Quality and Equity:

What does research tell us?

3–5 August 2014
Adelaide Convention Centre

Research Conference 2014

Australian Council *for* Educational Research

ACER

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FOREWORD

FOREWORD

Professor Geoff Masters AO

Australian Council for Educational Research

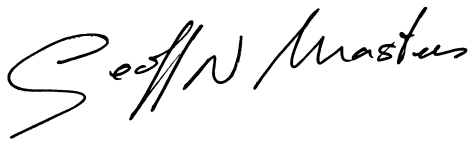
An important conclusion from the OECD's Programme for International Student Assessment (PISA) is that some countries are succeeding not only in raising overall levels of national performance, but also in improving levels of equity over time (OECD, 2012). As Australia grapples with the question of how to achieve improvements in both quality and equity in education, Research Conference 2014 brings together leading researchers and practitioners to share their evidence and experience in relation to this important challenge.

The papers from Research Conference 2014 report on Australian and international research into such topics as learning in the early years, the wide spread in achievement between our highest and lowest performing students at any year level, and re-emerging gender issues in mathematics.

Research presented at this conference includes evidence from both large and small scale studies of quality and equity, including for Māori and Aboriginal and Torres Strait Islander peoples.

This year we have expanded the Sunday program to include specific panel discussions on aspects of the conference theme.

We welcome you to Research Conference 2014 and trust that the research presentations and conversations with other participants will generate new knowledge and guide further research and action in your context.



Organisation for Economic Co-operation and Development (OECD). (2012). *Equity and quality in education: Supporting disadvantaged students and schools.* Paris: Author. doi: 10.1787/9789264130852-en

PRE-CONFERENCE PRESENTATIONS

Sunday 3 August

QUALITY AND EQUITY IN VOCATIONAL EDUCATION AND TRAINING (VET)

Sheldon Rothman

Australian Council for Educational Research

Dr Sheldon Rothman is a Principal Research Fellow in the Policy Analysis and Program Evaluation research program at ACER. He has highly developed expertise in the management and analysis of large-scale datasets; experience in the interpretation of results of analyses; and experience in the analysis of data to inform policy. At ACER, Sheldon has concentrated on school-to-work transition. He managed the Longitudinal Surveys of Australian Youth program for six years, and the Victorian On Track post-school destinations survey program for five. He was the lead author of the National report on social equity in VET 2013*, which was the first report to provide information on the participation, achievement and transitions from the Australian vocational education and training system for six groups in the Australian population.*

David Curtis

Flinders University, South Australia

Dr David Curtis is Associate Professor in Educational Research in the School of Education at Flinders University, South Australia.

He worked in the higher education sector for 25 years and then worked for 10 years as a consultant and senior research fellow for the Australian Council for Educational Research and the National Centre for Vocational Education Research before returning to higher education.

He is interested in youth transitions, equity, assessment and the measurement of achievement, the development and assessment of generic skills, and in evaluating institutional effectiveness. Much of the work David has undertaken in these areas is policy-focused. He is committed to undertaking analyses that lead to quality information upon which sound policy development can occur.

Lori Hocking

VETnetwork Australia

Lori Hocking is currently Chief Executive Officer of VETnetwork Australia and has been in this role since 2009. VETnetwork Australia is the peak national body representing Vocational Education and Training (VET) in Schools, with some 1500 members across Australia, including teachers, trainers, VET practitioners and VET administrators.

Lori began her career as a teacher at Taperoo High School in South Australia and subsequently moved into various regional VET advisory roles, supporting schools with VET program implementation. In the early stages of her career, VET was viewed as an 'alternative pathway' for students and young people at risk of disengaging with mainstream education.

Since assuming the role as CEO of VETnetwork Australia, Lori has attempted to expand and develop the organisation to enable it to better address the issues and challenges experienced by VET in Schools professionals, including:

- *designing high-quality, relevant professional learning for VET in Schools professionals*
- *building stronger relationships with business and industry that better support Vocational Education and Training*
- *publicly promoting the value and importance of Vocational Education and Training.*

Dave Tout

Australian Council for Educational Research

Dave Tout is Senior Research Fellow and Manager, Vocational, Adult and Workplace Education, ACER. He has had over 40 years experience in the education sector, with most of those being in the VET sector, and has worked in a range of programs in schools, TAFEs, community providers, universities, Adult Multicultural Education Services (AMES) and industry. He has had wide experience not only in teaching and training, but also in working at state, national and international levels in research, curriculum, assessment and materials development.

Dave joined ACER in 2008 and has worked on a number of projects, including the online Adult Literacy and Numeracy Assessment Tool for the Tertiary Education Commission in New Zealand; and the development of online literacy and numeracy assessment tools for both disengaged young people and for adults. He also helped manage and implement the mathematical literacy item development component of the 2012 Programme for International Student Assessment (PISA), in which mathematical literacy was the major domain to be assessed. Dave was a member of the Numeracy Expert group for the numeracy components of both the international Adult Literacy and Lifeskills (ALL) survey and the 2011–12 Programme in Assessment of Adult Competencies (PIAAC) surveys.

Abstract

The first *National report on social equity in VET,* published in 2013, provides baseline data on the participation, achievement and transitions of specific groups of VET learners in the Australian population. In this session, members of the panel will present findings of that report, and findings from other research on the school-to-work transition for specific groups of learners, and efforts to ensure that all participants have access to quality VET programs. The discussant, Lori Hocking, will offer a practitioner's perspective on the issues raised during the session. Panel members will answer questions from the floor.

NEGOTIATING COMPETING EDUCATION VALUES: EQUALITY, EQUITY, QUALITY AND INDIGENOUS RIGHTS

Peter Buckskin

PSM FACE

University of South Australia

Professor Buckskin is a Narungga man from the Yorke Peninsula in South Australia. He is currently the Dean: Indigenous Scholarship, Engagement and Research at the University of South Australia. As an educator and professional bureaucrat for more than three decades, Professor Buckskin's passion has been the pursuit of educational excellence for Aboriginal students. In 2007, he was elected as a Fellow of the Australian College of Educators. In recognition of his work, Professor Buckskin has received the Commonwealth Public Service Medal (2001), the Frank G Klassen Award for Leadership and Contribution to Teacher Education from the International Council on Education for Teaching (2003); and the National Deadly Award for Aboriginal and Torres Strait Islander Education (2005). In 2011, Professor Buckskin was awarded a $7.5 million grant to increase the number of Aboriginal and Torres Strait Islander teachers and leaders in Australian schools.

Gary Thomas

Queensland University of Technology

Associate Professor Gary Thomas is the Associate Director, Academic Indigenous Knowledges in the Learning and Teaching Unit at the Queensland University of Technology.

Gary has worked at the University of Southern Queensland, the University of Melbourne and La Trobe University. Prior to commencing at QUT, Gary held dual Directorships in Indigenous Education and Equity and Student Support Services at La Trobe University, and performed the role of Acting Pro Vice-Chancellor (Equity and Student Services) for 10 months.

Gary has made significant contributions to Indigenous education at both national and international levels over many years. He is the National Secretary of the National Aboriginal and Torres Strait Islander Higher Education Consortium (NATSIHEC AC). He has been instrumental in the development of the first taught programs of the World Indigenous Nations University. He was an Honorary Auditor for the Australian Universities Quality Agency (AUQA) and is currently a Registered Expert for the Tertiary Education Quality and Standards Authority (TEQSA).

Zane Ma Rhea

Monash University, Victoria

Dr Zane Ma Rhea has worked with Indigenous people over the last 35 years in various capacities. She is recognised internationally for her expertise in comparative education and for improving the quality of education and other human services for Indigenous people using a rights-based framework, focusing on organisational change management, professional development and the recognition and preservation of Indigenous knowledge in mainstream organisations through meaningful partnerships with Indigenous families and communities.

She teaches across Indigenous education, leadership, and sustainability programs at Monash University and undertakes research in Indigenous education, Indigenous studies and organisational development.

Abstract

This panel will examine the ideals of educational equality, educational equity and Indigenous *sui generis* rights using the Australian higher education system as the working example. The ideals of educational equality and educational equity are laden with inherent contradictions when considering power relations and the rights and needs of traditionally marginalised peoples across the world under conditions of globalisation and postcoloniality.

Within the neo-liberal economic reform agenda globally, there has been significant focus on raising the general standard of higher education through productivity and accountability measures. These measures have exposed the failure of states to recognise the aspirations and meet the higher education needs of Indigenous and other minority populations. This paper examines the arguments for both educational equality and educational equity in consideration of newer international legal mechanisms that are recognising the unextinguished rights of Indigenous peoples after colonisation.

Through undertaking an analysis of the concept of, and theories underpinning, both educational equality and equity using Australian higher education as the example, panellists will bring a wealth of evidence-based work to the argument for the need for a fundamental reformulation of the engagement of the higher education system with Indigenous people through a remobilised concept of commensurability enshrined in a concept of 'both ways' educational choice for Indigenous students.

LEARNING BEFORE THE SCHOOL YEARS: BENEFITS FOR LIFE

Joseph Sparling

The University of Melbourne, Victoria

Joseph Sparling, PhD, is a professor at the Melbourne Graduate School of Education at the University of Melbourne (Australia) and Senior Scientist Emeritus at the Frank Porter Graham Child Development Institute at the University of North Carolina (USA). Professor Sparling's early career experience includes work as a public school teacher and principal. His 50-year career has been focused on bringing educational opportunities to vulnerable children from birth to age 5. With Professor Craig Ramey, he developed an early educational program known as the Abecedarian Approach. This program has been evaluated in a series of randomised scientific studies conducted by colleagues in 10 universities including Harvard, Yale, and Stanford in the USA, and published in more than 200 peer-reviewed journal articles. The research has shown that educational support exemplified in the Abecedarian Approach in the first 5 years of life results in long-lasting improvement in the school and life achievement of at risk and vulnerable children. Sparling is now working with Australian colleagues to implement the Abecedarian Approach in Australia. Recently, the University of Melbourne and the NT Department of Education were awarded an Australian Research Council Linkage grant to study the Abecedarian Approach in remote Aboriginal towns in the Northern Territory, while other funded studies are being conducted in Canada and China. Sparling's publication LearningGames® (a component of the Abecedarian Approach) was recently published in Australia for a general audience by ASG Resources and by the NT Department of Education in a specially adapted Aboriginal version.

Susan Krieg

Flinders University, South Australia

Susan Krieg is Associate Professor and Program Coordinator of the Early Childhood programs at Flinders University. Prior to her 2006 Flinders appointment, Susan worked at Edith Cowan University (2000–2006), leading the development of a Bachelor of Education specifically designed to develop continuity between the early and primary years. Susan's experience includes teaching and leadership at local, state and national levels in her work as a District Coordinator, School Principal, Curriculum Manager and President of the Junior Primary Principals' Association of South Australia. Her work as School Principal in a large suburban integrated early childhood program has been researched and documented in research reports, including 100 Children go to school: Connections and disconnections in literacy development in the year prior to school and the first year of school *(S. Hill, B. Comber, B. Louden, J. Reid, & J. Rivalland, published by Department of Employment, Education, Training and Youth Affairs, 1998). Her educational leadership, research and teaching within the university context focus on social justice and repositioning children in the learning process as a way of achieving more equitable outcomes in early childhood education.*

Marion Meiers

Australian Council for Educational Research

Marion Meiers has had a career-long focus on the teaching and learning of literacy skills at all levels of education. She has contributed actively to the teaching of English and literacy as a secondary English teacher, P–12 curriculum consultant at regional and state levels, leader of national English professional association research projects, university lecturer, presenter at national and international conferences, and an editor of professional journals. Her extensive publications record includes journal articles, reports and textbooks. In recognition of her work, she was awarded life membership of the Australian Literacy Educators' Association in 2011.

