbane, 6 June 2007, p. 4; Marko Vojkovic, *Submission 2*, p. 2.

> are interested, you understand the ideas and you know how to promote those ideas and that discussion.[6]

3.14 It is over thirty years since the last debates were conducted about the relative merits of integrated education degrees and post-graduate diplomas. The B.Ed arrived concurrently with the lengthening of training courses for primary teachers, the demise of the teachers colleges, and the assumption of their role by the new Commonwealth funded colleges of advanced education.

3.15 The committee is concerned enough about the apparent decline in discipline course content in the B.Ed to propose that there is a strong case for a change in the culture of teacher training. In the committee's view there should be a shift away from the practice of secondary teachers obtaining a B.Ed as their academic qualification, toward a more discipline or subject-based degree like a BA or B.Sc, complemented by graduate teacher training qualifications such as the Diploma of Education. The committee believes that this would make a substantial contribution to ensuring that secondary teachers have a strong academic grounding in the disciplines or subjects they will end up teaching in schools.

3.16 The committee believes that studies in pedagogy and teaching theory are likely to be more effective for students with a solid grounding in their teaching discipline, if only by virtue of their increased maturity. This is in line with thinking which is attracting more support in other professions, notably medicine.

Practicum requirements

3.17 Criticism of current arrangements for practice teaching assignments have been covered fully in the report of the House of Representatives Education and Training Committee which was tabled in March 2007. The practicum varies across the country. The Queensland College of Teachers told the committee that up to a quarter of trainee teachers' time is spent in schools. Nationwide, DEST estimated that generally for a two-year degree, it is roughly 45 days, and for a four-year degree it is 90 days.[7] Further consideration of the length of time trainee teachers should spend in schools is not central to this committee's concerns.

3.18 One practicum issue which did interest the committee was raised by Dr Ruth Fielding-Barnsley in relation to exposure of trainee teachers to schools beyond the life experience of middle class teachers:

> About 70 per cent of our pre-service teachers actually went to private schools...and when they go into these low SES schools, they have no idea

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6 Dr Lawrence Ingvarsen, Australian Council for Educational Research, *Committee Hansard (H of R),* Melbourne, 7 June 2005, pp 13-14.

7 Mr Ewan McDonald, DEST, *Committee Hansard,* Canberra, 11 July 2007, p. 30. Also, Ms Roslyn Bell, Queensland College of Teachers, *Committee Hansard,* Brisbane, 5 June 2007, p. 46.

> 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.[8]

3.19 The committee believes that exposure to schools which inform them of equity issues is good experience, even if daunting. The committee believes this is one of many good reasons for there to be comprehensive practicum arrangements for each and every trainee or graduate teacher. The task of raising levels of literacy across all schools is indicated by the long tail of low achievement in many schools, when measured against school performance in other countries. The committee believes that education faculties should take advantage of opportunities to show students the extent of these problems.

3.20 In the 2007 Budget the Commonwealth announced that a condition of education faculty funding will shortly be an increase in the time allocated to the practicum. It is anticipated that 60 days will be required for a two year degree or diploma, and 120 days will be required for a four year degree.

Teacher training in literacy

3.21 An important issue for the committee in this inquiry was the role of university education faculties in preparing new teachers in literacy teaching methods. There is general agreement that too many primary school children are failing to learn to read. This results in a cohort of about 20 per cent of students who either cannot read, or who read with such difficulty as to be almost functionally illiterate. A proportion of this 20 per cent is unidentified by current safety-net practices because the student is able to disguise the extent of his or her inability to read. The biggest problem by far is with current teachers, but concern was expressed that education faculties were not playing their part in closing this teaching skill deficiency.

3.22 The literacy issue is perhaps the most important teaching challenge for primary teachers, and they operate in difficult conditions in many schools. Reading deficiencies are most noticeable in schools from lower socio-economic areas. Dr Fielding-Barnsley demonstrated the extent of the problem with a revealing observation from her own experience as a teacher:

> 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…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.[9]

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8 Dr Ruth Fielding-Barnsley, *Committee Hansard*, Brisbane, 6 June 2007, p. 3.

