



Math matters

The Hon. Brendan Nelson, MP

Supporting the Mathematical Sciences — Education for the Future

The Australian Government believes science education is critical for building a strong and inventive society. If Australia is to build upon its scientific and technological capabilities it is essential to foster high quality mathematics and science teaching in our schools. Government, schools and industry all play vital roles in building an environment in which most Australian children are encouraged to study science and mathematics. Our future scientific and innovation capacity is dependent upon the skills and attitudes fostered in our young people today and we need to do more for those who inspire our children to study science and maths. The development of strong skills in mathematics, science and technology in primary and junior secondary school, and encouragement of students to continue studies in these important areas, into senior secondary and tertiary years, is imperative. Numeracy is fundamental to learning at all stages of schooling and the Australian Government is determined to improve national standards in numeracy, and mathematics more broadly, in our schools. Generally speaking, Australian students have performed well on tests which provide internationally comparable performance information on mathematics in recent years.

The OECD's *International Students Assessment (PISA)* which tests 15 year olds on a triennial basis, showed in 2003 that Australian students perform strongly on both mathematical literacy and problem solving, and in fact our students were outperformed by students from only four other countries.

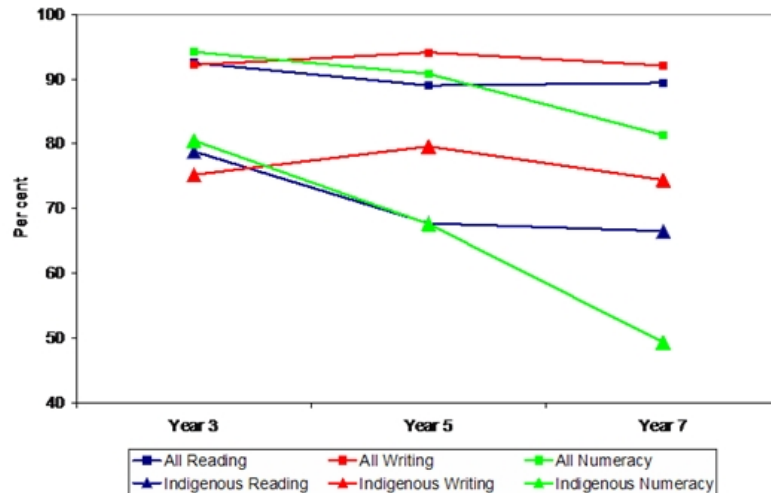
Against another internationally comparable instrument, *Trends in International Mathematics and Science Study (TIMSS)*,

which provides information on mathematics at years 4 and 8, Australian students scored above the international averages in three out of four areas. While Australian students have generally performed well against both these tests, I am concerned to ensure that standards in mathematics and literacy are maintained and improved.

A particular concern is that Indigenous students have performed (on average), significantly below non-Indigenous students on both of these tests and more must be done to ensure these students achieve on a par with non-indigenous students. The Australian Government has played a leading role in introducing literacy and numeracy testing for all students in Years 3, 5 and 7. Minimum national standards have been determined in these key curriculum areas and all children have been assessed against them. The latest available benchmark data (2003) shows that the vast majority of Australian students in Years 3 and 5 continue to meet the national numeracy benchmarks. However, preliminary results for Year 7 students, available for the first time in 2003, indicate that while the majority of students are meeting national benchmarks, notably fewer students in Year 7 than in previous years are meeting numeracy benchmarks.

While the benchmarks are set independently for each year level, there does not appear to be a decline in numeracy achievement in the middle years. 19% of Year 7 students failed to achieve the Year 7 numeracy benchmark in 2003. This is broadly consistent with results from PISA 2003 that 14% of 15 year-olds in Australia did not achieve a baseline proficiency in mathematical literacy.

Chart 1: Percentage of all and Indigenous students meeting the benchmarks in 2003



Most worrying are Year 7 numeracy results for Indigenous students — less than half of Indigenous students met the benchmark in 2003 and the gap between Indigenous and non-Indigenous students increases with years spent in school.