As a Senior Research Fellow at ACER, Marion's research work has included projects investigating literacy education in the early years of schooling, longitudinal studies, curriculum development, assessment, program evaluation and teachers' professional learning. In recent years, she has undertaken some international work, for example with the ACER India office in Delhi this year.

Abstract

How important is it for parents and childcare workers to engage in play, talking and reading with children before they reach school age?

Professor Joseph Sparling, who has spent his whole career improving educational opportunities for vulnerable children from birth to age 5, will lead this session and discussion, looking at the evidence from local and international research. The Abecedarian Approach commenced in the United States with four basic pillars: language priority, learning games, conversational reading and enriched caregiving. The long-term benefits he observed over decades have led Professor Sparling to use this approach in Australia, supporting parents and care-givers to make language the number-one priority, surrounding every event in a child's day with words, in a playful way.

Associate Professor Susan Krieg will share findings from a South Australian research project in which the researchers tracked children attending combined preschool/childcare centres as they made their transition to school. Children experiencing social disadvantage benefited most from quality early childhood programs and made a successful start at school.

Marion Meiers will report on the ACER Longitudinal Literacy and Numeracy Study: Transitions from Preschool to School. Using data collected during one-to-one teacher-student interviews focused on literacy activities – including responding to the narrative and ideas in a picture storybook – the researchers have developed scales showing growth in literacy learning over time.

CONVERSATION

Geoff Masters AO

Australian Council for Educational Research

Professor Geoff Masters is Chief Executive Officer and a member of the Board of ACER – roles he has held since 1998. He has a PhD in educational measurement from the University of Chicago and has published widely in the fields of educational assessment and research.

Professor Masters has served on a range of bodies, including terms as President of the Australian College of Educators; founding President of the Asia-Pacific Educational Research Association; member of the Business Council of Australia's Education, Skills and Innovation Taskforce; member of the Australian National Commission for UNESCO; and member of the International Baccalaureate Research Committee. He is currently a member of the Advisory Board for the Science of Learning Research Centre, the ABC Digital Education Advisory Group and the national Board of Life Education Australia.

He has conducted a number of reviews for governments, including a review of examination procedures in the NSW Higher School Certificate (2002); an investigation of options for the introduction of an Australian Certificate of Education (2005); a national review of options for reporting and comparing school performances (2008); and reviews of strategies for improving literacy and numeracy learning in government schools in Queensland (2009) and the Northern Territory (2011). He is currently undertaking a review of senior secondary assessment and tertiary entrance procedures in Queensland.

Professor Masters is an adjunct professor in the Queensland Brain Institute. His contributions to education have been recognised through the award of the Australian College of Educators' Medal in 2009 and his appointment as an Officer of the Order of Australia in 2014.

The Hon. Julia Gillard

Former Prime Minister of Australia, 2010–2013

Julia Gillard was sworn in as the 27th Prime Minister of Australia on 24 June 2010 and served in that office until June 2013.

As Prime Minister and in her previous role as Deputy Prime Minister, Ms Gillard was central to the successful management of Australia's economy, the 12th biggest economy in the world, during the global financial crisis and as Australia positioned itself to seize the benefits of Asia's rise. Ms Gillard developed Australia's guiding policy paper, Australia in the Asian century. *Ms Gillard delivered nation-changing policies, including reforming Australian education at every level from early childhood to university education; creating an emissions trading scheme; improving the provision and sustainability of health care, aged care and dental care; commencing the nation's first national scheme to care for people with disabilities; restructuring the telecommunications sector; and building a national broadband network. In foreign policy, Ms Gillard strengthened Australia's alliance with the United States, secured stronger architecture for the relationship with China, upgraded Australia's ties with India, and deepened ties with Japan, Indonesia and South Korea. Ms Gillard has represented Australia at the G20, winning Australia's right to host the 2014 meeting; the East Asia Summit; APEC; and NATO-ISAF, and chaired CHOGM. Under Ms Gillard's leadership, Australia was elected to the United Nations Security Council.*

Ms Gillard is the first woman to serve as Australia's Prime Minister or Deputy Prime Minister. In October 2012, Ms Gillard received worldwide attention for her speech in Parliament on the treatment of women in professional and public life.

CONFERENCE PAPERS

Monday 4 August

QUALITY AND EQUITY THROUGH EVIDENCE-BASED PRACTICE

Abstract

Over the past two decades, a number of countries have attempted to drive improved outcomes and to close achievement gaps in schools using strategies adopted from the world of business, including: setting explicit expectations and targets for improvement; developing better measures of outcomes; increasing transparency; giving employees autonomy to find local solutions; imposing performance cultures in which individuals are held accountable for improved results; and implementing results-based incentive schemes (rewards and/or sanctions) to promote greater effort. At least some of these strategies have clearly not improved performances in schools. In Australia, performance levels have either flat-lined or declined over the past decade, and there has been little or no reduction in Indigenous or socioeconomic gaps. This presentation will argue that 'macro' strategies of these kinds are often ineffective because they fail to change practice on the ground. They underestimate the importance of capacity building, the creation of collaborative learning cultures and the implementation of proven teaching and leadership practices. In short, improved quality and equity depend on evidence-based 'micro' reform.

Professor Geoff Masters AO

Australian Council for Educational Research

Reforming schools and improving student achievement levels are priorities for governments around the world. But not all countries approach these challenges in the same way. In a number of English-speaking countries, particularly the United States of America, the United Kingdom, New Zealand and Australia, school reform efforts over the past 20 years have included a number of common reform strategies.

One of those strategies has been to attempt to drive improvement by setting explicit curriculum expectations and targets for improvement. Curriculum 'standards' have been developed to make clear what teachers should teach and students should learn in each year of school, and targets for improvement have been set, such as the US government's 'adequate yearly progress' targets for schools and the Australian government's goal to be among the top five countries in the world by 2025.

To determine whether expectations and targets are being met, new performance measures have been introduced, usually in the form of student test scores. These measures have been used to monitor trends over time, establish how much 'value' each school contributes to student outcomes, and benchmark achievement levels against performances in other countries.

Better measures, in turn, have led to a push for greater public transparency about how schools are performing. In Australia, this has led to the introduction of the My School website. In the UK, league tables of 'value-add' measures have been used to compare schools and promote parental choice.

In parallel with these strategies, governments have given schools and teachers more autonomy to decide the best ways to improve student results. Self-managing schools were introduced in Victoria 20 years ago. Charter schools and other forms of self-managing schools have operated in the USA, Canada, the UK and New Zealand over the same period.

Increased autonomy has been accompanied by strengthened accountability arrangements. Governments have promoted 'performance cultures' in which system officials, school leaders and classroom teachers have been evaluated against explicit performance expectations and held accountable for improved outcomes – usually in the form of improved test scores.

And incentives for improvement have been introduced. These have included financial rewards for school improvement, teacher performance pay linked to improved test results, and sanctions such as the withholding of funding, increased government intervention, the dismissal of school leaders and the closing of schools.

The problem is that, during the period in which these 'macro' reforms have been implemented, there has often been little or no improvement in student performance. In Australia, results have either flatlined or declined over the past decade, and achievement gaps between Indigenous and non-Indigenous students, and between students from low and high socioeconomic backgrounds, have remained unchanged.

So why have results not improved? Part of the reason, I believe, is that too little attention has been given to the mechanisms by which macro reforms of this kind are expected to change day-to-day classroom teaching and school leadership practices. Too often, it has been assumed that approaches adopted from the world of business will be equally relevant to the work of schools. And too little attention has been paid to international experience and research evidence about the importance of micro-reform.

Take, for example, the evidence on incentive schemes. A major evaluation by the US National Research Council (Hout & Elliott, 2011) concluded that the international evidence over the past two decades was 'not encouraging about the ability of incentive programs to reliably produce meaningful increases in student achievement'. Worse, the report concluded that incentive programs had produced a range of undesirable school practices designed to maximise test scores rather than produce real improvements in teaching and learning.

The assumption underpinning most incentive schemes is that people know what to do and that what is lacking is effort. Carrots and sticks are designed to get employees to lift their game. But the evidence in schools – as well as in business – is that a focus on results is not enough; improvement depends on the micro-strategies of local capacity building and the creation of collaborative learning environments.

As a second example, consider the seemingly obvious and popular strategy of specifying what all students should learn in each year of school. In an effort to raise achievement levels, many countries benchmark their grade-level expectations against the curricula of high-performing countries. But a common outcome, particularly in developing countries, is that teachers find themselves teaching material several grade levels ahead of many – and in some countries, most – students. Inevitably, students, teachers and schools are then judged to be 'failing'.

Again, the research is clear. Learning is maximised when students are given opportunities and challenges appropriate to their current levels of achievement. In any given year of school in Australia, the least advanced 10 per cent of students are five to six years behind the most advanced 10 per cent of students. Rather than teaching, assessing and grading all students against the same grade-level expectations, improved learning depends on the micro-strategy of establishing and understanding where students are in their learning and then meeting individuals at their points of need.

Unless macro-strategies are effective in enhancing the quality of teaching and leadership, creating professional learning cultures in schools, and promoting the use of evidence-based methods – in other words, driving micro-reform – they are unlikely to lead to improved quality and equity in our schools.

References

This presentation will draw on the following references.

Barber, M., & Mourshed, M. (2007). *How the world's best-performing school systems come out on top*. London: McKinsey & Company.

Fullan, M. (2011). Choosing the wrong drivers for whole system reform. CSE Seminar Series 204. Melbourne: Centre for Strategic Education.

Hanushek, E. A. (2002). The failure of input-based schooling policies. Working Paper No. 9040. Cambridge, MA: National Bureau of Economic Research.

Hout, M., & Elliott, S. W. (Eds.) (2011). *Incentives and test-based accountability in education*. Report of the Committee on Incentives and Test-Based Accountability in Public Education. Washington: The National Academies Press.

Mourshed, M., Chijioke, C., & Barber, M. (2010). *How the world's most improved school systems come out on top*. London: McKinsey and Company.

Schleicher, A. (2013). Lessons from PISA outcomes. *OECD Observer*, No. 297 Q4.

Whelan, F. (2009). *Lessons learned: How good policies produce better schools*. London: Fenton Whelan.

Woessman, L. (2001). Why students in some countries do better. *Education Matters, 1*(2), 67–74.

ACHIEVING QUALITY AND EQUITY FOR MĀORI SECONDARY SCHOOL STUDENTS IN NEW ZEALAND

Mere Berryman

The University of Waikato, Hamilton, New Zealand

Associate Professor Mere Berryman has advanced along a unique career pathway that has both challenged and enabled her to make substantial and distinctive contributions to solution-focused theory and research in education. Her research and teaching have been firmly focused on finding new ways to improve educational outcomes for Māori students and families in both Māori-medium and English-medium educational settings. As a researcher, she has collaborated extensively with school leaders, classroom practitioners, families, communities and other professionals to bring about education reform. She has worked with educators in New Zealand and also in parts of Canada and the USA.

Mere Berryman is currently an Associate Professor in the Faculty of Education at the University of Waikato in Hamilton, New Zealand, where she has contributed as the director of Te Kotahitanga *since 2012. The work of this reform has been widely published.*

In 2014, Mere became an academic director within a larger New Zealand Ministry of Education funded research and development program known as Building on Success. This program seeks to improve the educational achievement of Māori students in mainstream secondary schools by working with their school leaders, teachers and Māori communities.

