

# rd

RESEARCH DEVELOPMENTS

ISSN 1442-6625

No. 11 Winter 2004



## Higher order thinking skills

**New effort needed to  
improve Indigenous  
education**

---

**ACER-led delegation  
investigates US teacher  
quality practices**

---

**Online assessment  
program aids learning  
in the home**

---

Australian Council for Educational Research

**ACER**

# Welcome



**Professor Geoff Masters**  
Chief Executive Officer

*Welcome to Research Developments in its new, magazine format.*

*Research Developments will continue to provide findings from recent research, as well as reports of studies currently underway. Beginning with this issue, Research Developments includes regular in-depth articles on key issues in Australian education. These articles outline relevant global developments in research and thinking and consider challenges for education policy and practice.*

In this issue, Margaret Forster reviews developments in conceptualising and assessing higher order thinking skills. How are higher order thinking skills described and operationalised in state curriculum documents and how are they assessed internationally through initiatives such as the OECD Programme for International Student Assessment (PISA)? The issues Margaret addresses in this article are crucial to conceptualising, teaching and assessing generic, cross-curricular competencies and skills.

This issue of *Research Developments* also includes a summary by Suzanne Mellor and Matthew Corrigan of the findings of a recent review of Indigenous education research in Australia. Their review calls for a national Indigenous education research agenda, similar to programs adopted in some other developed countries. ACER's review of Indigenous education research will support Australian government efforts to close the divide between Indigenous and non-Indigenous students.

In her article, Elizabeth Kleinhenz reports on the visit of an ACER-led delegation to observe the work of the US National Board for Professional Teaching Standards. The visit was timely, given the recent establishment of the National Institute for Quality Teaching and School Leadership, the development of state institutes of teaching, and the work

of several subject associations to develop standards for highly accomplished teaching and accompanying assessment procedures.

Progress in improving educational outcomes for all learners depends on good information about the current state of learning in Australian schools, pre-schools, TAFE and higher education institutions. Much of ACER's work is focused on developing an improved understanding of what is being learnt – by young people generally, by particular groups of students, and in comparison with international achievements.

Other ACER work is aimed at understanding effective practices and policies for improving educational outcomes. What works? For whom? Under what conditions? Professional knowledge in education accumulates slowly, often emerging only through many studies over a number of years. But as a profession we now have a significant knowledge base and should be insisting that this knowledge is used in policy development and in setting directions for the future.

*Research Developments* will provide an increasingly rich picture of what is being learnt through ACER research about ways of improving learning outcomes for all young Australians.

A handwritten signature in blue ink that reads "Geoff Masters". The signature is fluid and cursive.

# Contents

RESEARCH DEVELOPMENTS

No. 11 Winter 2004

## Higher order thinking skills

10

2



New effort needed to improve Indigenous education **2**

---

6



ACER-led delegation investigates US teacher quality practices **6**

---

9



Online assessment program aids learning in the home **9**

---

16



Higher order thinking skills **10**

---

Positive school climate helps students achieve positive results **16**

---

ACER Update **18**

---

### Research Developments is published by

The Australian Council for Educational Research  
19 Prospect Hill Road  
Camberwell VIC 3124  
Phone: (03) 9277 5500  
Email: [communications@acer.edu.au](mailto:communications@acer.edu.au)  
Website: [www.acer.edu.au](http://www.acer.edu.au)

Copyright © Australian Council for Educational Research 2004  
Printed July 2004

All rights reserved. Except under the conditions described in the Copyright Act 1968 of Australia and subsequent amendments, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the written permission of the publishers.

Editor: **Louise Reynolds**  
Design: **Integral**  
Printed by: **Camten Graphics**

### Acknowledgement

ACER wishes to thank Ms Helen Paphitis, Principal, and students of Salisbury High School in South Australia and Mr Chris Sarra, Principal, and students of Cherbourg State School in Queensland for their kind assistance in providing some of the images contained in this publication.

Print Post Approved PP328727/00028  
ISSN 1442-6625  
ABN 19 004 398 145



# New effort needed to improve Indigenous education



**By Suzanne Mellor  
& Matthew Corrigan**

*Suzanne is a Research Fellow with  
ACER. Matthew is a Research Officer.*

*A recent ACER report - **The Case for Change: A review of contemporary research on Indigenous educational outcomes** calls for the establishment of a new national research agenda as a means to help improve educational outcomes for Indigenous students.*

Despite good intentions and considerable funding in recent years, educational outcomes for Indigenous students remain well behind those of non-Indigenous students. *The Case for Change* argues that a lack of research evidence in policy making is contributing to a slow improvement in outcomes for Indigenous students and a new national research program to examine ways of improving these outcomes is required urgently.

Our review examines the research evidence and Indigenous education policies that have been implemented over the last decade. It analyses existing educational research into the precursors and other factors that contribute to educational achievement for students generally and for Indigenous students in particular. A number of problems with current research practices are identified and alternative approaches suggested. A national research agenda that systematically identifies and supports policy changes directed at significantly improving the educational outcomes for all Indigenous students is called for.



Photos on this page courtesy of Salisbury High School, South Australia

A major concern relating to current policy in Indigenous education is that it is insufficiently supported by comprehensive and substantive research evidence. This is largely because much of the recent research in Indigenous education has been based *either* on analyses of Indigenous students' test results with little consideration of context, or on small case studies of learning problems faced by specific groups of Indigenous students. Research aimed at improving outcomes for Indigenous students has also tended to be isolated from broader considerations of teacher quality and has been inadequately informed by advances in developmental psychology, paediatrics, sociology and community health. In addition, in the view of the authors, much of the research overemphasises the uniqueness of the Indigenous experience of education and underemphasises the many factors that impact on the learning of *all* students.

A better approach to research in Indigenous education would be to focus more on what the research tells us about the foundations of good teaching and learning generally.

These can be described as two key goals of an education, which apply to all students. These are:

- to support the moral and emotional development in the context of citizenship; and
- to be explicitly related to employment and life outcomes.

A number of other factors support these goals. They are:

- good health, both as infants and while at school;
- ensuring students' cognitive and social readiness for each developmental task and transition;
- good teachers supported by extensive and ongoing professional development;
- regular school attendance, so learning can be managed by students, teachers and parents or caregivers; and
- the development of productive and supportive relationships between schools and their communities.