The Australian Government has introduced an initiative which aims to improve literacy and numeracy standards in the crucial middle years of schooling. Funding of \$4.8 million is being provided for the Literacy and Numeracy in the *Middle Years of Schooling Initiative* to further support improved literacy and numeracy outcomes to meet the needs of educationally disadvantaged students in their middle years of schooling. The Initiative has two components:

- State/Territory-based Projects: \$4.0 million has been provided to State, Catholic and Independent education authorities to undertake cross sectoral cluster group activities in professional learning. These activities aim to strengthen the link between assessment, curriculum and teaching instruction. These projects have commenced progressively during 2005.

- National Research Projects: \$0.8 million will be used to fund national research projects in priority areas.

A further \$7 million was provided over 2001–2004 by the Australian Government for the *Numeracy Research and Development Initiative* — the largest undertaking of numeracy research and development in Australia. This initiative comprised two complementary strands at national and State/Territory level, designed to investigate a broad range of teaching and learning strategies that lead to improved numeracy outcomes. Reports from the projects are available from the DEST website.

Ten State and Territory projects and four national level projects have been undertaken since 2001 under this initiative, culminating in a series of practical research reports that provide teachers with an understanding of how numeracy is taught in schools and what works in the classroom. A key finding of the projects was that involvement in researching students' mathematical understandings developed teachers' own understandings of how children think about maths. Teachers involved in the projects recognised growth in their mathematical pedagogical knowledge and also in their own

deeper understanding of the mathematical concepts they were teaching.

It is clear that our children's future rests largely in the hands of schools, teachers and school leaders. I am committed to promoting the highest standards amongst teachers, and in rewarding excellence for outstanding work on behalf of our students.

On 21 July this year I announced a \$33 million boost for science and maths teaching in order to revitalise Australian classrooms and to assist schools to develop new approaches to science, technology and mathematics education. In the first round of the Australian Schools Innovation in Science, Technology and Mathematics (ASISTM) Project, the Australian Government will provide \$9 million to directly target the teaching of sciences, technology and mathematics. Initially, 623 schools and their partner organisations from the scientific community, universities, industry, education authorities and the wider community will be involved in the project. ASISTM is already achieving unprecedented collaboration between Australia's schools and universities. 35 of Australia's 39 universities are involved in the first round of projects. These universities will be directly involved in stimulating and enabling a range of exciting and innovative science, technology and maths teaching and learning initiatives in schools. They will bring to school projects leading edge knowledge, fresh perspective and enthusiasm, and state-of-the-art approaches.

Mathematics is well represented in round one projects, for example:

- Queensland University of Technology (QUT) and other project partners, through its Centre for Learning Innovation, is leading a project with a number of Queensland schools with significant Indigenous populations, to develop skills to teach remote Indigenous students in basic number understandings.
- QUT, through its School of Mathematics, Science and Technology Education, are also leading a project

aimed at improving mathematics learning and teaching of Indigenous students in Townsville.

- Australian Catholic University, through the Strathfield Campus, is a partner organisation in the *Outback Maths* project. This project aims to extend and consolidate teacher understanding of mathematics and make its teaching more relevant and motivating in project schools in Western NSW by using mathematical language and content embedded in Aboriginal culture.
- Latrobe University and Victoria University are partnering a cluster of four schools in Werribee in the *WITS Way to Learning* project which aims to raise the level of academic and social engagement by focusing on new learning models in numeracy, investigating the use of mathematics in a variety of work places, and improving teacher questioning techniques.
- Curtin University Mathematics Department is partnering with six Western Australian schools in the ASISTM to the Develop Visual Reasoning project, which will provide visual, spatial, tactile and kinaesthetic experiences enabling students to appreciate mathematics as a process, language and problem solving tool. This project will involve trainee teachers and a 'mathematician-in-residence'.
- Other innovative maths projects include *Developing Real World Mathematicians* (NSW), *Improving Students Achievements in Mathematics through Pedagogical Innovation* (NSW), and *Maths Alive — Teacher Maths Skills for Life* (TAS). Other ASISTM projects also have a cross-curricular focus that includes mathematics.