Abstract

Achievement disparities between specific groups of students continue to be consistently documented across the globe. For many, quality and equity have not been achieved, as education continues to underserve specific groups of clearly identifiable students. For New Zealand's Indigenous Māori students, this is neither a recent phenomenon nor is it confined to education.

This paper focuses on the results of a secondary school reform program known as *Te Kotahitanga* (Unity of Purpose). This reform was undertaken using an iterative research and development model aimed at school-wide intervention. Data are presented from 2010 to 2013, when *Te Kotahitanga* Phase 5 schools were in their fourth year of an accelerated program implementation. A mixed-method approach is used to understand the extent to which schools have successfully included and thus enabled higher rates of Māori students so that they are enjoying and achieving education success as Māori.

Changes in pedagogy have resulted in national qualification results for Māori students showing year-on-year improvements. A number of individual schools clearly show that the achievement gap between Indigenous Māori students and their non-Māori peers can be closed. This research has important implications for other countries grappling with this same problem of quality and equity for all.

With the signing of the Treaty of Waitangi in 1840, the Crown promised Māori equal benefits from their participation in the new nation of Aotearoa, New Zealand. However, since this time Māori have faced educational, social, economic and political disadvantage in their own country (Bishop & Glynn, 1999). In addition to the obvious social justice issue for Māori of not being able to benefit fully from participation in a modern nation state, this situation is now extremely serious for the nation as a whole. Twenty-two per cent of public school children are now of Māori descent; in the future a very large proportion of the population will be either an asset to their country or a liability. In this sense, the major social challenge facing New Zealand today is the continuation of these disparities within our nation, primarily between the descendants of the European colonisers (*Pākehā*) and the indigenous Māori people (Bishop, Berryman & Wearmouth, 2014).

Māori do not face these educational disparities alone. Shields, Bishop and Mazawi (2005) use the term 'minoritised' in their book to examine the pathologising by educators that continues to see three specific groups of indigenous students from around the world marginalised and failing. They explain that while these groups are examples, there are many more students who may not be in the numerical minority, but who are being minoritised so that their prior knowledge, cultural experiences and perspectives are pathologised and ascribed characteristics of lesser worth. Sleeter (2011) agrees, suggesting '[a] pressing problem facing nations around the world today is the persistence of educational disparities that adversely affect minoritised students and by extension, the nation as a whole' (p. 1). Sleeter suggests that minoritised populations generally include 'Indigenous students, students of colour, students whose families live in poverty, and new immigrants whose parents have relatively low levels of schooling' (p. 1). As populations of minoritised students expand, so too does the urgency to find responses to address these disparities.

The beginnings of *Te Kotahitanga*

Te Kotahitanga aimed to respond to these disparities by engaging with secondary-school teachers and leaders with the aim of reforming conditions within classrooms and schools in order for Māori students to experience greater engagement and success in secondary schooling.

The program began in 2001 with interviews with groups of Year 9 and 10 Māori students, members of their families, their principals and teachers, about the experiences of being Māori at school. From these interviews, a series of narratives of experience were developed (Bishop & Berryman, 2006). In contrast to the majority of their teachers, who tended to dwell upon the problems that Māori students' deficiencies caused, Māori students clearly identified that the main influence on their educational achievement was the quality of their in-class relationships and interactions with teachers. Māori students also explained how, by changing the ways they related to and interacted with students in their classrooms, their teachers could create contexts for learning in which Māori students' educational achievement could improve.

Reforming classroom pedagogy

From these interviews, an Effective Teaching Profile (ETP) was developed (Bishop, Berryman, Tiakiwai & Richardson, 2003). This ETP then formed the basis of the *Te Kotahitanga* professional learning and development (PLD) program. The program began by supporting teachers to focus on those things that they do have agency over, such as classroom pedagogy, rather than theorise about the perceived deficits of Māori students or their home communities. Through their implementation of the ETP, teachers were also supported to develop familial-like, or *whanaungatanga*-type, relationships of respect and trust with these students and their families (Bishop, Ladwig & Berryman, 2014). In so doing, teachers began adding value to and widening existing pedagogical skills. This included reinforcing these changes by using Māori student evidence to reflect critically on their own praxis in an ongoing and iterative way.

Te Kotahitanga teachers soon began to demonstrate that by working within contexts of relational trust, respect and interdependence they could begin to promote pedagogical responses whereby individuals (teachers and students) could be more self-determining and power could be shared; culture would count in their classroom (the culture of the student but also the culture of teachers) rather than rely only on transmission pedagogies; learning could be interactive, dialogic and spiral; and participants (teachers and Māori students) could be connected and committed to one another through the establishment of a common vision for what constituted educational excellence. We have termed this response a 'culturally responsive pedagogy

of relations' (CRP of R) (Bishop, Berryman, Cavanagh & Teddy, 2007).

Reforming schools

Te Kotahitanga has maintained an iterative approach in which the findings from one phase of the project have been used to improve and develop subsequent phases. This iterative approach to educational disparities has been organic in the sense that the initiative is not linear or prescriptive but responsive to schools and their evidence of Māori students' attendance, retention, engagement and achievement.

Given the aspirational objective and the extent, depth and urgency of the changes required across the numbers of schools and different phases that have been involved, we then moved to understand how a PLD and research response at the classroom level could be both sustained and scaled up within the school, and then accelerated across schools and from one phase to the next (Bishop, O'Sullivan & Berryman, 2010).

In response to the pedagogical reform at the classroom level, the school's leaders were then supported to incorporate a CRP of R in their own attempts with teachers to reform the school's systems and institutions. School leadership teams have demonstrated that evidence-based co-construction meetings and the development of strategic goals and action plans at multiple levels of the school can be used to effectively own and solve pedagogical and school leadership problems (Coburn, 2003). Meetings such as these have been used to re-institutionalise the decision-making processes and institutions within the school and then externally, by seeking to engage with their Māori communities (Durie, 2006).

A recent analysis of the effect of the implementation of the CRP of R in Phase 3 and 4 schools showed that when implemented most effectively, the schooling experiences of Māori students improved dramatically with attendance, retention, engagement and achievement all showing very positive gains in relation to a comparison group of schools (Bishop, Berryman, Wearmouth, Peter & Clapham, 2011). At the end of 2009, *Te Kotahitanga*, as a long-term, iterative, research and development program in over 30 New Zealand secondary schools, was able to apply what we had learned throughout all previous phases (Bishop, Berryman & Wearmouth, 2014) into an accelerated Phase 5, with 16 new schools.

Method of inquiry

In order to examine the degree to which a CRP of R was being implemented within the classrooms of Phase 3 and 4 schools, we developed and trialled two questionnaires and a walk-through observation tool using well-defined categories and related rating scales. The questionnaires focused on the changes in students' and teachers' classroom experiences, and the walk-through observations focused on identifying changes in teachers' pedagogy according to the CRP of R. In this paper, data from these questionnaires and observations are presented from Phase 5 schools, from 2012 and again in 2013. In addition, Māori students' achievements, on national assessments at Years 11 to 13, are compared with a decile[1]-weighted comparison group. These data examine the changes that Māori students and teachers had been experiencing in their schools as a response to the changes in pedagogy and achievement that had taken place.

Results

Results from questionnaires and walk-throughs

The majority of Year 9 and 10 Māori students surveyed in 2012 (600) from across the 16 schools said that they sometimes to always experienced schools where they felt good to be Māori; where Māori students had opportunities to do the things they wanted to do and were achieving; where teachers knew and respected them, cared for them and knew how to help them learn; and where teachers expected that they could and would achieve. A slightly lesser number said their teachers listened to students; knew how to make learning fun; let students help each other with their work; and shared their results with them so that they could achieve better results. Interestingly, results from the teacher survey revealed that teachers thought they were achieving even more positively in these domains than did their students. Importantly, there was very little difference between the responses of Māori students and non-Māori students.

Evidence from the walk-through observations revealed 216 teachers across the Phase 5 schools were providing

1 From the New Zealand census figures, schools receive a decile weighting and are funded according to the socioeconomic standing of the communities in which they are located. Decile-weighted funding is an attempt to achieve greater equity.

learning contexts in which a CRP of R and more discursive teaching interactions had become the new pedagogy. While a further 178 teachers were still learning to integrate these practices, of concern were the 20 teachers who showed no evidence of having changed their practices. In 2013, when these questionnaire and observation data were gathered again to provide a comparison measure over time, despite the data coming from new groups of students and many new teachers, the trends had continued to improve positively.

Results from national assessments

From their beginnings in *Te Kotahitanga* (the end of 2009) to 2012, across years 11 (NCEA[2] Level 1), 12 (NCEA Level 2) and 13 (NCEA Level 3), Māori students' results showed significant increases when compared with Māori students in a decile-weighted comparison group of schools. These increases were seen at rates of 9.5 per cent for comparison schools to 26 per cent for Phase 5 schools at Level 1; 11.0 per cent for comparison schools to 32.7 per cent for Phase 5 schools at Level 2; and 11.5 per cent for comparison schools to 30.9 per cent for Phase 5 schools at Level 3. Furthermore, in a context of greatly increased numbers of Māori students remaining to Year 13, the actual number of Māori students gaining University Entrance increased by 81 per cent over the period 2008–12 (Alton-Lee, 2014). The most recent NCEA data from 2013 national assessments have still to be confirmed but anecdotal evidence from these schools' leaders suggests that the positive trend has continued.

These combined data have become important talking points for school leaders in Phase 5 schools to have the challenging conversations that will continue to co-construct more equitable pathways for their students, thus maintaining the reform momentum.

Significance of this work

Phase 5 *Te Kotahitanga* school leaders have now begun to use classroom evidence, including the voices of students and teachers, to understand, evaluate and realign the school's institutions in response to pedagogical change and Māori students' increasing engagement and achievement. While this is still proving challenging for some teachers and school leaders, for others, developing co-constructed approaches to school-wide evaluation and reform has provided an important alternative to conventions of evaluation that are commonly misunderstood, 'somebody else's responsibility' or too focused on accountability and compliance. The use of evidenced-based co-construction meetings by teachers, facilitators, senior leaders and middle leaders is helping all to understand and take explicit ownership for both the evidence and the solutions. These actions are resulting in a more coherent and productive approach, whereby each is able to take responsibility for making judgements and determining specific acts of teaching and leadership in response. Importantly, this approach is creating contexts for learning in which more Māori students are enjoying the learning experience as Māori, where they are engaged with learning and where their achievement of national qualifications has begun to show marked improvements (Alton-Lee, 2014).

Conclusion

Shifts in pedagogy, to more closely resemble a CRP of R, have resulted in national qualification results for Māori students showing year-on-year improvements, with a number of individual schools clearly showing that the achievement gap between indigenous Māori students and their non-Māori peers can be closed (Alton-Lee, 2014).

The education 'achievement gap' between students from the majority cultural group and Māori students in New Zealand reflects a wider issue of cultural minoritisation that is increasingly common around the globe (Bishop, Berryman & Wearmouth, 2014). This research has important implications for other countries grappling with this same problem, as it provides a powerful example of educational research that is innovative and changing both practice and policy towards a more socially just and equitable education system for all students.

References

Alton-Lee, A. (2014, Draft). *Ka Hikitia Demonstration Report: Effectiveness of Te Kotahitanga Phase 5 2010–12*. Wellington, NZ: Ministry of Education.