The factors that are known to affect the learning of students in general should be at the centre of new research efforts. The particular needs of Indigenous students should be seen in the context of these universal educational needs. Such a context provides a better understanding of what research needs to be conducted in order to determine why Indigenous students have yet to achieve equal access, attendance and participation in schooling.

Our review also identified several particular educational needs for Indigenous students that link to broader issues, which require urgent policy consideration. These include a need to improve employment outcomes for Indigenous people; adopt culturally appropriate pedagogy; reduce teacher turnover, especially in remote areas; and improve the quality and quantity of teacher education courses in Indigenous education, both pre-service and in-service.

Another area of concern in current research and policy development is the practice of aggregating data on Indigenous students and



the inherent dangers of treating all Indigenous students as if they are the same despite their regional and socioeconomic locations. In analysing the key factors, both universal and particular, which impact on educational outcomes, more attention needs to be paid to the context of the student in his or her family and school community. It is important, therefore, that future research programs allow for the disaggregating of data.

In particular, data collected by systems need to be able to be disaggregated so that important distinctions in populations are not concealed. If data are not disaggregated, populations where progress has been made cannot be easily identified and the students and educators involved in these program initiatives miss out on the recognition and self-esteem that would come from being able to identify and report their successes.

The authors believe that rather than aggregating data into one Indigenous category, at least two different categories of Indigenous populations should be used in collecting data. These categories should be based on community rather than socioeconomic background. The first population is those generally traditional and remote Indigenous communities, where the vernacular is the common daily language, and where English exists only in the schools. The second is in those communities where English is the community and school language, even given that Aboriginal English is part of the language mix. Disaggregating data in this way would boost researchers' and policy makers' capacity to understand what will work best for any particular group of similar students.

Our review of the research concludes that, while there have been some improvements

over the past decade, the gap between Indigenous and non-Indigenous educational outcomes remains unacceptably large and we should not be satisfied with recent levels of improvement. Much more remains to be done, starting with a number of changes to existing policy and practice in the field of Indigenous educational research. This requires the establishment of a new national research agenda, consisting of large-scale studies using both qualitative and quantitative research methodologies. Similar research agendas, when adopted in other developed countries, have led to significant policy changes and improved outcomes for Indigenous people. Australia should instigate a similar research agenda, one that would better support more effective and efficient policy development in the area of Indigenous education.

Developing successful and better-targeted policies, which are based on empirical research findings, is the key to alleviating the substantial educational disadvantages faced by Indigenous students. We owe it to the current generation of Indigenous students to ensure that all Indigenous peoples have the opportunity to reach their full potential. We must embark on this research without further delay.

---

*The case for change: a review of contemporary research on Indigenous education outcomes*, by Suzanne Mellor and Matthew Corrigan was published by the Australian Council for Educational Research in February 2004 as the Australian Education Review (Number 47). The review can be purchased through ACER Press or downloaded from the ACER web site at [www.acer.edu.au](http://www.acer.edu.au) ■



## Australian Journal of Education

3 issues per year

### Australian subscribers

Individuals	\$99.00 (incl. GST)
Institutions	\$164.00 (incl. GST)

### Overseas subscribers (air mail)

Individuals	\$138.00
Institutions	\$194.00

■ Well-respected and established research education journal that features a wide range of articles on contemporary educational issues and quality educational research

■ Articles reflect cutting edge research on important topics

### For enquiries contact:

Jan Gardiner

Tel (03) 9835 7448

Fax (03) 9835 7499

Email [subscriptions@acer.edu.au](mailto:subscriptions@acer.edu.au)

# ACER-led delegation



# investigates US teacher quality practices



**By Dr Elizabeth Kleinhenz**

*Elizabeth is a Research Fellow in ACER's Teaching and Learning research program.*

*ACER recently led a delegation of representatives from Australian education systems and organisations on a study tour to Washington DC to observe the work of the National Board for Professional Teaching Standards (NBPTS). The aim of the visit was to find and share answers to questions on teacher quality in Australia such as: What do we mean when we talk about teacher quality? and how do we know it when we see it? Dr Elizabeth Kleinhenz, reports on the observations made during the visit.*

The issue of teacher quality is at the heart of all major efforts to improve educational opportunities for students. It has become a hot topic of discussion among various education stakeholders including teachers, administrators and teacher unions.

Some see the phrase 'teacher quality' as threatening, saying that it provides a basis for teacher bashing. But, for most people who are concerned about school education, the concept poses some serious questions: Just what do we mean when we talk about teacher quality? How do we know it when we see it? How can it be demonstrated?

Research has confirmed our intuitive understandings about the positive relationships between good teaching and improved student learning, but what complexities underlie these relationships? How can we make sure that our children are receiving the best possible teaching? How can teachers be encouraged and helped to improve the quality of their work?

In an attempt to find and share answers to questions such as these, ACER invited representatives of various state and independent education systems and organisations, including teacher unions, to participate in a week long study tour to Washington DC to observe the work of the National Board for Professional Teaching Standards (NBPTS) and to meet with representatives of several peak bodies that accredit university teacher preparation

courses and make decisions about teacher licensure. Visits were also arranged with senior staff of the two major US teacher unions and George Washington University, an institution recognised for the quality of its graduates in teacher education and its work in cooperation with NBPTS.

The tour took place in mid July 2003. The delegation of eleven included senior policy officers from Commonwealth, state and Catholic education departments, representatives of the Australian Education Union and Independent Education Union of Victoria and of the independent schools sector.

The NBPTS was founded in 1987. Its mission is threefold: to establish high and rigorous standards for what accomplished teachers should know and be able to do; to develop and operate a national voluntary system to assess and certify teachers who meet these standards; and to advance related education reforms. Board certification is highly prized among American teachers. Each year, thousands of teachers voluntarily submit for assessment comprehensive portfolios of evidence of the quality of their teaching that include lesson and unit planning, examples of students' work and videos that demonstrate the quality of their teaching. The evidence is assessed by trained peer teacher assessors against Board professional teaching standards that were established by teachers, teacher educators and subject matter experts in up to thirty-one teaching fields. The assessment is rigorous, but successful teachers are rewarded in a variety of ways, including substantial pay rises and bonuses.

Members of the visiting delegation spent the first two days at Howard University, Washington DC where groups of 'assessors' were being trained to conduct assessments for NBPTS certification. A notable feature of the sessions was that all participants – trainers and assessors in training were practising teachers. The sessions were field specific. In separate rooms groups of up to 20 assessors in training learned how to assess portfolios of evidence of quality teaching submitted by teachers of music, art,

languages other than English and physical education.

