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## ACER eNews 02 February 2005

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### Recommended Citation

ACER, "ACER eNews 02 February 2005" (2005).  
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## Comparing results from PISA and TIMSS

In early December 2004, the results of two international studies were released providing the most recent evidence we have on how levels of school achievement in Australia compare with international standards. ACER's chief executive Geoff Masters compares the results.

The OECD Programme for International Student Assessment (PISA) surveys reading, mathematical and scientific literacy levels every three years. The Trends in International Mathematics and Science Study (TIMSS) surveys student achievement in mathematics and science every four years. Every 12 years PISA and TIMSS align, and their results are released more or less simultaneously. This was the case in 2004.

Both surveys were conducted in 2002/03 in more than 40 countries. In Australia, samples of students were drawn from all states and territories and included government, Catholic and independent schools. As well as providing information about overall levels of achievement, PISA and TIMSS provide details of the performances of girls, boys, students in each State/Territory, Indigenous students, students living in cities/regional/rural areas, students with non-English language backgrounds, and students from various socioeconomic backgrounds.

While PISA and TIMSS have much in common, they provide different, but complementary, information about levels of student achievement.

PISA looks at 15-year-olds-who in most countries are approaching the end of compulsory schooling-and asks how well they are able to apply basic understandings and skills in reading, mathematics and science to everyday situations.

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TIMSS, on the other hand, looks at how well Year 4 and Year 8 students have mastered the factual and procedural knowledge taught in school mathematics and science curricula. TIMSS begins with a detailed analysis of Year 4 and Year 8 mathematics and science curricula and then tests curriculum content common across participating countries.

So what did we learn? It will take some time to sift through the results in detail, but there are some clear and immediate conclusions.

From PISA we learn that Australian 15-year-olds perform well (on average) when it comes to careful reading, logical thinking, and the application of reading skills and mathematical and scientific understandings to everyday problems. In fact, Australian students are among the best in the world on tasks of this kind. In reading literacy we rank fourth among 41 participating countries, behind Finland, Korea and Canada, with only Finland significantly outperforming Australia. In mathematical literacy, we rank eleventh, with only Hong Kong SAR, Finland, Korea and Netherlands significantly outperforming Australia. In scientific literacy, we rank sixth, significantly below Finland, Japan and Korea.

The conclusion from PISA is that, on average, Australian 15-year-olds have relatively high levels of reading, mathematical and scientific 'literacy', defined as the ability to apply skills in reading and basic mathematical and scientific principles and processes to everyday problems.

PISA also reveals that many students in Australia -as in other countries- complete the compulsory years of school with only minimal levels of reading, mathematical and scientific literacy. For example, among Australian 15-year-olds, 7 per cent of girls and 17 per cent of boys perform at or below the lowest international reading benchmark. Many of these students are able to locate specific detail in a piece of text, but are unable to connect ideas or to draw conclusions from a piece of writing.

From TIMSS we learn that Australian students perform less well on tests of mathematical and scientific knowledge. Among the 25 countries testing at Year 4 in 2002/03, Australia ranked 16th in mathematics and 11th in science. Countries significantly outperforming Australia in either Year 4 mathematics or science included England, USA, Latvia, Lithuania, Russian Federation, Hungary and Cyprus. Worse, over the past decade, achievement levels in Australia remained largely static while achievement levels in many other countries increased. The result is that some countries which were below or equal to Australia a decade ago in school science achievement (eg, Hong Kong SAR, England) and school mathematics (eg, England and Hungary) now outrank us.

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Among the 46 countries testing at Year 8, Australia ranked 14<sup>th</sup> in mathematics and 11<sup>th</sup> in science. Countries significantly outperforming Australia in either Year 8 mathematics or science included England, Belgium, Netherlands, Estonia and Hungary. And while our performance in Year 8 science improved over the past decade, half the countries we outscored in Year 8 mathematics in 1994/5 improved to perform at the same level as Australia in 2002/03.

What lessons can we learn from these observations?

PISA and TIMSS provide information about different aspects of students' mathematics and science learning. PISA assesses careful reading, logical thinking and the application of general mathematical and scientific processes and principles to everyday problems. TIMSS assesses mastery of the factual and procedural knowledge taught in school mathematics and science curricula. While students in some countries—such as Hong Kong SAR and Korea—perform very well in both these areas, students in some other countries perform better in one area than the other.

In Australia and New Zealand students perform better (on average) in applying general mathematical and scientific principles and skills to everyday problems than in recalling and using curriculum-based factual and procedural knowledge. As an illustration, Australian high school students significantly outperform students in the United States in the first of these two areas, but perform no better than US students in the second.

An obvious question that follows from these observations is whether Australian schools are placing sufficient emphasis on the teaching of factual and procedural knowledge in mathematics and science, particularly at Year 4. While 73 per cent of Year 4 students in Singapore reach the high international mathematics benchmark, only 26 per cent of Australian students reach this benchmark. The corresponding percentages for Year 4 science are 61 per cent and 38 per cent. And, relative to other countries, Australian Year 4 students now perform less well in school mathematics and science than they did a decade ago.