Bishop, R., & Berryman, M. (2006). *Culture speaks: Cultural relationships and classroom learning.* Wellington, New Zealand: Huia.

Bishop, R., Berryman, M., Cavanagh, T., & Teddy, L. (2007). *Te Kotahitanga Phase 3 whanaungatanga: Establishing a culturally responsive pedagogy of*

2 National Certificate of Educational Achievement

relations in mainstream secondary school classrooms. Wellington: Ministry of Education.

Bishop, R., Berryman, M., Tiakiwai, S., & Richardson, C. (2003). *Te Kotahitanga: The experiences of year 9 and 10 Maori students in mainstream classrooms.* Wellington, New Zealand: Ministry of Education.

Bishop, R., Berryman, M., & Wearmouth, J. (2014). *Te Kotahitanga: Towards effective education reform for indigenous and other minoritised students.* Wellington, New Zealand: New Zealand Council for Educational Research.

Bishop, R., Berryman, M., Wearmouth, J., Peter, M., & Clapham, S. (2011). *Te Kotahitanga: Maintaining, replicating and sustaining change*. Wellington, New Zealand: Ministry of Education.

Bishop, R., & Glynn, T. (1999). *Culture counts: Changing power relations in education*. Palmerston North, New Zealand: Dunmore Press.

Bishop, R., Ladwig, J., & Berryman, M. (2014). The centrality of relationships for pedagogy: The Whanaungatanga thesis. *American Educational Research Journal, 51*(1), 184–214.

Bishop, R., O'Sullivan, D., & Berryman, M., (2010). *Scaling up education reform: Addressing the politics of disparity*. Wellington, New Zealand: New Zealand Council for Educational Research.

Coburn, C. (2003). Rethinking scale: Moving beyond numbers to deep and lasting change. *Educational Researcher, 32*(6), 3–12.

Durie, M. (2006, October). Whānau, education and Māori potential. Paper presented at the Hui Taumata Mātauranga V, Taupo, New Zealand.

Shields, C., Bishop, R., & Mazawi, A. E. (2005). *Pathologizing practices: The impact of deficit thinking on education.* New York: Lang.

Sleeter, C. (Ed.). (2011). *Professional development for culturally responsive and relationship-based pedagogy* (1st ed.). New York: Peter Lang Publishing.

PERSPECTIVES ON QUALITY AND EQUITY FROM LARGE-SCALE ASSESSMENT STUDIES

Abstract

Over the past two decades there has been a number of large-scale assessment surveys conducted in Australia. These include international studies of achievement in fields such as reading, mathematics and science, as well as the annual National Assessment Program – Literacy and Numeracy (NAPLAN) surveys conducted for Years 3, 5, 7, and 9 as part of the National Assessment Program since 2008. All these surveys use similar assessment designs and psychometric methods that facilitate the measurement of change over time as well as analyses of the distribution of achievement. This paper focuses on analyses of data concerning 15-year-old students from the Programme for International Student Assessment (PISA) and NAPLAN Reading for students in Years 3 and 5. It notes the increased differentiation among secondary schools in the reading and mathematics achievement of 15-year-olds, and comments on the sources and possible consequences of that increased differentiation. It also reports on the improvements in reading for Year 3 students since 2008 and, more recently, for Year 5 students. It describes differences among students and education systems in the extent of those improvements, notes that the improvements have occurred in reading but not numeracy, and interprets the observed changes in terms of initiatives in the early school and preschool years. The paper is predicated on the assumption that perspectives on the impact of policies and practices on student outcomes can be informed by evidence about the ways in which achievement co-varies with differences in policy and practice, and about the extent to which achievement changes over time.

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Large-scale assessments play an important role in education policy and planning in many countries. Although they differ in purpose, approach and methods, these assessment programs are characterised by the use of a common assessment tool administered to large numbers of students (either samples or populations) under uniform conditions. Most use methods that enable the measurement of change over time. In Australia, the large-scale assessments are NAPLAN for Years 3, 5, 7 and 9, annually since 2008 (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2013); PISA every three years since 2000 (Thomson, de Bortoli & Buckley, 2013); and the Trends in International Mathematics and Science Studies (TIMSS) every four years since 1994 (Thomson, Hillman & Wernert, 2012; Thomson et al., 2012). Large-scale assessments also typically include measures of aspects of student background that enable analyses of the distribution of achievement. In this paper we focus on trends in achievement using NAPLAN and PISA. Comparisons between countries or jurisdictions are mainly comparisons of changes and relationships rather than comparisons of achievement at a point in time.

Perspectives from NAPLAN

NAPLAN has been conducted with the full cohort of students in Years 3, 5, 7 and 9 each year since 2008, covering the domains of reading, numeracy, writing and language conventions (reported as 'spelling' and 'grammar and punctuation'). This paper focuses on reading and numeracy. Table 1 presents national means in reading and numeracy from 2008 to 2013[1, 2].

National changes in reading achievement

Results in Table 1 indicate that there was an improvement of 19 scale points in Year 3 mean reading achievement at a national level from 2008 to 2013. However, there was no significant difference between the means for 2012 and 2013. National means had increased from 2008 to 2009 by 10 scale points, followed by smaller increases each successive year from 2009 to 2012. These changes cumulatively represented an improvement, but one which had levelled off by 2013. Table 1 also shows an increase of 18 points in the mean reading achievement for Year 5 students from 2008 to 2013 but no substantial change between 2012 and 2013. There were no substantial changes over these time periods for reading achievement at Years 7 or 9 or for numeracy achievement at any year level.

The improvements in reading achievement from 2008 to 2013 were similar for both male and female students. In Year 3, the mean for female students was higher than the mean for male students by 15 scale points in 2008 and by 16 scale points in 2013. In Year 5, the corresponding differences were 12 scale points and 10 scale points. The improvements in reading

1 The reporting scales were set to an overall mean of 500 and a standard deviation of 100 in 2008.

2 Differences between 2008 and 2013 are recorded if the difference is statistically significant and the effect size is greater than 0.2 standard deviations in accord with the ACARA convention.

Table 1 National mean scores for NAPLAN reading and numeracy from 2008 to 2013

	2008	2009	2010	2011	2012	2013	Difference 2008–13
Reading							
Year 3	401	411	414	416	420	419	**19**
Year 5	484	494	487	488	494	502	**18**
Year 7	537	541	546	540	542	541	
Year 9	578	581	574	580	575	580	
Numeracy							
Year 3	397	394	395	398	396	397	
Year 5	476	487	489	489	489	486	
Year 7	545	544	548	545	538	542	
Year 9	582	589	585	583	584	584	

Source: ACARA (2013).

Table 2 Mean scores in reading for Indigenous and non-Indigenous students in Years 3 and 5 from 2008 to 2013

	2008	2009	2010	2011	2012	2013	Difference 2008–13
Year 3 reading							
Indigenous	314	327	331	332	333	344	**30**
Non-Indigenous	405	415	419	420	424	423	**18**
Year 5 reading							
Indigenous	403	414	410	410	409	439	**36**
Non-Indigenous	489	498	491	492	498	506	**17**

Source: ACARA (2013).

achievement from 2008 to 2013 for students with a language background other than English (LBOTE) and non-LBOTE students were also similar. The difference in reading achievement between LBOTE and non-LBOTE at Year 3 was 3 scale points in 2008 and 4 scale points in 2013. At Year 5 the corresponding differences were larger: 20 and 17 scale points.

Improvements in reading for Indigenous students

The data in Table 2 show that Year 3 reading achievement improved from 2008 to 2013 for both Indigenous (by 30 points) and non-Indigenous students (by 18 points). The greater improvement by Indigenous students was reflected in a reduction in the difference in mean reading achievement between Indigenous and non-Indigenous students from 91 points in 2008 to 80 points in 2013. There was also an improvement (of 36 scale points) in the mean reading score for Year 5 Indigenous students between 2008 and 2013, which mainly came about between 2012 and 2013[3].

Jurisdictional trends in reading achievement

Table 3 records Year 3 and Year 5 reading achievement data for each jurisdiction. From 2008 to 2013, there were increases in mean reading achievement among Year 3 students in Queensland, Western Australia, the Australian Capital Territory and the Northern Territory. However, in these jurisdictions there was no noteworthy increase in mean reading achievement between 2012 and 2013. In New South Wales, Victoria, South Australia and Tasmania, there was no increase that met the criteria for noting from 2008 to 2013 or from 2012 to 2013[4, 5].

There were also increases in mean reading scores among Year 5 students over the period from 2008 to 2013 in all jurisdictions except New South Wales. The largest increases were in the Northern Territory (32 points) and Queensland (31 points). Furthermore, in these two jurisdictions there were also increases in mean reading scores from 2012 to 2013. In the Northern Territory, most of the increase over the six years from 2008 arose between 2012 and 2013. In Queensland, there was little overall change in mean reading achievement scores from 2008 to 2011 but there were increases from 2011 to 2012, as well as from 2012 to 2013.

Achievement in numeracy

It was noted in Table 1 that numeracy achievement at the national level has remained unchanged for all four year levels assessed from 2008 to 2013. This lack of change was also evident among subgroups disaggregated by sex, Indigenous status and language background. However, there was an improvement in Year 3 numeracy achievement in Queensland (by 18 points) and in Year 5 there were improvements in Queensland, Western Australia and the Australian Capital Territory (by between 14 and 23 points).

3 The percentage of Year 3 Indigenous students achieving at or above the national minimum standard increased by 13 percentage points (from 68 to 81 per cent) from 2008 to 2013. The percentage of Year 5 Indigenous students achieving at or above the national minimum standard increased by 20 percentage points (from 63 to 83 per cent) from 2008 to 2013.

4 The criteria adopted by ACARA are that the difference is statistically significant and the effect size is greater than 0.2 standard deviations.

5 However, for New South Wales, Victoria and Tasmania there were increases of 12 to 14 scale points, which did not quite meet the criteria of statistical significance and an effect size greater than 0.2.

Table 3 Jurisdictional mean scores for reading in Years 3 and 5 from 2008 to 2013

	2008	2009	2010	2011	2012	2013	Difference 2008–13
New South Wales							
Year 3	412	422	422	423	426	424	
Year 5	495	503	496	495	500	506	
Victoria							
Year 3	420	430	431	434	432	434	
Year 5	497	506	502	504	504	510	**13**
Queensland							
Year 3	371	386	393	400	409	408	**37**
Year 5	466	478	469	469	480	497	**31**
Western Australia							
Year 3	387	396	399	400	408	406	**19**
Year 5	474	482	478	480	483	495	**22**
South Australia							
Year 3	401	399	402	402	409	410	
Year 5	478	484	477	478	484	492	**14**
Tasmania							
Year 3	401	405	414	410	419	415	
Year 5	476	487	485	486	492	496	**20**
Australian Capital Territory							
Year 3	421	434	439	443	444	442	**21**
Year 5	503	513	509	516	519	519	**16**
Northern Territory							
Year 3	307	322	329	323	332	339	**33**
Year 5	405	421	412	403	405	437	**32**

Source: ACARA (2013).

Summary

There appear to have been improvements in reading achievement in Years 3 and 5 over the period 2008 to 2013, but no evidence of any similar improvement in numeracy. This appears to be consistent with an emphasis on reading in reform initiatives in preschool, early school and the middle primary years. Improvements have occurred in the areas at which most reform initiatives have been targeted.