Observing selected 'benchmark' training videos of teachers' classroom performance from high to low levels, in conjunction with the teachers' own commentaries, was enlightening. For those teachers whose performance was benchmarked as 'high,' there was a strong correlation between their written reflections on the video lesson and the video performance itself. These teachers understood the standards, were able to demonstrate the standards in their teaching, and could reflect on their own performance in relation to the standards. The written reflections of the lower benchmark samples that clearly did not demonstrate the standards tended, on the other hand, to show the teachers' lack of insight into their own teaching and the effects it was having on the students. All of this had powerful implications for teacher professional development, as well as identifying the quality of professional practice.

Even more interesting was the observation, made by one tour group member, that some of the teachers in the less successful video examples could have been representative of any teacher considered to be 'good' in any school. These teachers looked good, they appeared to have good classroom control and they were articulate. But, according to the profession-defined standards and the assessment of their peers, these people were not pedagogically competent and their students were probably not learning much. This posed the questions, how many such teachers do we have in Australian schools and what is being done to recognise them and help them improve?

As well as observing the training sessions of the NBPTS, the tour group visited various influential education organisations, including the two major US teacher unions. Although these organisations differed greatly in their functions and purposes, the glue that appeared to bind them together was their commitment to high teacher quality. The degree of consensus on the meaning of 'teacher quality' among these diverse

groups of people was remarkable.

However, members of the tour group were told that fifteen years ago, when the work of the NBPTS began, things were very different. 'It was like the Cheshire Cat,' said Joan Baratz-Snowden of the American Federation of Teachers (AFT) 'When you don't know where you're going, any path will take you there. In 1987, the unions were highly suspicious of the motives of the Board and there were many competing agendas with people caucusing all over the place. Gradually though, as the Board, with its majority of teachers, led the standards, a professional consensus around issues of teacher quality was built, and the various stakeholders, unlike poor Alice, became empowered to follow a common path to a worthwhile destination.'

'How has the National Board managed to achieve so much over the past fifteen years?' a member of the group asked Professor Mary Futrell, the African-American former National President of the National Education Association who is now Dean of Education at George Washington University. But Mary was not to be drawn into looking back. 'Don't think about the past,' she advised. 'Don't work in the reactionary mode. Stop saying what you're against. Start saying what you're for. I have big serious challenges right here, right now, never mind what's gone on before. My energy is all directed towards encouraging my staff to meet those challenges in the strongest, most pro-active ways possible.'

There are lessons in those statements for all of us who care about teacher quality in Australia. Teacher unions in particular need to recognise that defensive rhetoric alone will not allow teaching to make the transition from an occupation to a true profession in the eyes of the public. Current state and national initiatives to codify the knowledge and expertise of teachers and to find means of recognising those teachers who are able to demonstrate their expertise and knowledge deserve full and active support. ■



# Online assessment program aids learning in the home

*ACER's expertise in test development has been combined with the latest advances in internet technology to develop Australia's first online assessment program for use in the home.*

Photo Peter Solness

The *iAchieve at home* program provides a series of web-based multiple-choice tests in English and Mathematics for students in Years 3-10 with detailed feedback. It has been developed to complement school-based testing and to help parents become more involved in their children's learning.

Students who enrol in the *iAchieve at home* program can complete an online test in English and/or Mathematics at the beginning of the year and another at the end of the year and receive an indication of how they have progressed over time.

Tests are available for different ability levels. When a student completes a test, it is marked online and immediate feedback is provided in the form of three reports. The first report provides a break down on which questions were answered correctly or incorrectly. It also indicates how the student performed relative to a national sample of students. A second report shows what a student knows and can do in relation to the abilities being tested. The third report shows where a student is along a continuum of growth in the subject. These reports are designed to help students and parents understand areas in which a student has

struggled and help to identify potential strengths and weaknesses.

A team of 15 test writers, IT specialists and teachers worked throughout 2003 to develop *iAchieve at home*. All test items assess a nationally important learning outcome; have been reviewed by experienced teachers and test developers; and trialled on samples of Australian students. In addition, *iAchieve at home* is unique in Australia. There are no other programs available in Australia that address national curriculum outcomes and have been tested Australia-wide.

In 2004, English and Mathematics tests are available for students in Years 3 to 10. The program will eventually include all subjects across Years 1 to 10. The first suite of test items for *iAchieve at home* became available in January. It is possible for students to join the program at any time. The second suite of test items will become available in November.

To register for *iAchieve at home* or find further information, you can visit the website at [www.iachieveathome.com.au](http://www.iachieveathome.com.au) ■

Higher order



# thinking skills



**By Margaret Forster**

*Margaret is the Research Director of ACER's Assessment and Reporting research program.*

*In today's world it is necessary, but not sufficient, for students to achieve minimal competence in areas such as reading, writing and numeracy. Beyond the achievement of minimal competence, students also need to develop what are often called 'higher order' thinking skills including critical literacy, critical numeracy and cross-curricular competencies.*

*A useful conceptualisation of higher order thinking skills distinguishes two contexts in which these skills are employed: contexts where the thought processes are needed to solve problems and make decisions in everyday life; and contexts where mental processes are needed to benefit from instruction, including comparing, evaluating, justifying and making inferences (Wheeler & Haertel, 1993). The ability to employ higher order thinking skills in both these contexts is seen as essential in a rapidly changing world and the first context in particular is being adopted as a starting point for international assessment programs.*

**Higher order literacy and numeracy skills are now adopted as a starting point in most international assessment programs.**

## **International Adult Literacy Survey**

**Reading literacy** is no longer defined merely in terms of a basic threshold of reading ability which everyone growing up in developed countries is expected to attain. Rather, literacy is now equated with an individual's ability to use written information to function in society. (Kirsch, 2001, p.4)

## **Programme for International Student Assessment**

**Reading literacy** is an individual's capacity to understand, use and reflect on written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society. (OECD, 2003, p.15)

## **International Life Skills Survey**

**Numeracy** involves abilities that include interpreting, applying and communicating mathematical information in commonly encountered situations to enable full, critical and effective participation in a wide range of life roles. (ETS, 2004, p.14)

## **Programme for International Student Assessment**

**Mathematical literacy** is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage in mathematics in ways that meet the needs of that individual's life as a constructive, concerned, and reflective citizen. (OECD, 2003, p.15)

In Australia, school systems are increasingly focusing attention on higher order thinking skills. For example, the curriculum in Tasmania is organised around five cross discipline constructs or 'essential learnings'. The 'learnings' are intended to culminate in the lifelong outcomes of inquiring and reflective thinkers, effective communicators, self-directed and ethical people, responsible citizens, and world contributors. They are also intended to be future-oriented and connected to the real world, to focus on depth rather than breadth, to focus on connections and transfer of learning, and to reflect and embody values and purposes'. In the Tasmanian framework, higher order *thinking* is situated in the broader context of higher order *learning* with the five 'essential learnings' listed as: communicating, personal futures, social responsibility, world futures, and thinking.