9 Ibid. Also, Dr Glenn Finger et al, *Submission* 46, pp 5-6.

3.23 The teaching of literacy is dealt with further on in this chapter. The point the committee makes here is that, from the evidence, it appears that phonemic awareness has not been sufficiently linked with sound teaching practice during the training of teachers.

3.24 Dr Kerry Hempenstall, an experienced educator in literacy, critiscised the methods taught by universities for the teaching of literacy.

> The state governments produce guidelines very similar to that which teachers are taught in teacher training institutions…Teachers as a group have not really been trained in critical thinking. Much of their education does not involve the use of logic or the use of the scientific method, and many teachers with perhaps an arts background tend to be suspicious of science and research. That is evident in teacher training institutions. Research of the type that one might call hard-nosed is often viewed disparagingly and described disparagingly in teacher education courses.[10]

3.25 There was other evidence that teachers receive either little or no pre-service training on how children learn to read, and how children's learning difficulties can be overcome. Primary Teachers Association representatives told the committee that new teachers generally do not feel confident about the art and craft of teaching literacy and numeracy. This problem was also evident in other subject areas.[11]

3.26 Universities determine their own course content. There is variation between the universities, as would be expected, and it is likely that these variations reflect, to a degree, the interests and specialisation of academic staff. Individuals exercise particular influence, and recruitment of 'like-minded' academics may result in faculties having prevailing views on matters such as teaching and learning theory. It is difficult to know if this is a serious problem. All of the university academics to whom the committee spoke affirmed that their literacy method courses included phonemic approaches. The question appears to be how well the phonics approach is taught; according to some critics, not very well. Dr Hempenstall told the committee that education courses in general do not teach synthetic phonics in the teaching of literacy, and that there are final year trainee teachers who have no knowledge of issues such as phonemic awareness, phonological processing, explicit phonics, or direct instruction.[12] The committee can only note these differing opinions, but according to most authorities, the best practice is to employ a number of different approaches.

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10 Dr Kerry Hempenstall, *Committee Hansard*, Melbourne, 25 June 2007, p. 18.

11 Ms Leonie Trimper, *Committee Hansard*, Sydney, 17 May 2007, p. 29; Ms Joy Schultz, *Submission 59*, p. 3.

12 Dr Kerry Hempenstall, *Submission 5*, p. 2; Ms Yvonne Meyer, *Submission 17*, p. 2; Professor Max Coltheart, *Committee Hansard*, Sydney, 17 May 2007, p. 4.

Internal reforms

3.27 The committee acknowledges that some, if not all, universities are actively reviewing and revising the structure and content of their education courses. Professor Greg Robson from Edith Cowan University told the committee,

> Most of our schools and faculties of education are having a good, hard look and reviewing the process of preparation of teachers. I can only speak for our place, but we continue to wrestle with getting the balance right. In the last round of reviews we have built up the practicum component significantly...That is one part of the balance equation. The second part is to look much more closely at, if you like, the subject content, whether that be in literacy or whether that be in numeracy, and to give that as much weight as we possibly can. The final component in the balance equation is the general education studies. In our last round of reviews we tried to push the balance much more towards those first two: the practicum component and the content of curriculum and subject knowledge component.[13]

Literacy and the 'reading wars'

3.28 An important focus of the committee's work was consideration of evidence concerning weaknesses seen in the teaching of literacy in schools. This has proved to be an intractable problem despite intensive work done in schools, and the application of remedial policies instituted at both state and Commonwealth levels. No primary school can be criticised for failing to recognise the centrality of literacy as the key factor in quality learning, and of the dependence of all future learning on this skill. Still, the failure rate of around 20 per cent persists. This 20 per cent of children is very unevenly distributed and is usually linked to socio-economic conditions in families and neighbourhoods. So a failure in literacy partly indicates a problem of social inequity which is beyond the functional capacity of schools. Some would argue that illiteracy is in the main a consequence of social inequity. But, for the purposes of this inquiry the focus has been on a failure of pedagogy. There are tens of thousands of children who have the capacity to learn to read and write fluently despite their disadvantaged family background.

Whole language v phonics methods

3.29 The committee was interested in the most effective methods of teaching literacy. It read and heard extensive evidence on the importance of a phonemic approach, and rather less on what was claimed to be the dominant method centred on a 'whole of language'. A difficulty for the committee was that most of its knowledge of the 'whole of language' method came by way of evidence from those opposed to its use. The following instance may be cited:

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13 Professor Gregory Robson, Edith Cowan University, *Committee Hansard*, Perth, 2 July 2007, p. 40. Also, Professor Michael O'Neill, University of Notre Dame Australia, *Committee Hansard*, Perth, 2 July 2007, p. 41.