The ASISTM initiative will ultimately employ around 1,300 teacher associates (university students, researchers and other specialists in these fields) who will provide project support, excite student interest and

act as role models. It is a key element of the Australian Government's response to the independent *2003 Review of Teaching and Teacher Education*. Further details are available on the ASISTM website: <http://www.asistm.edu.au>.

Another initiative which also encourages excellence in the teaching of mathematics is the *National Awards for Quality Schooling (NAQS)* worth almost \$1 million annually. Winners are selected in a number of criteria including innovation, science, mathematics and technology. However, excellent teachers are often the product of excellent training. It was with this principle in mind that on 17 February I announced a national inquiry into teacher education. The Inquiry is being conducted by the House of Representatives Standing Committee on Education and Vocational Training. It will examine and report on the quality and adequacy of teacher education courses at Australian universities to ensure that all graduates are ready to meet the demands of teaching in the 21st century. This wide-ranging Inquiry addresses many elements of teachers' education, including the examination of the role and input of schools and their staff into the preparation of trainee teachers, the adequacy of funding of teacher training courses by university administrations, and the degree to which teacher trainees are being prepared effectively to deal with the challenges they will face in the classroom.

I expect that the Inquiry's findings will help the profession to improve the quality of training teachers receive, which will in turn assist them in providing Australian students with an excellent educational experience. I am also concerned that there are currently different Year 12 certificates in each state and territory. There are differences in completion requirements, curriculum, the number of hours of study, compulsory subjects, and subject choice and patterns. It cannot be said with any confidence at all that the standard of a year 12 chemistry exam

in Adelaide will be the same as that of Sydney. I have commissioned the Australian Council for Educational Research (ACER) to develop options for an Australian Certificate of Education, to ensure national consistency. The study, to be led by Professor Geoff Masters, CEO of ACER, is an important first step towards implementing an Australian Certificate of Education, and I look forward to receiving the results of ACER's work by the end of this year. If we are to be effective in our teaching of mathematics at all levels of schooling we need to ensure that our universities are attracting and generating enough mathematical sciences graduates to meet our current and future needs for maths teachers and for other careers where maths skills are essential.

Having knowledge of the mathematical sciences is critical to young people's life chances, and it is also critical to research, innovation and industry in Australia. The role of research, innovation and technological change in driving economic growth is now widely accepted in Australia. As the Australian Mathematics Society in its submission to the Higher Education Review observed, the creation of complex/intelligent systems, photonics and nanotechnology as priority research areas will not lead to a rapid increase in Australian contribution to them unless they are supported by strong mathematics and physical sciences in the higher education sector. While it is encouraging to see that the number of students studying mathematics at university is increasing (Table 1) it is not clear if this will meet the demands of industry, research and for maths teachers. Women's enrolments in mathematics have remained at the same level in recent years, effectively reducing the possibility of strong growth in the mathematical sciences. The Australian Government has moved quickly to support a number of initiatives designed to improve our expertise in the mathematical sciences. This

is in keeping with our policy of maintaining strength in the areas of national importance in line with the thrust of *Backing Australia's Ability*.

One such initiative is *The International Centre of Excellence for Education Mathematics*, announced in the 2003/04 Federal Budget. It is a major initiative, intended to raise Australia's profile as the leading expert in education in mathematics. The centre will strengthen mathematics education and its contemporary application in Australia, undertake research to support its activities, and improve mathematics education in Australian schools by facilitating professional development of teachers,

and developing resources and materials for teachers and students. Another initiative, the Australian Science and Mathematics School (ASMS) was opened in 2003 as a new purpose-built senior secondary school within the campus of Flinders University for selected students in years 10 to 12. The Australian Government contributed \$5 million in 2002–2009 towards the building of the school and a further grant supported the release of seven staff to work with ASMS staff to produce a curriculum framework and to develop a new pedagogy for mathematics and science education.