It is easy to articulate a commitment to the development of higher order thinking skills but more demanding to translate this commitment into action. How do we develop a curriculum that both addresses subject knowledge and emphasises higher order thinking? And how do we monitor and assess the development of students' higher order thinking ability? In the case of assessment, the first challenge is to define exactly what it is we wish to focus on (how we define higher order thinking), the second is to select an appropriate method for gathering evidence of students' skills (what form of assessment we use).

Two areas of work undertaken at ACER provide two different approaches to the assessment of higher order thinking skills through paper and pen tests: tests of performance 'beyond the school curriculum', and tests of 'general academic abilities'. These approaches reflect two different contexts in which higher order thinking skills are employed.

### **Performance beyond the school curriculum**

Tests of performance 'beyond the school curriculum' assess the thought processes that are needed to solve problems and make decisions in everyday life. At ACER these skills are addressed in the Programme for International Student Assessment (PISA), an international study of the skills of 15-year-

olds in 46 countries<sup>2</sup>. Here the approach to assessing the higher order thinking skills is based on a dynamic model of *lifelong learning* in which new knowledge and skills necessary for successful adaptation to a changing world are continuously acquired throughout life. Rather than assessing 'school' knowledge, PISA aims to measure how well students perform beyond the school curriculum.

Although the domains assessed in PISA so far (reading literacy, mathematical literacy and scientific literacy) are closely related to subjects learned at school, PISA concentrates on the value of the skills acquired, through applying them in real-life situations<sup>3</sup>. The definitions of the assessment domains make this clear.

Reading literacy is defined as 'an individual's capacity to understand, use and reflect on written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society'. Mathematical literacy is defined as 'an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen'; and scientific literacy is defined as 'the capacity to use scientific knowledge to identify questions and to draw evidence-based conclusions in order to understand and to help make decisions about the natural world and the changes made to it through human activity' (OECD, 2003, p15).

In the case of 'reading literacy' students perform a variety of tasks with different kinds of text selected to reflect the range of written forms that individuals will encounter in adult life. Written forms include both continuous prose and 'non continuous' text such as lists, forms, graphs, and diagrams. The range of texts also samples texts constructed for different purposes such as a novel, personal letter or biography written for people's 'private' use; official documents or announcements for 'public' use; a manual or report for 'occupational' use; and a textbook or worksheet for 'educational' use.

Students are not assessed on the most basic reading skills. Rather, they are expected to demonstrate their proficiency in retrieving

information, forming a broad general understanding of the text, interpreting it, reflecting on the content and form of texts in relation to their own knowledge of the world, and arguing their own point of view.

In the case of mathematical literacy, tasks address three dimensions. First, the *content* of mathematics, as defined mainly in terms of broad mathematical concepts underlying mathematical thinking (such as chance, change and growth, space and shape, reasoning, uncertainty and dependency relationships), and only secondarily in relation to 'curricular strands' (such as number, algebra and geometry).

Second, the *process* of mathematics as defined by general mathematical competencies. These include the use of mathematical language, modeling and problem-solving skills. The idea is not, however, to separate out such skills in different test items, since it is assumed that a range of competencies will be needed to perform any given mathematical task. Rather, questions are organised according to the type of thinking skill needed (simple computations or definitions; connections to be made to solve straightforward problems; mathematical thinking, generalisation and insight).

Third, the *situations* in which mathematics is used, ranging from private contexts to those relating to wider scientific and public issues.

In the case of scientific literacy, tasks address three dimensions also. First, *scientific concepts*, which are needed to understand certain phenomena of the natural world and the changes made to it through human activity. Second, *scientific processes*, focusing on the ability to acquire, interpret and act upon evidence. Third, *scientific situations* selected mainly from people's everyday lives rather than from the practice of science in a school classroom or laboratory, or the work of professional scientists. As with mathematics, science figures in people's lives in contexts ranging from personal or private situations to wider public, sometimes global issues.

Examples of a PISA scientific literacy task and a PISA mathematics literacy task are provided on the facing page.

## An example of a PISA Mathematics Unit with one of the unit questions<sup>4</sup>

For health reasons people should limit their efforts, for instance during sports, in order not to exceed a certain heartbeat frequency.

For years the relationship between a person's recommended maximum heart rate and the person's age was described by the following formula:

$$\text{Recommended maximum heart rate} = 220 - \text{age}$$

Recent research showed that this formula should be modified slightly.

The new formula is as follows:

$$\text{Recommended maximum heart rate} = 208 - (0.7 \times \text{age})$$

### Example question

A newspaper article stated 'A result of using the new formula instead of the old one is that the recommended maximum number of heartbeats per minute for young people decreases slightly and for old people increases slightly.'

*From which age onwards does the recommended maximum heart rate increase as a result of the introduction of the new formula? Show your work.*

## An example of a PISA Science Unit with one of the unit questions<sup>5</sup>

Another way that Peter gathers information to improve road safety is by the use of a TV camera on a 13 metre pole to film the traffic on a narrow road. The pictures tell the researchers such things as how fast the traffic is going, how far apart the cars travel, and what part of the road the traffic uses. Then after a time, lane lines are painted on the road. The researchers can then use the TV camera to see whether the traffic is now different. Does the traffic now go faster or slower? Are the cars closer together or further apart than before? Do motorists drive closer to the edge of the road or closer to the centre now that the lines are there? When Peter knows these things he can give advice about whether or not to paint lines on narrow roads.

Suppose that on one stretch of the narrow road Peter finds that after the lane lines are painted the traffic changes as below.