> The whole language approach is that you should not distinguish reading from spoken language because language is just a whole. Since nobody needed to teach us to speak, nobody needs to teach us to read. We learn to speak and understand speech just by being in a language community, and the argument is the same thing will happen with reading. That completely ignores the fact that speaking is a biological process that is a part of our brains; reading is as artificial as learning chess or music. So that is why it has to be specifically taught.[14]

3.30 Proponents of phonics told the committee that research shows that children acquire reading using the phonics method, although some children struggle without sufficient phonics instruction. Success with this method does not require additional resources, just teacher training in the phonics method and early focussed instruction.[15]

3.31 However, other evidence argued that the two methods are not incompatible and are used in conjunction with each other. There is a tone to this evidence which suggests that some schools and teachers have been discomfited by the 'literacy war', and that principals have had difficulty over this controversy in discussions with their staff and with parents:

> Schools have borne the brunt of the whole word method and/or the role of phonics. You would find that most teachers are very balanced and recognise that a whole range of strategies have to be used for students and that there is not a one-size-fits-all in the teaching of reading and the teaching of numeracy.[16]

3.32 The committee also notes the diplomacy and reassurance in the responses below, and a welcome recourse to the backing of the NSW syllabus. But there is no indication in either response that the points made in the National Inquiry into the Teaching of Literacy (NITL) have been completely understood. That is, that phonemic teaching of reading requires a great deal of understanding and awareness of the intellectual processes involved:

> The New South Wales syllabus is similar to many other states in that it looks at systematic explicit teaching of all of the skills, that is, phonics as well as a range of reading and language skills. It has resolved the false dichotomy that we see between just teaching purely phonics and teaching whole language. It looks at amalgamating the best of both of those.[17]

3.33 As Dr Fielding-Barnsley explained to the committee, there are complex needs of many children facing reading difficulties, and her comments are interesting in the light of views experienced by principals appearing before the committee:

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14 Professor Max Coltheart, *Committee Hansard*, 17 May 2007, p. 4.

15 Ibid, p. 5.

16 Ms Leonie Trimper, *Committee Hansard*, Sydney, 17 May 2007, p. 20.

17 Dr Ian Chambers, *Committee Hansard*, Sydney, 17 May 2007, p. 28. Also, Australian Education Union, *Submission 14*, p. 24.

> 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.[18]

3.34 The NITL report of the disadvantage suffered by children from lower socio-economic groups exposed exclusively to whole of language found another echo in evidence given by Dr Fielding-Barnsley. She spoke of the shock faced by beginning middle class teachers meeting for the first time children suffering from cultural deprivation they would not have imagined. Such children have limited vocabularies, in part the result of their very limited exposure to average middle class growing experiences. It is less confronting to teach them in a whole-of-language way.

> 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.[19]

3.35 And phonemically aware and expert teachers can be as eclectic as whole-of language teachers would claim to be:

> 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

18 Dr Ruth Fielding-Barnsley, *Committee Hansard,* Brisbane, 6 June 2007, pp 11-12.

19 Ibid, p. 4.

> 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.[20]

3.36 The committee was highly impressed by the commitment shown by witnesses who emphasised the need for more rigorous and scientifically-based literacy teaching methods. The committee believes that system managers have a responsibility to take up the challenge of encouraging idealism in the pursuit of improved literacy. That will be assisted when more teachers are trained in effective literacy strategies.

3.37 Aside from the reflections upon teacher training, this example highlights the need for the implementation of effective classroom pedagogy. Without this knowledge and skill, teachers are not able to fully impart the foundation skills, such as alphabet knowledge and phonological awareness. This might affect only a portion of the class, yet those children are prevented from learning to read. This prejudices their chances of successful academic progression and learning for life. A quality education for all includes those who are not as academically gifted as their peers, or who are merely slow learners.