It is of interest that, while there have been substantial initiatives in early school and preschool education in most jurisdictions, in Queensland there were structural changes with the introduction of Year K (or preparatory year) in schools prior to and at this time[6]. This appears to have been associated with the improvement in Year 3 reading achievement in Queensland from 2008 to 2012 and in Year 5 reading achievement from 2011 to 2013. There were smaller improvements in numeracy achievement at Year 3 (18 points) and Year 5 (23 points) in Queensland, suggesting that the impact of the structural change was not confined to reading[7]. In the Northern Territory, there were also improvements in reading achievement

6 There had been a similar structural change in Western Australia a little earlier and too soon to impact on trends in Year 3 achievement.

7 The only other jurisdictions in which there were improvements in numeracy achievement were Year 5 in Western Australia (17 points) and the Australian Capital Territory (14 points).

at Year 3 (a steady rise, accumulating to a total of 33 scale points) and Year 5 (an increase of 32 scale points between 2012 and 2013). In the Northern Territory, there had been substantial reform initiatives focused on reading achievement, especially Indigenous student achievement. It is also notable that the improvements in reading achievement among Indigenous students in Years 3 and 5 reflect a number of reform initiatives at national and jurisdictional levels. The improvements were steady over the six years for Year 3, but for Year 5 there was a sudden upturn between 2012 and 2103.

Messages from PISA

PISA focuses on achievement by 15-year-old students in three domains (reading, mathematical and scientific literacy) over a three-year assessment cycle. A different domain is chosen to be the major domain in each assessment cycle. This means that more assessment items are included from, and more assessment time is allocated to, the major domain than the two minor domains. More precise assessments are possible for a major domain than for minor domains, and more accurate estimates of trends are possible between cycles that involve a common major domain. Reading literacy was the major domain in 2000 and 2009. Mathematical literacy was the major domain in 2003 and 2012. This paper focuses on trends in reading literacy achievement from 2000 to 2009 (with reference to data for 2012) and in mathematical literacy achievement from 2003 to 2012.

Changes in achievement

Table 4 shows that, between 2000 and 2009, the average achievement in reading literacy for Australia declined from 528 to 515, a difference of 13 scale points (about one-eighth of a standard deviation). Other

Table 4 Mean reading performance for selected OECD countries: PISA 2000, 2009 and 2012

Country	Mean score PISA 2000	Mean score PISA 2009	Difference 2000–2009	Mean score PISA 2012	Difference 2000–2012
Japan	522 (5.2)	520 (3.5)	–2	538 (3.7)	16
Korea	525 (2.4)	539 (3.5)	**14**	536 (3.9)	11
Finland	546 (2.6)	536 (2.3)	**–10**	524 (2.4)	**–22**
Ireland	527 (3.2)	496 (3.0)	**–31**	523 (2.6)	–3
Canada	534 (1.6)	524 (1.5)	–10	523 (1.9)	–11
Poland	479 (4.5)	500 (2.6)	**21**	518 (3.1)	**39**
New Zealand	529 (2.8)	521 (2.4)	–8	512 (2.4)	**–17**
Australia	528 (3.5)	515 (2.3)	**–13**	512 (1.6)	**–16**
Germany	484 (2.5)	497 (2.7)	**13**	508 (2.8)	**24**
France	505 (2.7)	496 (3.4)	**–9**	505 (2.8)	1
United States	504 (7.0)	500 (3.7)	–4	498 (3.7)	–7
Czech Republic	492 (2.4)	478 (2.9)	**–14**	493 (2.9)	1
Portugal	470 (4.5)	489 (3.1)	**19**	488 (3.8)	**18**
Hungary	480 (4.0)	494 (3.2)	**14**	488 (3.2)	8
Spain	493 (2.7)	481 (2.0)	**–12**	488 (1.9)	–5
Israel	452 (8.5)	474 (3.6)	**22**	486 (5.0)	**34**
Sweden	516 (2.2)	497 (2.9)	**–19**	483 (3.0)	**–33**
Chile	410 (3.6)	449 (3.1)	**40**	441 (2.9)	**32**
OECD average	496 (0.7)	496 (0.5)	1	498 (0.6)	2

Notes:

1 Differences that are statistically significant are shown in bold.
2 Countries listed in order of mean scores for 2012.

Data source: Thomson et al. (2013).

Table 5 Mean mathematical literacy for selected OECD countries: PISA 2003 and 2012

Country	Mean score PISA 2003	Mean score PISA 2012	Difference 2003–2012
Korea	542 (3.2)	554 (4.6)	12
Japan	534 (4.0)	536 (3.6)	2
Netherlands	538 (3.1)	523 (3.5)	**–15**
Finland	544 (1.9)	519 (1.9)	**–26**
Canada	532 (1.8)	518 (1.8)	**–14**
Poland	490 (2.5)	518 (3.6)	**27**
Belgium	529 (2.3)	515 (2.1)	**–15**
Germany	503 (3.3)	514 (2.9)	**11**
Australia	524 (2.1)	504 (1.6)	**–20**
Ireland	503 (2.4)	501 (2.2)	–1
Denmark	514 (2.7)	500 (2.3)	**–14**
New Zealand	523 (2.3)	500 (2.2)	**–24**
Czech Republic	516 (3.5)	499 (2.9)	**–17**
France	511 (2.5)	495 (2.5)	**–16**
Portugal	466 (3.4)	487 (3.8)	**21**
Italy	466 (3.1)	485 (2.0)	**20**
Russian Federation	468 (4.2)	482 (3.0)	**14**
Slovak Republic	498 (3.3)	482 (3.4)	**–17**
United States	483 (2.9)	481 (3.6)	–2
Sweden	509 (2.6)	478 (2.3)	**–31**
Hungary	490 (2.8)	477 (3.2)	**–13**
OECD average	500 (0.6)	496 (0.5)	–3

Notes:

1 Differences that are statistically significant are shown in bold.
2 Countries listed in order of mean scores for 2012.

Data source: Thomson et al. (2013).

countries to record a significant decline in average reading scores included Ireland, Sweden and the Czech Republic. Seven countries (Chile, Israel, Poland, Portugal, Korea, Hungary and Germany) recorded significant improvements (with gains of 13 to 40 scale points) (Organisation for Economic Co-operation and Development [OECD], 2010). In 2012, the average achievement in reading literacy in Australia was 512, which represented an overall decline since 2000 of 16 scale points (about one-sixth of a standard deviation). Germany continued to improve so that its average achievement was 508 (484 in PISA 2000), and Sweden continued to decline so that its average was 483 (it had been 516 in PISA 2000).

Table 5 shows that, between 2003 and 2012, the average achievement in mathematical literacy for Australia declined from 524 to 504, a difference of 20 scale points (about one-fifth of a standard deviation). Other countries to record a significant decline in average mathematical literacy scores included Finland, Sweden and New Zealand. Five countries (Poland, Portugal, Italy, the Russian Federation and Germany) recorded significant improvements (with gains of 11 to 27 scale points) (OECD, 2013). In Germany, the average achievement in 2012 was 514 (503 in PISA 2003), and in Sweden the average was 478 (it had been 509 in PISA 2003).

Table 6 Jurisdictional trends in PISA reading achievement: 2000, 2009 and 2012

	PISA 2000	PISA 2009	PISA 2012	Difference 2000–2012
New South Wales	539 (6.3)	516 (5.6)	513 (3.3)	**–26**
Victoria	516 (7.6)	513 (4.7)	517 (3.5)	1
Queensland	521 (8.6)	519 (7.0)	508 (3.4)	–13
Western Australia	538 (8.0)	522 (6.3)	519 (3.1)	–19
South Australia	537 (7.7)	506 (4.8)	500 (4.0)	**–37**
Tasmania	514 (9.7)	483 (5.8)	485 (3.6)	**–30**
Australian Capital Territory	552 (4.6)	531 (6.0)	525 (3.6)	**–27**
Northern Territory	489 (5.6)	481 (5.6)	466 (8.3)	**–23**

Notes:

1 Standard errors are shown in parentheses.
2 Differences between 2000 and 2012 that are statistically significant are shown in bold.

Source: Thomson et al. (2013, p. 199).

Student background

Achievements in PISA can be investigated in relation to student characteristics such as sex, Indigenous status, socioeconomic background, language background, immigrant background, and geographic location. There were no significant changes from 2000 to 2009 for reading or from 2003 to 2012 for mathematics in the differences between females and males, between Indigenous and non-Indigenous students, or between students in metropolitan and non-metropolitan locations (Ainley & Gebhardt, 2013; Thomson et al., 2013; Ryan, 2013).

For both reading (2000 to 2009) and mathematics (2003 to 2012) there was a reduction in the difference between students with an immigrant background and those with a non-immigrant background, and between LBOTE and other students, arising mainly from the fact there was no decline for students with an immigrant background or LBOTE students, whereas there had been a decline for other students.

There was no change in the slope of the relationships between reading literacy (2000 to 2009), or mathematical literacy (2003 to 2012), and socioeconomic status as measured by the index of Economic, Social and Cultural Status (ESCS)[8]. Nor were there any changes in the percentage of the variance in achievement explained by ESCS. Ainley and Gebhardt (2013) used quantile regression to show that the relationships between reading literacy and these student characteristics were similar across the range of achievement for all PISA cycles[9].

Differences among jurisdictions

Table 6 indicates that there were differences among jurisdictions in the change in mean reading scores between 2000 and 2012. In Tasmania, South Australia, New South Wales, the Australian Capital Territory and the Northern Territory there were significant declines. There were no significant changes in Western Australia, Victoria or Queensland (Thomson et al., 2013). The variations among Australian jurisdictions in the extent of the declines suggest that there may be some systemic factors associated with curricula or

8 Although there was small drop in the average reading literacy scores of students from the top quarter of the distribution of socioeconomic status (Ainley & Gebhardt, 2013).

9 There was a small change in the distributions of student scores in reading in 2000 and 2009. There was a greater decline in the 75th, 90th and 95th percentiles than in the 5th, 10th and 25th percentiles (Ainley and Gebhardt, 2013). The decline of the 90th percentiles was 18 scale points, whereas the decline of the 10th percentile was 11 points. There was a significant decline in the percentage of students at proficiency level 5 and above (18 per cent in 2000 compared to 13 per cent in 2009) but no significant change in the percentage of students below level 2 (13 per cent in both 2000 and 2009) (OECD, 2010). This shift in distribution is also evident when the distribution of reading literacy data in PISA 2012 is compared with that from PISA 2000 (Thomson et al., 2013). There did not appear to be any corresponding shift in distributions for mathematical literacy between 2003 and 2012 (Thomson et al., 2013).

Table 7 Jurisdictional trends in PISA mathematics achievement: 2003 and 2012

	PISA 2003	PISA 2012	Difference 2003–2012
New South Wales	526 (4.3)	509 (3.6)	**–17**
Victoria	511 (5.1)	501 (3.7)	–10
Queensland	520 (6.9)	503 (2.9)	**–16**
Western Australia	548 (4.1)	516 (3.4)	**–32**
South Australia	535 (4.9)	489 (3.3)	**–46**
Tasmania	507 (9.4)	478 (3.4)	**–30**
Australian Capital Territory	548 (3.5)	518 (3.6)	**–30**
Northern Territory	496 (4.9)	452 (10.4)	**–45**

Notes:

1 Standard errors are shown in parentheses.
2 Differences between 2003 and 2009 that are statistically significant are shown in bold.
3 The mean score differences have been calculated from data that do not round off decimal places and may seem different from those suggested by simply substracting the whole numbers in the table.

Source: Thomson et al. (2013, p. 50).