All Students studying Mathematics at Australian Universities 2001-2004

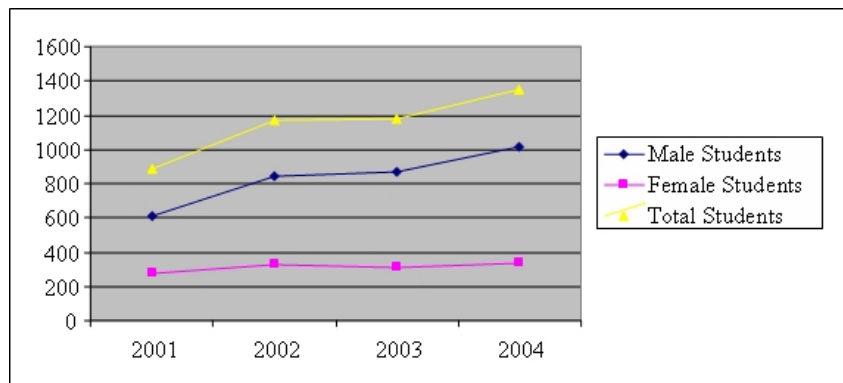


Table 1: All Students in Mathematics Field of Education
Source: DEST Higher Education Statistics 2005

In August 2004, the Government also announced an audit of science, engineering and technology (SET) skills in response to concerns expressed by industry and the academic research community about SET skills issues. The main objective of the audit is to determine the extent to which Australia's current and future industry and research body needs are being met by the higher education and vocational education and training (VET) sector in the supply of science, engineering and technology graduates. The audit will assess the current supply of SET skills in the

short, medium and long term and provide a detailed analysis of employer demand, skills needs and shortages, recruitment issues and long-term skills needs. It will also examine youth attitudes on studying science, engineering and technology subjects; analyse the supply of skills from schools, VET and higher education sectors; and review population, immigration and SET related policy initiatives in OECD countries which may draw Australian students, with SET skills, overseas. The audit is being informed by a systemic literature review. Views from key stakeholders have been sought through

a public consultation process and written submissions. A high level steering committee with representatives from the science community, the university sector, the learned academies, the VET sector, schools and industry bodies has oversight of this audit. I understand that the President of your Society, Professor Michael Cowling, in the recent *Gazette* (Volume 32, no2) expressed members' concerns about aspects of the proposed Research Quality Framework. In particular, concern was expressed about the possibility that all scientific disciplines would be treated in the same way and that lower publication and citation rates in the mathematical sciences compared to other sciences might be used as evidence against the mathematics discipline. Let me assure you this is not the case. An Expert Advisory Group of the Research Quality Framework has acknowledged the issue of a the sensitivity of the research assessment to discipline area and a series of workshops have taken place earlier this year with each of four National Academies to discuss research assessment in a discipline context. A follow-up workshop was also held with the National Academies Forum to discuss the

implications of interdisciplinary research on quality assessment. These discussions proved highly valuable and the outcomes were considered by the Expert group in the preparation of its two discussion papers to date. The Expert Group will continue to examine discipline differences related to the assessment of research quality and impact.

Mathematics is an enabling science and advances in science and engineering are dependent on research in mathematics, statistics and modelling. I look forward to the outcomes of the current National Strategic Review of Mathematical Sciences Research being conducted through the National Committee on Mathematics (Australian Academy of Science), which the government is supporting through the Australian Research Committee. With the initiatives my government has taken and is continuing to take, I believe that mathematics education will be greatly enhanced for the benefit of our students, the development of an innovation process for the pursuit of scientific advances and to ensure the competitiveness of our industry in the global marketplace in the future.

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