3.38 With this in mind, and in view of the under achievement referred to in Chapter 2, the committee was very interested in the NITL. The primary conclusion of that 2005 inquiry was that the dominant Australian approach to the teaching of literacy (the whole language approach) is not in the best interests of students, particularly those having difficulty learning to read. The conclusions and recommendations of the NITL were supported by other recent international surveys, namely, the United Kingdom's Rose Review and the United State's National Reading Panel.[21]

3.39 The NITL made a number of recommendations, including:

- Teachers should be equipped with teaching strategies based on findings from rigorous, evidence-based research that are shown to be effective in enhancing learning to read in all children;
- Teachers should provide systematic, direct and explicit phonics instruction so that children master the essential alphabetic code-breaking skills required for foundational reading proficiency;
- The teaching of reading throughout schooling should be informed by comprehensive, diagnostic and developmentally appropriate assessments of every child, mapped on common scales; and

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20 Ibid, p. 6.

21 Department of Education, Science and Training, *National Inquiry into the Teaching of Literacy*: *Report and Recommendations*, December 2005; Jim Rose, *Independent Review of the Teaching of Early Reading*, March 2006; National Reading Panel, *Teaching Children to Read*, 2000.

- The conditions for teacher registration of graduates from all primary and secondary teacher education programs should include a demonstrated command of personal literacy skills necessary for effective teaching of reading.

3.40 A number of academics told the committee that there is little evidence of any of these recommendations being implemented. There was disturbing evidence that some of the initiatives undertaken subsequent to this report are directly contrary to the recommendations of the report.[22]

3.41 The 'phonic' versus the 'whole language' debate bears strong similarities with the standard syllabus supporters versus the outcomes-based devotees. In both debates there are those in the middle of the fight who deny that it is being waged at all, or that it has been blown out of proportion. Professor Claire Wyatt-Smith from Griffith University told the committee:

> Much is being made of the whole-of-language debate, but it should have been past tense because what is recognised by practitioners in the field is that whole-of-language in and of itself is never going to be sufficient for quality learning experiences in reading. Of course we need phonics. And of course we need whole language and a range of reading materials provided. I would support the findings of the reading inquiry by saying that it was not news. It was not news to the academy, I should say.[23]

3.42 And the Independent Education Union of Australia, with members on both sides of the argument, told the committee:

> The notion that there are various schools of thought that compete with one another in schools about how to teach kids is a nonsense. When you talk to teachers about what they are doing, they are using strategies not just from those camps but from a range of camps…What is important is that teachers have access to quality research that indicates which things work and which things do not, and how you put things together. The other element of it comes back to the individual student: individual students' learning styles and needs are different. Unless you cater for those, there is no point in saying, 'This is the only way you can do it.' It is not going to work for some of those kids, and you are going to need different strategies.[24]

3.43 The committee notes that home-based literacy practices are also important in teaching children how to read. Yet, if teachers are finding the task difficult, parents might well be finding it more so. According to Professor Max Coltheart, there are five

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22 Professor Kevin Wheldall et al, *Submission 27*, pp 1 & 3-4.

23 Professor Claire Wyatt-Smith, Griffith University, *Committee Hansard*, Brisbane, 5 June 2007, p. 92. Also, Professor Michael O'Neill, University of Notre Dame Australia, *Committee Hansard*, Perth, 2 July 2007, p. 35.

24 Mr Chris Watt, Independent Education Union of Australia, *Committee Hansard*, Melbourne, 26 June 2007, p. 12.

popular commercial products, which have been scientifically validated.[25] However, there does not appear to be any procedure for informing parents of the availability of effective products or programs. Government agencies cannot do so, and professional bodies, such as Specific Learning Difficulties Association of New South Wales, choose not to do so out of fear of litigation. The committee presumes that parents must necessarily rely upon word of mouth, or unofficial advice from teaching experts or professional associations.

Mathematics

3.44 The committee received more evidence in relation to the quality of mathematics teaching than on any other aspect of the curriculum. Many of the submissions and much of the testimony was critical to the point of being pessimistic about the likelihood of improved standards, as well as being fearful of a further decline in standards and performance. There are three related reasons for this, representing a downward spiral of consequences. These are that first, the quality of aspiring teachers is in decline, especially at primary school level; second, this is compounded by the inadequate treatment of mathematics content during teacher training, giving new teachers neither confidence nor enthusiasm to teach mathematics; third, the consequence being that too many children are unprepared at the end of primary school to learn algebra, without which they cannot study mathematics at a higher level in Years 11 and 12.