Table 8 Between-school variance as a percentage of total variance in PISA reading scores in 2000 and 2009 for selected countries

	Percentage variance between schools			
	Reading		Mathematics	
	PISA 2000	PISA 2009	PISA 2003	PISA 2012
Finland	8	9	5	8
Sweden	9	18	9	13
Canada	20	22	17	20
New Zealand	16	24	17	24
Australia	20	26	22	28
United States	30	36	24	24
Mexico	53	48	45	35
Germany	59	60	57	53
OECD average	36	37	33	35

Data source: OECD database.

school organisation that may be linked to these declines in reading achievement.

Table 7 indicates that there were differences among jurisdictions in the change in mean mathematics scores between 2003 and 2012. There were significant declines in all jurisdictions except Victoria. The larger declines were in South Australia (46 points), the Northern Territory (45 points), Western Australia (32 points), Tasmania (30 points) and the ACT (30 points). There were smaller declines in New South Wales (17 points) and Queensland (16 points). In Victoria there was no significant decline.

The jurisdictional declines in reading and mathematics achievement were correlated (r = 0.72), which suggests that it is unlikely that particular changes in curricula or teaching in these areas would provide the main explanation for those declines, although they could be associated with more general changes in approaches to teaching.

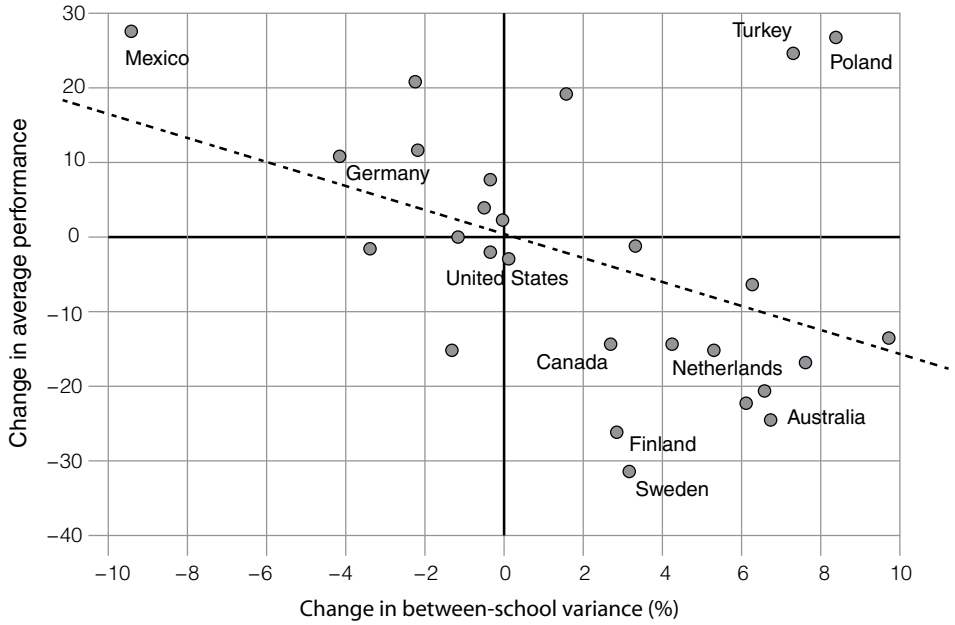

Figure 1 Relationship between change in between-school variance and change in average performance

Changes in the relative variation of achievement between and within schools

Students vary in reading achievement and the extent of variation is indicated as the variance in achievement scores. Variance is a measure of dispersion calculated as the mean of the squared deviations of observed values from a mean. The total variance in student achievement can be envisaged as made up of two sources: the variance within schools and the variance between schools' mean scores. In other words, the (total) variance can be decomposed into between-school variance and within-school variance so that the sum of the between- and within-school variance is equal to the total variance. Both the between- and the within-school variance can be expressed as a percentage of the total variance. The percentage of the total variance that is between schools provides an indication of the extent to which schools differ in their average achievement scores.

The balance of these two forms of variation also differs between countries. In some countries, students are very similar to each other within schools, but the schools are very different from each other in average performance. In other countries, schools are on average quite similar to each other in performance, but students within those schools vary considerably. The extent of differentiation is influenced by factors such as explicit selectivity in entry to types of secondary school, the extent of enrolment in private schools and the extent to which residential location is socially stratified.

The highest level of differentiation is found in tracked education systems where entry to secondary school is based on measured performance (e.g. Germany). The lowest level of differentiation is found in fully comprehensive school systems where there is little social stratification by location (e.g. Finland). Table 8 records the percentage of the variance that is between schools for Australia and selected OECD countries in reading between 2000 and 2009 and in mathematics between 2003 and 2012.

More generally, there may be a negative relationship between the change in mean performance and the change in percentage of variance that is between-school variance. Figure 1 shows the relationship between the change in average mathematics achievement (trend estimate) and the change in percentage of variance that is between-school variance for 28 OECD countries. The result shows that for each percentage point of increase in between-school variance (horizontal axis), the national average performance dropped by 1.6 PISA scale points (vertical axis). This is equivalent to a medium effect size (0.42). In addition, the change in between-school variance explained 17 per cent of the variation in trend estimates. Two countries clearly did not follow this pattern; Turkey and Poland showed a large increase in both average performance and

between-school variance. If these two countries were excluded from the analysis, 53 per cent of the variation in trend estimates would be explained by a change in between-school variance.

Summary

Results from PISA indicate declines of between one-eighth and one-fifth of a standard deviation in reading and mathematics achievement over the relevant nine-year periods among 15-year-old students in Australia. These declines do not appear to be associated with changes in the personal, social and demographic characteristics of students. However, there did appear to be differences among jurisdictions in the magnitude of the declines, and those jurisdictional declines appeared to be similar for reading and mathematics. In our view, the underlying correlates of these patterns deserve further investigation. There was also an increase in the percentage of the variation in student scores that was associated with differences among schools. Other literature has suggested that higher levels of differentiation are associated with lower levels of achievement (OECD, 2010; Willms, 2010). This paper suggests that changes in differentiation are associated with changes in average achievement.

Conclusion

There are two quite different themes emerging from this paper. The first concerns reading achievement in the primary school years in Australia. There has been a steady improvement in reading achievement among Year 3 students from 2008 to 2013 and in Year 5 reading achievement over the same period. Moreover, the improvements have been greatest where there have been the strongest interventions. These improvements give some cause for optimism in terms of the efforts that have been made in the preschool years, the early years of schooling and primary school in general. The counterpoint is that there have been only isolated instances of improvement in other curriculum areas such as numeracy or writing.

The second theme concerns reading and mathematics achievement in the middle secondary years, in which there have been declines over periods of 9 to 12 years. These declines vary among jurisdictions and have been associated with increased differentiation among schools. That should suggest caution regarding initiatives that might have the concomitant effect of exacerbating differences among schools in intake characteristics or effectiveness and support for measures that provide quality assurance.

References

Ainley, J., & Gebhardt, E. (2013). *Measure for measure: A review of outcomes of school education in Australia.* Camberwell: ACER.

Australian Curriculum, Assessment and Reporting Authority. (2013). *National Assessment Program—Literacy and Numeracy: Achievement in reading, persuasive writing, language conventions and numeracy: National report for 2013.* Sydney: Author.

Organisation for Economic Co-operation and Development (OECD). (2010). *PISA 2009 results: Learning trends.* Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (2013). *PISA 2012 results: What students know and can do. Student performance in mathematics, reading and science, Volume I.* Paris: Author.

Ryan, C. (2013). What is behind the decline in student achievement in Australia? *Economics of Education Review, 37*(1), 226–239.

Thomson, S., de Bortoli, L., & Buckley, S. (2013). *PISA 2012: How Australia measures up.* Camberwell: ACER.

Thomson, S., Hillman, K., & Wernert, N. (2012). *Monitoring Australian Year 8 student achievement internationally: TIMSS 2011.* Camberwell: ACER.

Thomson, S., Hillman, K., Wernert, N., Schmid, M., Buckley, S., & Munene, A. (2012). *Monitoring Australian Year 4 student achievement internationally: TIMSS and PIRLS 2011.* Camberwell: ACER.

Willms, J. D. (2010). School composition and contextual effects on student outcomes. *Teachers College Record, 112*(4), 1008–1037.

SCHOOL ATTENDANCE: EQUITIES AND INEQUITIES IN GROWTH TRAJECTORIES OF ACADEMIC PERFORMANCE

Abstract

Much of the pedagogical as well as political tension in the discussion about the effects of education on the development of children has been focused on the importance of the quality of education as distinct from the quantity of it. It is reasonable to expect that some attendance at school is necessary to achieve its desired effects, or to posit that there might be a point at which the quantity dimension becomes so eroded that the quality characteristics cannot be expressed in the achievement outcomes. We used Australian data on school enrolment, school attendance, and standardised literacy and numeracy achievement tests from 2008 to 2012 to longitudinally assess the attendance patterns of over 415 000 primary and secondary students across the five-year period. We also examined how these patterns vary for students with different characteristics. We examined the extent to which authorised and unauthorised absences from school related to achievement after controlling for a range of factors. We also investigated how absence rates in previous years relate to current achievement levels and whether there is a 'safe' threshold of absence at which students could catch up on missed schooling without affecting their overall achievement. Equities and inequities in trajectories and outcomes are apparent – particularly at the outset of schooling – with clear implications for educational policies.

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Apart from the effects of parenting on the development of children, there is probably no other greater force applied to alter the course of their development than that of education. Like parenting, education, and more particularly the experiences packaged in it, contains proximal developmental exposures (Bronfenbrenner & Evans, 2000): education occurs close to the developing child, fairly regularly and over an extended period of time. Importantly, it is also reciprocal in the sense that some educational exposures are changed in response to changes in the development of children.

In most cultures, education is a developmentally 'prompted' expectation. Through legislation, it is variously mandated, and because of this it becomes one of the few societal expectations that is explicitly organised to change the course of human development. The significance of this is apparent in all cultures. Typically, education is broadly revered and considered to be an important human right, and controversy often arises when changes to curricula, methods of delivery and access to schooling are proposed.

The broad acceptance of these features of education is accompanied by a surprisingly barren scientific landscape in respect of estimates of the developmental effect of actual school attendance upon intended educational outcomes such as academic achievement. Much of the pedagogical as well as political tension over the effects of education on the development of children has been focused on the importance of the quality of education as distinct from the quantity of it. The research literature is replete with studies that provide a compelling consensus on the pre-eminent importance of the quality of teacher contributions and their actual teaching behaviours to the academic achievement outcomes of students (Hattie, 2009). Understandably, an interest in how education develops children should focus on the quality dimensions of the developmental experience rather than reducing the effect of education to merely a matter of 'showing up' at school. And yet, it is reasonable to expect that some attendance at school is necessary for education to achieve its desired effects, although one might posit that there is a point at which the quantity dimension becomes so minimal that the quality characteristics cannot be expressed in the achievement outcomes (National Audit Office, 2005).

Approaches to the study of school attendance

The literature about the effects of school attendance on academic achievement is narrated around four broad foci: 1) truancy, 2) school 'drop-out' (or 'engagement'), 3) mobility and 4) absence (or attendance). There are other more narrowly focused problem areas (e.g. school refusal), but these four broad foci characterise the predominant literature. While overlapping in some regards, each of them has served slightly different aims.