Speed	Traffic moves more quickly
Position	Traffic keeps nearer edges of road
Distance apart	No change

*On the basis of these results it was decided that the lane lines should be painted on all narrow roads. Do you think this was the best decision? Give your reasons for agreeing or disagreeing.*

**Agree**

**Disagree**

**Reason**

## General academic abilities

The second approach to the assessment of higher order thinking skills focuses on the mental processes needed to benefit from instruction (such as comparing, evaluating, justifying and making inferences). At ACER these skills are assessed in tests of general academic abilities. These tests aim to measure how well students *reason*.

Two broad domains are sampled in these tests: reasoning in the 'natural world' (mathematics, science and technology); and reasoning in 'human world' (humanities, arts and social sciences). While these broad domains reflect a basic division in school curricula, the tests focus on the styles of thinking elicited when we reason in the two domains rather than the kinds of material that are considered, or school knowledge.

These styles of thinking can be seen as two ends of a continuum. Reasoning in the natural world elicits styles of thinking that typically can be described as 'objective' or 'scientific'. They include problem solving, and using logical analysis to draw inferences.

Categorisation, representation, transformation of information, relationships and objects are important. Reasoning in the human world elicits styles of thinking that typically can be described as 'subjective'. They include the interpretation of subjective human constructs, and holistic judgements about meaning. Vocabulary and socio-cultural understandings are important.

At the extreme ends of the continuum the styles of reasoning elicited are clearly differentiated. For example, at the human world end 'interpretive reasoning' is elicited (see Example A), whilst thinking typical of the 'natural world' (mathematics, science and technology) elicits styles at the other end of the continuum (see Example B).

Of course, the separation of styles of thinking within contexts is not watertight. For example, reasoning in both the natural and the human world includes 'critical thinking'; and a single piece of stimulus can address both the natural and human world and can elicit objective and subjective styles of reasoning.

And, of course, the assessment of higher order thinking skills can occur at different levels of specificity. The two examples illustrate the measurement of skills at a broad level of generality that samples a

## Example A

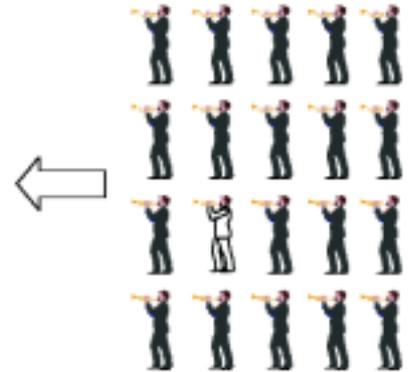


**The image above suggests that we:**

- A cannot escape conformity.**
- B can effectively disguise ourselves.**
- C appear to be anonymous but are unique.**
- D appear to be unique but are anonymous.**

The finger-print is known around the world, and its suggestions and significance can be interpreted from a range of different cultural perspectives. The image plays the apparent anonymity of a faceless, nameless human figure against the unique personal identity embodied by the fingerprint. Identifying the correct response depends on the candidate's ability to perceive this paradox within the image and then work out its most likely meaning. Distractors A and B are wrong because neither captures this central feature of the image; in fact, the uniqueness of a fingerprint suggests rather the opposite of conformity or disguise. D is wrong because the relationship between uniqueness and anonymity is reversed; it is the uniqueness that is fundamental and real rather than the anonymity.

## Example B



In this parade, Alfonso (white uniform) is second from the front, third from the right. Barthollo is in another, similar parade. He is fourth from the front, third from the back, second from the left and third from the right.

**How many people are there in Barthollo's parade?**

- A 20**
- B 24**
- C 28**
- D 42**
- E more than 42**

*The correct response to this item is B.*

In this item, the stimulus describes how a person's position in a group is designated. Then a description is given of a person's location in another group. The problem is to determine the size of this second group. There is enough information for the candidate to see that if the person is fourth from the front and third from the back, then there must be six rows marching forward. The other information shows that there are four columns. Thus there are twenty-four people in all.

range of skills. For example, a test of reasoning in the human world might draw on 'understanding' (recognition of explicit and implicit meanings through close reading of words and phrases, and global interpretations of text); 'interpretation' (interrelating, elaborating and extending concepts and ideas and drawing conclusions); and 'critical thinking' (making discriminations and judgements in the realm of plausible reasoning and/or making assessments and value judgements).

These general academic abilities could be conceptualised, measured and reported at a greater level of specificity. For example, it would be possible to measure and report students' ability in the specific area of 'empathy' (narrowly defined) rather than the more general area of 'interpersonal understandings', or 'socio-cultural understandings', or the still more general area of 'reasoning in the human world'.

The two different approaches to the assessment of higher order thinking skills described here – PISA tests of performance 'beyond the school curriculum', and tests of 'general academic abilities' – reflect two different contexts in which higher order thinking skills are employed. Ongoing challenges for work in this area include continued refinement of our understanding of higher order thinking and continued exploration of the contexts in which higher order thinking might be developed, assessed and monitored. ■

#### References:

- Kirsch, I. (2001). *The International Adult Literacy Survey (IALS): Understanding what was measured*. ETS Research Report. Princeton: Education Testing Service.
- ETS (2004). *Adult Literacy and Life Skills Survey: Numeracy*. [www.ets.org/all/survey.html](http://www.ets.org/all/survey.html)
- OECD (2003). *The PISA 2003 Assessment Framework – Mathematics, Reading, Science and Problem Solving Knowledge and Skills*. Paris: Organisation for Economic Co-operation and Development.
- Wheeler, P. and Haertel, G. (1993). *Resource Handbook on Performance Assessment and Measurement*. Berkeley, CA: The Owl Press.