3.45 There are other consequences. With fewer students studying higher level maths at school, fewer still are qualified to study mathematics at an undergraduate level. This is the pool from which high school mathematics teachers are drawn. Far fewer are choosing to enter the teaching profession, for several obvious reasons.

3.46 To begin with the quality of entry level students to education faculties, the committee notes some forthright comments from Professor Bill Louden from the University of Western Australia.

> One of the things about selection of primary teaching as an occupation is that there is a genetic selection against mathematics ability. People who can do maths do not choose to become primary teachers. To put it in its negative form, one of the reasons you choose to be a primary teacher rather than do a commerce degree is that you are going to have to do two units of first year mathematics in a commerce degree. So there is actually a selection against mathematical ability into primary teaching. That has a larger effect than whether there is anybody in the department who can teach maths.[26]

3.47 Professor Louden described how early tests of numeracy conducted by education faculties showed that a very large proportion of students cannot do grade 5

25 Professor Max Coltheart, *Committee Hansard*, Sydney, 17 May 2007, pp 7-8.

26 Professor Bill Louden, *Submission 73*, pp 10-11.

maths because they never learned a lot of maths at school. They have the same problem in Britain. This, he explained, was a selection effect which could only be changed if we required people to be good at maths. With the current pay, conditions, status and morale of teaching, that would just mean there were no teachers. In order to fix the problem, maths professional development courses in Western Australia put most of their emphasis on trying to teach the teachers some mathematics so that they can teach the children.[27]

3.48 There are differences of opinion about the problems that face mathematics teaching and the causes of them. On the one hand there are those who consider the curriculum old-fashioned, as discussed in the next chapter, and who criticise the outdated pedagogy that they believe is still prevalent. Pedagogy, they believe, should centre mathematics in 'real-life' contexts to ensure engagement and commitment to task. On the other hand are those who see nothing wrong with traditional ways of teaching, and who believe that mathematics should be challenging in its discipline, its requirement for 'automaticity' of response in arithmetical functions, and in the enjoyment students should feel in the realisation of their intellectual growth. There are clear differences in philosophy here.

3.49 The Australian Association of Mathematics Teachers argued that the pedagogy is largely to blame in that it is not teaching students deep learning processes.

> Mathematics teaching methods are frequently poor and modelled on methods used in the ‘60s which focus primarily on the inculcation of mathematical routines and algorithms; these approaches foster memorisation as opposed to deep learning needed by students if they are to be confident users of mathematics.[28]

3.50 The Mathematics Association blamed the fact that out-of-date teaching methods persisted because they were promoted through the media in 'back-to-basics' campaigns, making it difficult for teachers to attempt more appropriate methods.[29] The committee finds this difficult to believe.

3.51 While the Mathematics Association takes the view that out-of-date teaching methods and a failure to make maths sufficiently relevant and exciting to students are matters of concern, others have a different perspective. For them, mathematics is an intellectual task to be mastered to the extent of a student's capability. Their complaint is that the syllabus does not prescribe a sufficiently rigorous program of learning. As the committee was told:

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27 Ibid, p. 11.

28 Australian Association of Mathematics Teachers, *Submission 21*, pp 1-2. Also, Dr Glenn Finger et al, *Submission 46*, p. 7; Association of Consulting Engineers Australia, *Submission 71*, p. 6.

29 Ibid.

> 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 [progress] 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.[30]

3.52 The committee assumes from this that there is no alternative to some serious application of mathematics basics, and that it should be done early. The committee wanted to know what was at the heart of falling interest and falling achievement levels. Where were things going wrong? The progressive curriculum challenge, with its potential pitfalls was described in these terms:

> 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.[31]

Technology

3.53 Another element of disagreement among mathematics teaching practitioners concerns the use of technology. The Mathematics Association takes the view that the widespread use of calculators and computers has liberated mathematics from the memorising and mechanical chores of the past:

> Back in the sixties and seventies mathematics at school was designed to make every student be a calculator. Well, now that we have those technologies obviously the discipline has changed and also the mathematics in schools need to change to accommodate that. So it is more about inquiry, making sense of what is there in the display on the calculator as opposed to producing numbers and results from exponential equations that you have no idea what they are for.[32]

3.54 The Australian Mathematical Sciences Institute noted the idea that because we have calculators we do not need to do a lot of mathematics dominated a lot of thinking:

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30 Assoc. Professor Wayne Read, James Cook University, *Committee Hansard,* Brisbane, 6 June 2007, p. 13.