Truancy is predicated upon education having a legislative remit that makes it compulsory across certain age ranges and in so doing defines truancy as any intentional, unauthorised absence from school. Part of the history of such legislation traces back to the introduction of laws to prohibit child labour, thereby strengthening, among other things, the mandate for compulsory education as a right or entitlement of all children (Ramirez & Boli, 1987; Richardson, 1994; Weiner, 1991). With the community expectation about the importance of compulsory education being emphasised in legislation, it is the parents' responsibility to ensure that their children attend school. There is a large scientific literature underpinning current knowledge about the characteristics of students who truant (Reid, 2012), as well as about interventions that may reduce truancy (Maynard, McCrea, Pigott & Kelly, 2013). This work accepts, prima facie, that students not only are compelled to attend, but also benefit from attending school. So it is particularly critical to understand and address the characteristics and modifiable risks for truant behavior. These risks include those associated with the student, the family, the local community and the school.

In contrast to truancy, the notion of school 'drop-out' is more firmly linked to disengagement from the later years of compulsory schooling (or in some developed countries, the non-compulsory years of upper high school), typically occurring in students aged 16 years and over. In this regard, school drop-out might be thought of as a more distal outcome on a pathway characterised by earlier truancy. However, drop-out overlaps with broader concepts of school retention and participation (Council of Australian Governments, 2010; Gray & Partington, 2012) and often takes into consideration patterns of segregation (and discrimination) of students into academic and vocational 'streams', whereby the academic students are traditionally retained in the upper or final years of high school, with vocational students leaving high school for trades and vocational training or other work. This diversity is more clearly seen in the underpinning scientific literature on school drop-out. It variously encompasses school (dis)engagement, preparation for

tertiary studies or non-tertiary vocations, psychosocial circumstances such as early-onset mental illness, drug and alcohol use, early pregnancy, and social gradients in onward life preparation. The scope of empirical findings encompasses the risks of dropping out associated with social disadvantage, the responsiveness of school drop-out to community and family supports that encourage onward engagement in school, and broader policy concerns with inequality and social inclusion. School programs and interventions to promote retention into the later years of schooling also predominate.

Mobility, or multiple enrolments over time in different schools, is also studied with respect to continuity of education and the impact that either spatial moves or multiple school enrolments within the same geographic area have on both rates of attendance and onward engagement. High levels of family mobility may be used as a proxy indicator for developmental chaos or other processes that disrupt key developmental acquisitions (Evans, 2006). Specific empirical studies of the effects of mobility on academic achievement, as distinct from the effects of being absent, are rare. Early studies returned mixed and confounded findings. They observed that the relationship between mobility and academic test scores was not significant when models were controlled for prior academic performance and student background characteristics (Alexander, Entwisle & Dauber, 1996; Wright, 1999). At the same time, the work of Dunn, Kadane and Garrow (2003), which is notable for its quantitative focus on the independent effects of mobility and class absence on academic achievement, revealed that mobility and academic achievement were negatively correlated. In broad terms, changing schools at least once in the three-year period prior to achievement being assessed resulted in an impact on standardised tests equivalent to being absent about 14 days in the immediate one-year period prior to the assessment.

The problem focus

Each of these preceding areas examines school attendance, or non-attendance, as a risk factor or consequence, rather than as a direct developmental effect. The interests of researchers are understandably on the causes and dynamics that produce non-attendance or attendance rather than on the actual effects of attendance or absence on academic and other achievements. Of course, it's assumed that attendance affects learning – but how much, and for whom?

The more molar study of school absence (or attendance) as an indicator in its own right of developmental 'dose', or of developmental effect, is less evident in the empirical literature, with a rare study by Gottfried (2010) distinguishing an otherwise slender empirical field. Employing a fixed-effects framework and an instrumental variable strategy, he demonstrated that more attendance is predictive of higher grade-point averages in a longitudinal design encompassing 223 elementary and middle schools with approximately 86 000 students in kindergarten through to Grade 8. He estimated positive effect sizes of attendance on GPA of about 0.28 when adjusted both instrumentally and for prior (e.g. lagged) achievement.

The extent to which actual school attendance matters, then, is of substantive concern to schools, with many Australian school jurisdictions implementing programs to monitor, report and address non-attendance. It remains the case, though, that there are no comprehensive descriptions of the typical relationship between attendance or absence from school and actual academic performance.

This paper seeks to address some of these gaps in respect of descriptions of, and associations between, school attendance patterns and academic performances in Australian school children by posing and answering the following questions:

- What are the typical patterns of school attendance and absence among schools and students over time?
- How do these patterns vary across schools and students with different characteristics?
- How do these patterns of attendance and absence contribute to school and student outcomes over time?

Data

Data were provided by the WA Department of Education for the population of primary and secondary students in Western Australia enrolled in a government school at any time between Semester 1, 2008 and Semester 2, 2012, inclusive. Students who were enrolled only in private-sector educational institutions during this period are therefore not included in the estimates presented in this report. The project is focused solely on students who were in Years 1–10 during the period of interest. After validation and cleaning, the final analysis file contained information on approximately 420 000 unique students enrolled during the 2008–2012 period. Details were available for these students in regard to their daily attendance during this period, and the data source included details of approximately 2.5 million attendance records on these students. In addition to these details, other data were also available, enabling a richer analysis

of effects. These data included National Assessment Program – Literacy and Numeracy (NAPLAN) results in each of Years 3, 5, 7 and 9 for each student in the sample over the five-year period. Some information was also available on caregivers of these children, as well as school-level descriptors that included geographic location and socioeconomic indices for schools. (For full details see Hancock, Shepherd, Lawrence & Zubrick, 2013.)

Results

Typical attendance patterns

The typical Australian primary-school student is absent for 16 days of school a year, and the typical secondary school student is absent for 24 days of school in a year (Figure 1). Children have highly stable attendance throughout the primary years. Attendance rates fall in secondary school. Attendance rates were consistently high in each year of primary school (about 92 per cent), and remained so over the study period (2008–2012). In addition to these aggregate attendance rates, we found that individual students have similar levels of attendance from year to year. School attendance patterns ('attendance careers') are established as early as Year 1, and onward prediction of school attendance is strongly associated with the pattern of attendance established in the first years of schooling.

Attendance rates declined markedly from the first year of secondary schooling (from Year 8). This pattern was evident among all student subgroups.

Disparities in attendance

Disparities in attendance rates are evident from Year 1. They are carried into, and become wider, in secondary school. We found unequivocally that relative disadvantage was associated with poorer attendance, from the very beginning of formal schooling (Figure 2). Students in schools with a lower socioeconomic index (SEI), Aboriginal students, students who were highly mobile and those whose parents had lower levels of education and occupational status all had lower levels of attendance, on average. These attendance gaps were established early (by at least Year 1), and are influenced by factors and events prior to school entry. These gaps remain constant throughout primary school, but become wider when students enter high school. These patterns were observed repeatedly, across all indicators of disadvantage and using different types of analysis (e.g. both cross-sectional and longitudinal).

Attendance and achievement

In all analyses, average academic achievement on NAPLAN tests declined with any absence from school and continued to decline as absence rates increased. The nature of the relationship between absence from school and achievement, across all subgroups of students, strongly suggests that every day of attendance in school contributes towards a child's learning, and that academic outcomes are enhanced by maximising attendance in school. There is no 'safe' threshold (Figure 3).

Most achievement disparities are already established at the outset of Year 3. Improving the attendance of

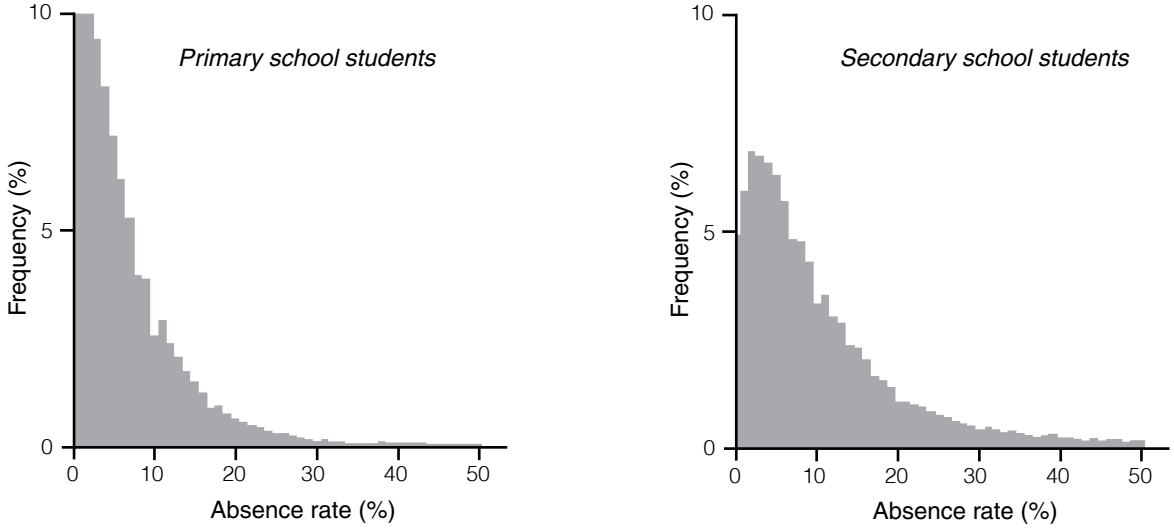

Figure 1 Distribution and mean absence rates per semester

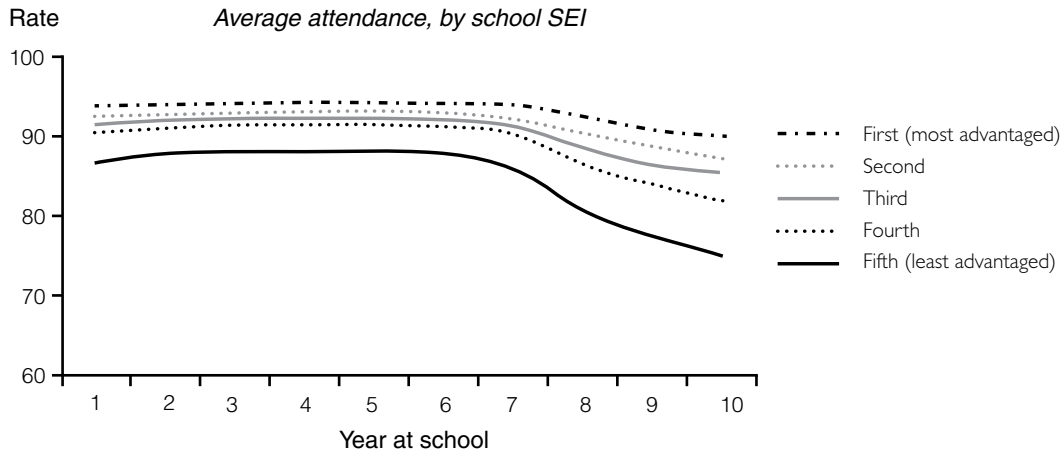

Figure 2 Students in lower socioeconomic strata have poorer attendance

disadvantaged students may help to reduce these, or prevent the gaps from becoming wider.

The effects of absence also accumulate over time. We found that absence from school was related to academic achievement in numeracy, reading and writing not only in the current year, but in future years as well. Parents need to be aware of these relationships, and understand that when their child misses school it can have an ongoing impact on their learning.

Unauthorised absences produce stronger effects on academic achievement

Unauthorised absences had a significantly stronger association with achievement than authorised absences, and this was seen consistently in Years 3, 5, 7 and 9. Even small amounts of unauthorised absence from school were associated with substantial falls in average NAPLAN test scores. It is likely that unauthorised absences reflect more than just time away from school, but also possibly behavioural and school engagement issues. We noted that distinct gaps in unauthorised absences between more and less advantaged students emerged from Year 1, and this may reflect differences in parental attitudes towards education.