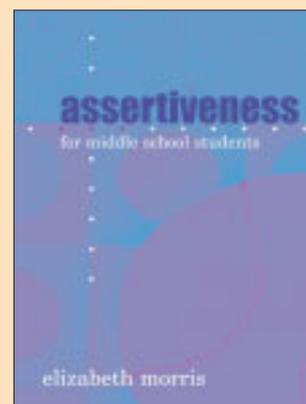
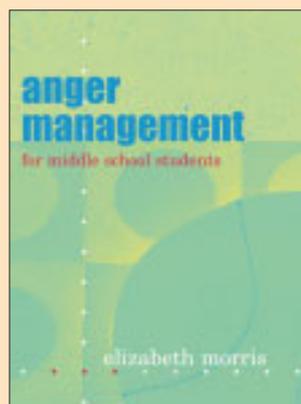
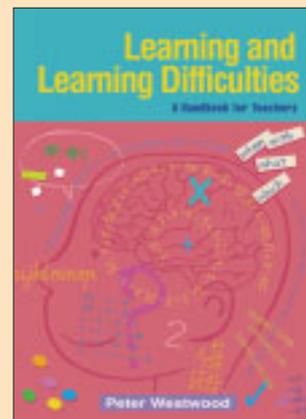
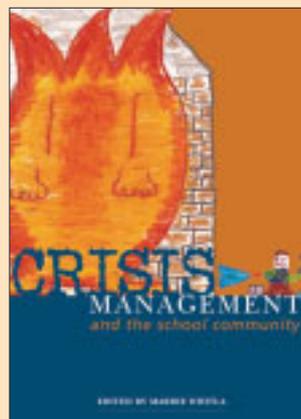
<sup>1</sup> For further information on essential learning see the Tasmanian Education Department website: [www.education.tas.gov.au](http://www.education.tas.gov.au)

<sup>2</sup> For further information on PISA see [www.pisa.oecd.org](http://www.pisa.oecd.org)

<sup>3</sup> Competencies more obviously across disciplinary boundaries also have a growing importance in PISA. PISA 2000 analysed students' approaches to learning and beliefs in their own abilities, motivation and engagement and other aspects of student attitudes, under the heading "self-regulated learning" and in 2003, PISA assessed students' ability to solve problems.

<sup>4</sup> OECD, 2003, p.64

<sup>5</sup> OECD, 2003, p.144



## New Releases from ACER Press

For enquiries contact:

### Customer Service

347 Camberwell Road, Camberwell VIC 3124

Toll Free 1800 338 402 Tel (03) 9835 7447

Fax (03) 9835 7499 Email [sales@acer.edu.au](mailto:sales@acer.edu.au)

[www.acerpress.com.au](http://www.acerpress.com.au)

# Positive school climate helps students achieve positive results



Photo: Walter Colalito



**By Sheldon Rothman & Julie MacMillan**

Sheldon is a senior Research Fellow at ACER and director of the LSAY project. Julie is a Research Fellow and is involved in the LSAY project.

## **The Longitudinal Surveys of Australian Youth (LSAY)**

*The findings are based upon data on more than 27,000 Year 9 students and 600 schools. The students were in Year 9 in 1995 or 1998, and took part in the Longitudinal Surveys of Australian Youth (LSAY).*

*As part of the study, students took a reading comprehension test and a mathematics test, and completed a questionnaire that provided other student background information. The questionnaire included items that describe students' quality of school life, such as 'My school is a place where I feel happy' and 'My school is a place where I feel safe and secure'. A positive school climate was measured by students' responses to these items.*

A recent ACER study of Year 9 students' results on reading comprehension and mathematics tests found that a positive school climate is associated with higher literacy and numeracy test scores. Socioeconomic status (SES), language background, Indigenous status, gender and educational aspirations were also found to have significant effects on achievement in both literacy and numeracy. Parents' education had a significant effect on literacy but not on numeracy.

These findings, released in December 2003, were contained in a report, *Influences on achievement in literacy and numeracy*. Three sets of questions formed the basis of the report.

- What factors contribute to differences in literacy and numeracy achievement among Year 9 students in Australian schools? Are these factors the same as factors that have been found to contribute to literacy and numeracy achievement in other studies, from Australia and overseas?
- How much of the variation in student achievement in literacy and numeracy can be attributed to differences between students and how much can be attributed to differences between schools?
- How much of the overall variation in school achievement in literacy and numeracy can be explained at both the student and school levels?

### Factors associated with literacy and numeracy achievement

An important finding in the study was that schools with a positive school climate achieved higher average scores on tests of reading comprehension and mathematics, suggesting a positive link between a school's climate and the achievement of its students. Schools that work to develop a positive climate may also develop greater academic achievement in their students.

The socioeconomic status (SES) of students was found to have a major influence on their achievement. SES influenced achievement in two ways. First, schools with a higher level of SES also scored higher on the tests. Second, students from higher SES families scored higher on the tests, regardless of the school they attended.

Parents' education levels were associated with students' reading comprehension test scores, but not mathematics test scores. Year 9 students whose fathers had completed some form of post-secondary education had higher reading scores than those whose fathers did not. Among the Year 9 class of 1998, students whose mothers had completed secondary school also had higher reading scores.

Language background had differential effects on student's achievement scores. On average, students had lower reading comprehension scores if they were from a language background other than English (LBOTE), but in mathematics there were no significant differences. Both reading comprehension and mathematics scores were influenced by the percentage of LBOTE students in the school, although the

effect for mathematics was about half the effect for reading.

Indigenous Australian students scored consistently lower than non-Indigenous students on tests of reading comprehension and mathematics, even after SES and other factors were considered.

Gender was shown to influence both literacy and numeracy achievement levels, but in opposite directions. Females scored higher than males in reading comprehension, while males scored higher than females in mathematics.

Educational aspirations were associated with achievement levels. Students with plans to complete Year 12 achieved higher scores in both reading comprehension and mathematics. Students who planned to attend university achieved even higher scores on both tests, approximately twice the effect of plans for Year 12 completion.

### How much could be explained?

Approximately one-sixth of the variation in scores on tests of reading comprehension and mathematics could be attributed to differences between schools, and the remaining five-sixths to differences between students. This is consistent with findings for Australian students who participated in international studies of student achievement.

A little more than one half of the differences between schools could be explained by differences in the student composition – school socioeconomic status (SES) and the proportion of students from language backgrounds other than English in the school – and the school climate. By far the greatest influence on between-schools differences was the school's average socioeconomic status.

Far less of the within-schools variance could be explained. The influences on literacy and numeracy achievement described above accounted for a little more than 10 per cent of the differences between students.

### Implications

There are a number of policy implications from this study. First, as already noted, schools that work to develop a positive climate may also develop greater academic achievement in their students.

The data reported here suggest that the schools with larger proportions of low-SES

students experience lower achievement scores, and that schools with larger proportions of high-SES students experience higher scores. As such, programs that provide greater school enrolment choices for children from low-SES families may assist in an increase in achievement scores.

Alternatively, schools that serve students from low-SES families may benefit from school-wide programs that ameliorate the effects of poverty, especially programs that emphasise literacy and numeracy achievement.

Finally, the magnitude of the differences in achievement test scores between Indigenous and non-Indigenous students indicates that much work is still required to increase literacy and numeracy achievement among Indigenous Australians. Literacy and numeracy programs are required not only in the early years of schooling but through the middle years as well.