31 Ibid, p. 12.

32 Dr Thelma Perso, Australian Association of Mathematics Teachers, *Committee Hansard,* Brisbane, 5 June 2007, p. 59.

> 'that somehow or other the availability of technological tools does away with the need to understand the concepts underpinning these things. That is wrong, in fact. Everyone is saying that you need to have better conceptual skills and better knowledge of core mathematics because otherwise you do not understand the tools that you are using, and you cannot use them appropriately without that knowledge.[33]

3.55 The committee notes that Victoria led the way in allowing graphics calculators into Year 12, but the realisation grew that students were becoming excessively reliant on the calculators, which were getting more powerful. In 2006 Victoria reintroduced a technology-free exam for part of the harder Year 12 subjects. It was claimed that teachers welcomed it with open arms because it meant that the students once again had to start thinking about what they were doing and be able to do things with pen and paper as well. There was reported to be some interest in the concept in Western Australia.

> It really has focused curriculum in Victoria again on how much the students actually understand the key concepts. Mathematics has got to be about that; it cannot just be playing around with ideas and shoving a few things into a calculator. If these students are really going to compete internationally they have to understand key concepts.[34]

Good practice and solid teaching

3.56 The committee had constantly to bear in mind that in classrooms across the country, solid teaching and successful learning is an everyday, routine occurrence. Research evidence supports this. The National Centre of Science, ICT, and Mathematics Education for Rural and Regional Australia (SiMERR), based at the University of New England, has recently undertaken research on what principles, processes and practices in teaching lead to outstanding educational outcomes in core disciplines. Funded by the ARC and the NSW Department of Education and Training, the AESOP study in mathematics teaching involved 50 intensive case studies of seven non-selective high schools, in both country and city locations, drawing students from across the socio-economic spectrum. The schools had one common characteristic: a consistent improvement across low, middle and high achievement bands over four years. The purpose of the inquiry was to identify the reasons for this successful record.

3.57 The researchers identified the following characteristics of successful maths departments: having experienced staff, with a majority having degrees with mathematics majors and therefore confident of their subject and able to 'talk mathematics'; all staff believing in 'solid teaching' (see below) and organised to maximise 'time on task'; having and supporting a well-developed testing regime for

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33 Ms Jan Thomas, Australian Mathematical Sciences Institute and International Centre of Excellence for Education in Mathematics, *Committee Hansard*, Melbourne, 26 June 2007, p. 30.

34 Ibid, p. 31.

the purpose of assisting learning. In addition, good maths departments are friendly and have supportive teams, even though methods vary between individuals, with a culture and reputation for caring about students and their learning. In regard to 'solid teaching', the researchers made the following observation:

> All teachers interviewed referred to their style as “traditional” meaning it involved a “standard” approach to classroom instruction. While there were variations to the meaning of a standard approach there was a great deal of commonality in approaches across schools. In particular, there was a clear and consistent structure to lessons.
>
> In practice, this common structure related to similarities in the way teachers started lessons, how lessons proceeded, and how lessons ended. This structure gave a sense of security to students in their learning. Nevertheless, within this structure, there was still variety in these lessons. For students, lessons were not dull, repetitive or boring.
>
> At some stage in the lessons observed students were given practice exercises. Students who finished the work were given additional activities, usually from another source. Teachers made every effort to ensure that students were given an opportunity to learn, or to practise skills, in each lesson. A feature of the lessons observed was that teachers were aware of the need for appropriate revision before proceeding, careful explanation of new concepts, appropriate practice and follow-up.
>
> Common to many lessons observed was an underlying rigour appropriate to the ability of the students. Teachers were conscious of helping and encouraging all students to achieve. Numerous conversations with teachers revealed the importance of “bringing students up to a level rather than pitching the work down”. Every effort was made to ensure that students achieved syllabus outcomes.
>
> Faculty members established supportive classroom environments for their students using an array of teaching aids or interesting approaches to topics. They accepted the need for some change and appeared willing to try new ideas, but did so in an environment of scrutiny. They were skeptical [sic] of educational fads and felt that they had been “burnt” many times before through change for change’s sake. They spoke about being prepared to put in place whatever was needed to ensure that their students were placed in the best position to benefit from changes.
>
> We have battled away with all these new approaches in teaching, group work and so forth…and mathematics-wise we have found it very hard to really move away from set maths lessons…you know your structured maths lessons…As soon as you get the unstructured happening the students are not comfortable (Head Teacher Mathematics).[35]