During the 1990s, considerable effort went into the reform of curricula for the primary and middle years of schooling in Australia, resulting in new state curriculum and standards frameworks. In the same period, education systems introduced systemwide testing programs to monitor student and school achievement. It is not clear that these efforts have improved levels of mathematics and science performance in Australian primary schools.

If Australia is to lift its performance in TIMSS over the next decade, then greater attention will need to be given to the teaching of basic factual and procedural knowledge and the development of teachers' confidence and competence in teaching primary school mathematics and science.

**Published February 2005**

The focus of the past decade on what is taught (the curriculum) needs to be accompanied by a greater focus on how subject matter is taught (research-based pedagogy). And testing programs for accountability and monitoring need to be complemented by assessments more capable of diagnosing individuals' learning difficulties and providing guidance to classroom teaching and learning.

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## Where to now for early childhood education and care?

The following article by Dr Alison Elliott, ACER's Research Director in Early Childhood Education is a shortened version of an article published in the current edition of ACER's Research Developments newsletter. You can read the version at [Research Developments](#).

Australia's early childhood sector caters for well over half a million 0-5 year-olds in a myriad of services that are legislated and funded by a complex network of agencies and organisations, and operated and administered by a range of government, community and private for profit operators.

About three quarters of children aged 3 to 4 years used some type of formal childcare in 2002, including home-based Family Day Care. Yet, little is known about how children fare. There are no agreed standards and learning programs across services, no agreed positions on staffing and staff qualifications, and no strategies for mapping, tracking or comparing children's experiences and outcomes. In short, there is little monitoring of children's progress and little investment in research and development.

Most early childhood sector growth has been in provision of child care programs for young children while parents work. But in the scramble to provide affordable child care for working families, and without a national policy and vision for early childhood education, the once strong focus on early learning and education has slipped into the background.

There is growing anecdotal evidence of a widening 'care' - 'education' divide in early childhood services that is being supported and sustained by differential funding and resourcing. Closing it will be difficult unless there is a rethinking of early childhood policy and a commitment to funding services and supporting families, rather than the market driven approach that currently prevails. Further, despite widespread recognition that early years experiences have a major impact on longer term educational and social outcomes, many children miss out altogether. There is no universal entitlement to, or provision for, early childhood education and care. A national, independent review of early childhood services is long overdue.

On the surface, Australia seems to have a sound system of early childhood education and care, but a closer look shows that equity of access, experience and outcome for young children is a long way off.

**Published February 2005**

We might wonder why issues of government funding, equity of access, quality and outcomes, accountability, teacher quality and effectiveness, and the shift to 'private' education, so contentious in the schooling sector, raise barely a whisper when applied to children five and under? The increasing monopoly of not just 'private' and not-for-profit, but commercial and for-profit early childhood centres, has been all but ignored in the public debates about education funding.

There is an urgent need for a review of early childhood care and education. We need to create a national vision and action plan. We need to decide whether we want a universal entitlement to quality early childhood education and care independent of families' ability to pay. The current 'care' - 'education' divide must be closed. We need to create more holistic, integrated early education and care services for children, and seriously consider accessibility, affordability and quality. Unless action is taken now, the twin system of care and education will be set in concrete. More affluent families will avoid child care altogether. Families eligible for the Child Care Benefit will cluster in services where fees, and hence quality, are kept low to maximize affordability. Services and quality will be further tied to family socio-economic status and ability to pay.

Today, there is widespread recognition of the longer term educational and social outcomes of early childhood education, but we have little idea about the extent to which child care centres, preschools, and Family Day Care afford rich early developmental opportunities and promote sound learning outcomes. We don't have a mechanism to monitor, assess and compare children's progress, or to evaluate the outcomes of the many different types of early childhood programs. We're not even sure how early childhood programs should look, how curriculum should be structured, what values, learning experiences and outcomes could and should be expected and what staffing standards are most likely to ensure optimum outcomes for children. There is an urgent need for a review of early childhood service provision and outcomes, and future policy development needs to be informed by good evidence. To close the school achievement gap, we need to be much clearer about what works in early childhood, under what conditions and for which children.

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## ACER UPDATE

### **ACER to publish Professional Educator**

ACER recently reached an agreement with the Australian College of Educators to publish Professional Educator. ACER has had a close involvement with Professional Educator since its pilot in 2002. Professional Educator is recognised as one of Australia's premier quarterly education magazines, reaching practising educators and school leaders, education researchers and policymakers - ACE members and direct subscribers. Steve Holden will continue to edit the magazine. The first issue of Professional Educator under ACER direction will be published on 16 March.

### **ACER contributes to tsunami relief efforts**

ACER has been working with World Vision, Red Cross, AusAid and the Curriculum Corporation to produce a Tsunami Education Kit for primary and secondary school teachers. The kit examines how the tsunami disaster fits with bigger picture issues of poverty, development and aid and provides a background for teachers and students on these issues through information and key questions, as well as providing activity suggestions for all age groups.

ACER has also donated \$10 000 to World Vision's Tsunami relief appeal and will continue to work with World Vision and other aid agencies. The kit can be downloaded from [World Vision's website](#).

### **ACER annual report**

ACER's annual report for 2002-03 and 2003-04 have been published on the website. [Download ACER's 73rd Annual Report 2002-2003](#)

Published February 2005

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