Literacy and numeracy remain at the top of the agenda for Australian education, so it is imperative that researchers continue to examine the literacy and numeracy skills of Australian school students and understand better why some students achieve higher levels than other students. Understanding the influences on students' achievement in literacy and numeracy remains a major topic for education research in Australia. In turn, ensuring that all students, regardless of background, are literate and numerate must be a primary goal for Australian educational policy makers.

Further information can be found in the report, *Influences on achievement in literacy and numeracy*, by Sheldon Rothman and Julie McMillan. This is research report number 36 in the Longitudinal Surveys of Australian Youth (LSAY) research program, which is jointly managed by ACER and the Commonwealth Department of Education, Science and Training (DEST). The report and other information on the LSAY program are available at [www.acer.edu.au](http://www.acer.edu.au) ■

### Premier Bracks opens Dubai office



Victorian Premier Steve Bracks (centre) at the opening of ACER's Dubai office with (left) Mr Noel Campbell, Australian Ambassador to the UAE and Qatar, and (right) Dr Abdulla Al Karam, Director of Knowledge Village

Victorian Premier Steve Bracks opened ACER's Dubai branch office in Dubai's Knowledge Village in March. Noel Campbell, Ambassador of Australia to the UAE and Qatar was also in attendance.

Dubai is ACER's first overseas office. Its objective is to establish ACER as the leading provider of educational research and assessment services in the Middle East region.

The opening of the Dubai office follows a resolution by the ACER board of directors to establish its services in the Middle East with the development of an international testing instrument suitable for the region.

ACER has been working with the UAE Ministry of Education and Youth to develop a national assessment program for government schools and was encouraged by the Ministry to open a branch office in the UAE.

The Dubai office will be involved in contracted research in education in the Gulf States, conducting training programs and workshops for education professionals and

marketing a wide range of ACER products and services.

ACER appointed Mr Alan Egbert to the position of office Manager, ACER Dubai in February.

### UK consultants appointed

Two part-time consultants were appointed during May to promote ACER in the UK. One of the consultants, who was closely involved in establishing graduate-entry medicine programs in the UK and in the decision to use GAMSAT in the selection of students into these programs, will work to promote the two ACER medical tests already being used in that country. The other consultant will promote ACER's capabilities more generally, building networks, identifying business opportunities and marketing a range of ACER assessment services.

The new MSAT (Medical School Admissions Test) has been developed in consultation with UK medical schools for use in the selection of students into 4 and 5-year medicine degrees. It is a test of reasoning and communication skills. MSAT scores are used in conjunction with academic results and performance at interview. It will be mandatory for applicants for 2005 admission to three medical schools. Four graduate-entry medical schools use GAMSAT UK.

### Supporting Indigenous students in the early years



Photo courtesy of Cherbourg State School, Queensland

A longitudinal survey is monitoring the growth in English literacy and numeracy achievement of a group of Indigenous Australian students through their first years of primary school and the factors which may be associated with the development of these skills.

ACER researchers have completed a report *Supporting English Literacy and Numeracy Learning for Indigenous Students in the Early Years* detailing the findings of the first two years of the study.

The developing English literacy and numeracy skills of a group of 152 Indigenous students were assessed at five points over their first three years of school.

Among the key findings of the first report is that Indigenous Australian children begin school with similar levels of literacy and numeracy to their non-Indigenous classmates but fall behind as they move through the early years.

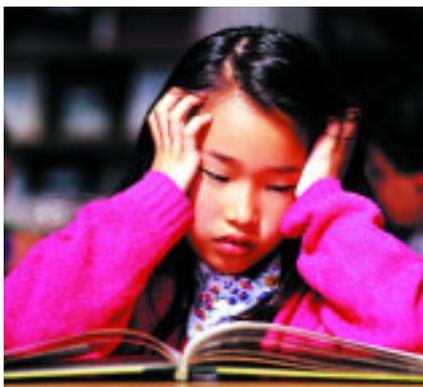
"In general, the English literacy and numeracy achievement of Indigenous students began at a similar level to the main sample, but by the fifth assessment in the third year of school, substantial gaps had

emerged,' said ACER's deputy chief executive Dr John Ainley.

The study identified initial achievement, attendance, attentiveness in class, language background, region and school as factors influencing achievement.

*Supporting English Literacy and Numeracy Learning for Indigenous Students in the Early Years* by Tracey Frigo, Matthew Corrigan, Isabelle Adams, Paul Hughes, Maria Stephens and Davina Woods is ACER Research Monograph number 57 published by ACER Press.

### Evaluating Literacy Advance and its effects over five years



The Catholic Education Commission of Victoria (CECV) released the report *Five Years On: Literacy Advance in the Primary Years*, by ACER researchers John Ainley and Marianne Fleming in April.

The report describes Phase Three of the Literacy Advance Research Project (LARP), which evaluates Literacy Advance, the CECV strategy to improve the literacy development of students in Victorian Catholic schools.

The study highlighted the importance of a good foundation in literacy beginning in the preparatory year or even earlier in the pre-school years, with benefits flowing through to the later years of schooling.

"Building a strong foundation in literacy in the earliest years of schooling is crucial to growth in literacy in later years. There is a window of opportunity in the first two years of schooling that can make a difference to the literacy development of children," Dr Ainley said.

The Literacy Advance Research Project was a collaborative venture of ACER, the Catholic Education Commission of Victoria and the University of Melbourne's Centre for Applied Educational Research.

### Masters appointed ACE national president

ACER's chief executive Professor Geoff Masters recently commenced a two-year term as National President of the Australian College of Educators (ACE). Professor Masters has been an active member of the College's National Council for the past three years.

On taking up his appointment, Professor Masters said "Given that the fundamental purpose of the College is to advance the profession nationally across all sectors and levels for the individual and collective success of Australia's educators, I will do everything that I can to build on the achievements of the College to date – especially with regard to enhancing professionalism and the quality of teaching."

### ACER appoints Research Director in early childhood education



ACER has appointed Dr Alison Elliott to the newly created position of Research Director, Early Childhood Education. Dr Elliott joined ACER in late 2003 from the University of Canberra where she was Professor of Early Childhood Education and Head of School. Dr Elliott has had a long connection with the Australian Early Childhood Association and has been editor of the Association's publication *Every Child* for the past eight years.