35 John Pegg, Debra Panizzon, Trevor Lynch, *Identifying and Analysing Processes in NSW Public Schooling producing Outstanding Educational Outcomes in Mathematics*, Conference Paper on forthcoming AESOP Project publication, UNE, 2007, p.6

3.58 The committee believes these descriptions to be interesting in the light of calls from various quarters for change. There is a belief that the needs of students in the 21st century are different. Methods must change because technology has changed. The committee applauds the scepticism which is shown by teachers in the face of these exhortations, especially when success in conventional and traditional ways is evident.

3.59 In conclusion, it is clear to the committee that while many of the factors which militate against higher standards of performance in school mathematics result from social conditions, and which are not easy for governments to influence, the problems we can fix are to do with improved training. The most formidable hurdle to overcome is reluctance on the part of the profession to admit that a high proportion of primary school teachers have an aversion toward, or fear of, mathematics because of their own school experiences. The effects on performance must be significant. If the influence of teaching is as crucial as all authorities agree, there must be very poor transmission of knowledge, if only because of a lack of energy and enthusiasm. A teacher's ignorance and apprehension must be evident in some way, even to young children. This may partly explain the perpetuation of the long tail of underachievement we see in test results.

3.60 The committee is aware that what it has from submissions and testimony gives only a narrow beam of insight into the problem facing mathematics teaching. As can be seen from the AESOP research itself, admittedly a restricted study, there is excellent work going on in classrooms across the country every day. Nonetheless, there are obvious concerns: the rapidly declining proportion of teachers with mathematics majors as part of their degrees; the failure of universities to stipulate high level maths as a pre-requisite for science and engineering and similar degrees, and above all, the failure to ensure that the 'basics' in fractions and algebra are mastered in those crucial Years 6-8, when so much of the essential grounding is achieved.

Conclusion

3.61 The committee is conscious of the fact that some factors relating to improvement in the quality of teaching are beyond the scope of any government. Teaching no longer attracts the same proportion of clever young people as it did forty years ago. It does not attract, as it did, those aiming to rise to secure and respected jobs with middle-class status. Such people now look beyond teaching to better paid professions and occupations. The committee believes, however that those who are attracted to teaching need to be better prepared. Quality teaching is more than ever dependent on quality training. That is the responsibility of university administrators, with prodding from governments where necessary. The committee believes that subject content is a weak spot in teacher training, and universities have the capacity to fix this.

3.62 The committee also notes in conclusion that literacy teaching in primary schools and mathematics teaching in both primary and secondary school can be improved in quality overall. It is concerned that students may be slipping through school without grasping the key skills which need to be acquired as a pre-requisite for

continued learning. The committee does not comprehend why more rigorous method training cannot be applied to literacy teaching using evidence-based data. In similar vein, it believes that much more should be done in teacher training and in professional development courses to remedy teacher deficiencies in content knowledge and instil more confidence in teaching method.

Recommendation 2

The committee recommends that the Government consider ways of restructuring teacher training courses so as to encourage and require aspiring secondary teachers to commence their studies in arts, science and other relevant disciplines before undertaking specific studies in education by degree or diploma.

Recommendation 3

The committee recommends that schools and school systems take particular measures to improve teacher professional development in mathematics.

Recommendation 4

The committee recommends that the Minister take up with Universities Australia the need for administrative changes of a cross-disciplinary nature so as to allow schools and faculties of education to draw on expertise elsewhere in the university for the purposes of giving specialist tuition to trainee teachers in their teaching discipline.

Recommendation 5

The committee recommends that the Minister take up with Universities Australia the need to encourage a more rigorous and evidence-based approach to the preparation of trainee teachers in regard to literacy and mathematics method.