In welcoming Professor Elliott to ACER chief executive Geoff Masters said "Alison Elliott's appointment and the prospect of building our research in the early childhood area are exciting developments for ACER."

He said the appointment was in keeping with ACER's objective of expanding its research activities over the next few years.

Dr Elliott is based in ACER's Sydney office.

### Investigating post-school plans and aspirations



An ACER study conducted for the Smith Family has investigated the post-school plans of a group of young Australians in the late 1990s and the factors associated with the development of these plans.

The study found that family wealth has a weak effect on students' post-school plans although students from low-income families find it harder to realise plans for university study. Gender, ability and vocational orientation were the most important factors influencing post-school plans.

The study, *Post-School Plans: aspirations, expectations and implementation* was officially released by the Smith Family in March.

### ACER to manage national PISA 2006

ACER was advised recently of its successful bid to manage Australia's participation in the 2006 OECD PISA survey. This project will run in parallel with ACER's management of international PISA. The national project will collect, analyse and report on the

performances of Australian 15-year-olds in PISA 2006. The primary focus of this study will be on students' scientific literacy levels. ACER also managed the PISA national data collection and analysis in 2000 and 2003.

### ACER acquires Educare

ACER has acquired the education publishing business known as Educare. Current Educare publications include the monthly magazine for government and non-government schools, *Educare News*; the *National Register of Independent Schools of Australia*; the *School Supply Guide*; and the *School Activities Guide*. The acquisition was completed in May.



### International School Bangkok

The International School of Bangkok has engaged ACER to help the school in developing curriculum, assessment and pedagogy of writing. In the first phase of the project ACER will critique and refine existing documents. The second phase will be devoted to preparing a resource of instructional materials for the teaching of writing appropriate for different grade levels across the school.

### National Awards for Quality Schooling

ACER and the Australian College of Educators are again jointly managing the National Awards for Quality Schooling (NAQS) in 2004. The project is conducted on behalf of the Commonwealth Department of Education, Science and Training (DEST). ACER has responsibility for all stages of the assessment process. ACER staff are developing the judging strategy for the awards; the criteria applied to short-listing candidates and training the judges.

### New project on learning difficulties

ACER has been commissioned by the Victorian Department of Education to undertake a study of effective teaching and learning practices for students with learning difficulties. The study will be conducted in government, Catholic and independent schools and will identify effective practices in the early and middle years of school. Teacher professional development materials, programming advice and assessment and reporting tools will be developed to support the delivery of effective intervention programs.



*Improving Learning*

## Research Conference 2004

Supporting student wellbeing: What does the research tell us about the social and emotional development of young people?

**24–26 October 2004 – Radisson Playford Hotel, Adelaide**

### Keynote speakers

- Dr Michael Carr-Gregg  
Albert Road Centre for Health,  
South Melbourne
- Professor Michael Sawyer  
Adelaide University
- Professor Judy Harackiewicz  
University of Wisconsin, USA
- Emeritus Professor Brian Hill  
Murdoch University

### For further information contact

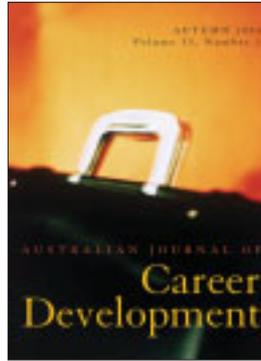
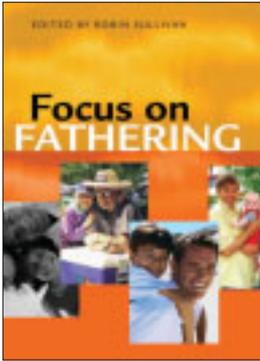
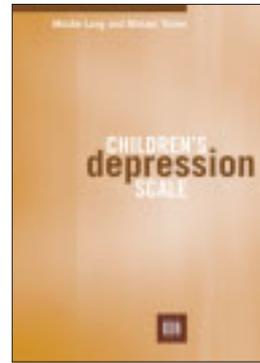
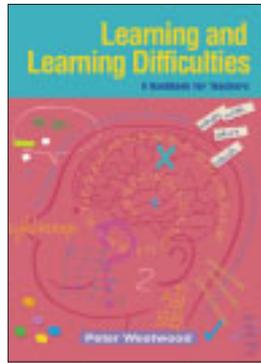
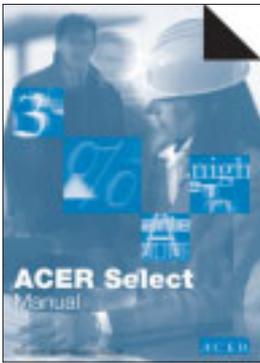
Margaret Taylor

Phone: 03 9835 7403

Fax: 03 9835 7456

Email: [taylor@acer.edu.au](mailto:taylor@acer.edu.au)

Web: [www.acer.edu.au](http://www.acer.edu.au)



# What do you know about ACER Press?

**ACER Press** publishes and distributes close to 4000 books, journals, tests, assessment instruments and programs. All of our publications are evidence based. **ACER Press** is supported by **ACER's** significant body of research.

If you are a teacher, psychologist, human resources practitioner, policy maker, parent, guidance officer, librarian or student **ACER Press** will have something for you.

Our market areas include **Education** (books, education programs and assessment materials), **Early Learning and Development**, **Parenting**, **Human Resources**, and **Psychology**.

For a catalogue or further information contact **Customer Service** on Toll Free 1 800 338 402, Tel (03) 9835 7447, Email [sales@acer.edu.au](mailto:sales@acer.edu.au) or visit our Website [www.acerpress.com.au](http://www.acerpress.com.au)

Australian Council for Educational Research



## ACER contact details

### Melbourne

19 Prospect Hill Road, Camberwell,  
Victoria, 3124 Australia

Telephone: +61 3 9277 5555

Facsimile: +61 3 9277 5500

347 Camberwell Road, Camberwell,  
Victoria, 3124 Australia

Telephone: +61 3 9835 7447

Facsimile: +61 3 9835 7499

### Sydney

1/140 Bourke Road, Alexandria,  
NSW, 2015 Australia

Telephone: +61 2 8338 6800

Facsimile: +61 2 9693 5844

Email: [communications@acer.edu.au](mailto:communications@acer.edu.au)

Web: [www.acer.edu.au](http://www.acer.edu.au)

ABN: 19 004 398 145