Disadvantage, produces a greater, more persisting educational liability

Among disadvantaged students, achievement declined rapidly with increasing levels of absence (Figure 4). More

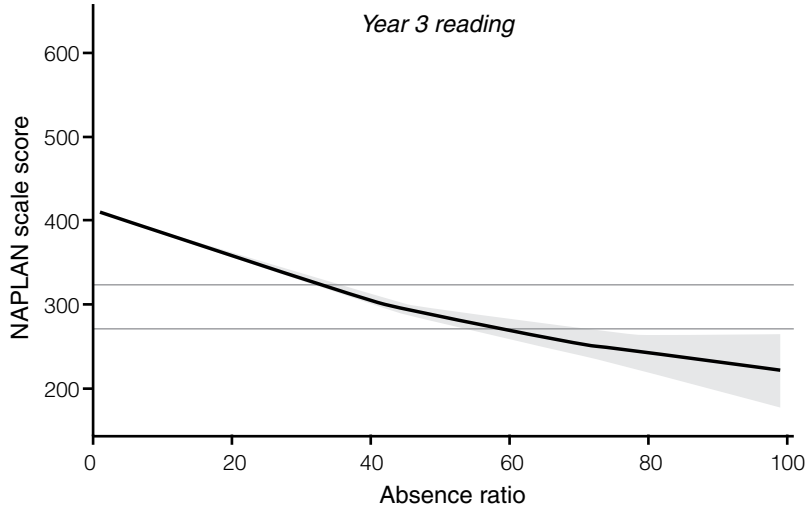

Figure 3 The relationship between being absent and academic performance using Year 3 NAPLAN results – every day counts

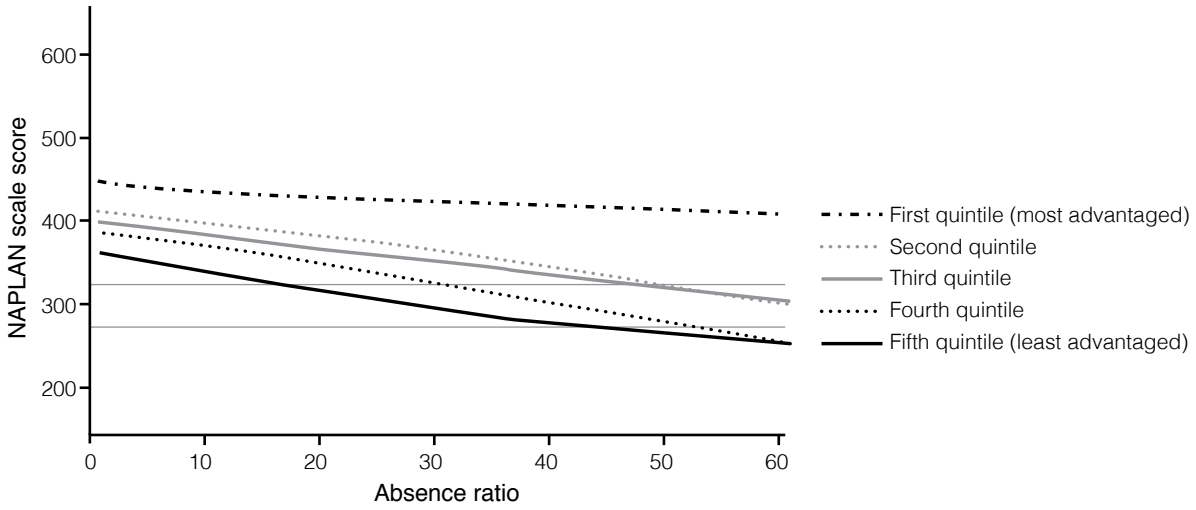

Figure 4 Students in lower SEI schools are more adversely affected by absence

advantaged children had relatively high achievement levels irrespective of their level of attendance at school. This pattern is particularly evident in the primary school years, and suggests that more advantaged children have alternative and effective resources that help them achieve learning objectives, both at school and in the home, during the early years of school.

Disadvantaged students achieved at significantly lower levels at Year 3, and these achievement gaps remained in place throughout the school years. While some of the differences could be attributable to differences in attendance patterns, the largest gaps in Year 3 achievement were observed for students from low SEI schools, Aboriginal students, and students who were highly mobile.

Improvements in absence rates over time, particularly for unauthorised absences, protected students from falling further behind and in some cases were related to improvements in NAPLAN scores. Likewise, declines in absence rates were related to declines in NAPLAN achievement, although more so for numeracy than reading achievement. We also found that low-achieving students had a propensity for poor attendance in later years even when their initial attendance was good.

Conclusions

The broad message from these early analyses is that there is a dose-response relationship between school attendance and academic performance: every day counts. Moreover, the effects of non-attendance accumulate over time. Days missed in Year 3, for example, are detectable in the years ahead. This is important and has not been, until now, documented in the literature.

The pattern of attendance in Year 1 is highly predictive of what the pattern of attendance will be in subsequent years. Children appear to arrive at school, in the earliest years, with their attendance careers already in their school bags. This is not a trivial issue. The data demonstrate very little change or variability in attendance careers over time. Moreover, the benefits of improving poor attendance, while evident, are not as prominent as might be hoped. This suggests that the major opportunity for preventing poor attendance is at the point of entry to preschool, pre-primary and Year 1. 'Lifting' attendance at this point, and setting the expectation and pattern about attendance early, may offer the best long-term, sustainable approach to addressing poor attendance at a universal level. Beyond this, individual treatment and targeting will need to be tailored to circumstances.

If early prevention of poor attendance is aimed for, then two school performance indicators are particularly important: the proportion of unexplained absences should fall – this is critically important and may be more important than the absolute absence rate for a student. A drop in unexplained absences may signal better engagement and expectation setting, with awareness and action on the part of the school and parents. The second indicator is the overall absence rate, which includes explained absences.

Finally, the effects of attendance on academic achievement are readily demonstrable for all students. However, these effects are modest when compared with the impact of socioeconomic status on current and onward academic achievement. The combination of low SEI with poor attendance rates, with higher proportions of unexplained absences, is particularly damaging to achievement attainment and onward success. There are substantial opportunities for targeted interventions for at risk students.

References

Alexander, K. L., Entwisle, D., & Dauber, S. L. (1996). Children in motion: school transfers and elementary school performance. *Journal of Educational Research, 90,* 3–12.

Bronfenbrenner, U., & Evans, G. W. (2000). Developmental science in the 21st century: Emerging theoretical models, research designs, and empirical findings. *Social Development, 9,* 115–125.

Council of Australian Governments (COAG). (2010). *National education agreement: performance report for 2009: Report to the Council of Australian Governments*. Sydney: Author.

Dunn, M., Kadane, J. B., & Garrow, J. R. (2003). Comparing harm done by mobility and class absence: Missing students and missing data. *Journal of Education and Behavioral Statistics, 28*(3), 269–288.

Evans, G. W. (2006). Child development and the physical environment. *Annual Review of Psychology, 57,* 423–451.

Gottfried, M. A. (2010). Evaluating the relationship between student attendance and achievement in urban elementary and middle schools: An instrumental variables approach. *American Educational Research, 47*(2), 434–465.

Gray, J., & Partington, G. (2012). Attendance and non-attendance at school. In Q. Beresford, G. Partington & G. Gower (Eds.), *Reform and resistance in Aboriginal education* (fully revised edition) (pp. 261–303). Crawley, WA: UWA Publishing.

Hancock, K. J., Shepherd, C. C. J., Lawrence, D., & Zubrick, S. R. (2013). *Student attendance and educational outcomes: Every day counts*. Canberra: Department of Education, Employment and Workplace Relations.

Hattie, J. (2009). *Visible Learning: A Synthesis of over 800 meta-analyses relating to achievement*. Oxford, UK: Routledge.

Maynard, B. R., McCrea, K. T., Pigott, T. D. & Kelly, M. S. (2013). Indicated truancy interventions for chronic truant students: A Campbell Systematic Review. *Research on Social Work Practice, 23*(1), 5–21.

National Audit Office. (2005). Improving school attendance in England. Report by the Comptroller and Audit General, HC 212 Session 2004–2005. London: The Stationery Office.

Ramirez, F. O., & Boli, J. (1987). The political construction of mass schooling: European origins and worldwide institutionalization. *Sociology of Education, 60*(1), 2–17.

Reid, K. (2012). The strategic management of truancy and school absenteeism: Finding solutions from a national perspective. *Educational Review, 64*(2), 211–222.

Richardson, J. G. (1994). Common, delinquent, and special: On the formalization of common schooling in the American States. *American Educational Research Journal, 31,* 695–723.

Weiner, M. (1991). *The child and the state in India: Child labour and educational policy in comparative perspective*. Princeton, NJ: Princeton University Press.

Wright, D. (1999). Student mobility: A negligible and confounded influence on student achievement. *Journal of Educational Research, 92*(6), 347–353.

COOPERATIVE LEARNING: THE BEHAVIOURAL AND NEUROLOGICAL MARKERS THAT HELP TO EXPLAIN ITS SUCCESS

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Dr Robyn Gillies is a Professor of Education in the School of Education at the University of Queensland. She has spent over 20 years researching how students can be encouraged to engage in class and learn. Her research spans primary and secondary schools and has focused on student-centred pedagogical practices and, in particular, cooperative learning as a way of promoting both social and academic learning in children and young people. She has been the recipient of a number of Australian Research Council grants that have investigated inquiry learning in science and mathematics, teacher and peer-mediated learning, student-centred learning, and classroom discourses and processes related to learning outcomes. She is the author of five books, two single-authored, and over 100 journal articles and book chapters.

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Abstract

Cooperative learning is widely recognised as a pedagogical practice that promotes socialisation and learning among students from preschool to post-secondary education and across different key learning areas and subject domains. It involves students working together in small groups to achieve common goals or complete group tasks. Interest in cooperative learning has grown rapidly over the last three decades, as research clearly demonstrates how it can be used to promote a range of achievements in reading and writing, conceptual understanding and problem-solving in science and mathematics, and higher level thinking and reasoning. It has also been shown to promote interpersonal relationships among students with diverse learning and adjustments needs and among those from culturally and ethnically different backgrounds. In fact, it is argued that there is no other pedagogical practice that achieves such outcomes. The purpose of this presentation is to highlight those factors that have been found to contribute to the success of cooperative learning, including recent research in neuroscience that helps to explain how and why students learn when they cooperate.

Interest in cooperative learning began to emerge in the 1970s as reports on the social and academic benefits students obtained from working together to assist each other to learn began to be published (Brown, Fenwick & Klemme, 1971; Gartner, Kholer & Riesman, 1971). These studies showed that children could be taught to facilitate academic accomplishments in others, help underachieving children overcome their motivational deficits, improve attitudes towards others, and enhance communication among group members. Interestingly, students who participated in helping others also benefited, possibly because they had to cognitively restructure the information they were teaching in order to explain it in a way that those being helped could understand (Allen, 1976). In so doing, they often consolidated their own understandings of the information they were teaching and gained greater mastery over it than they had previously. These findings were exciting and helped to stimulate further research on cooperating groups and how they could be used to facilitate learning and socialisation.

As many schools demonstrated traditional instructional approaches to teaching, whereby students were expected to be passive recipients of knowledge, research focused on comparing cooperative learning to competitive and/or individual approaches to learning. In 1981, Johnson, Maruyama, Johnson, Nelson and Skon published the results of a meta-analysis of 122 studies that examined the effects of cooperative, competitive and individualistic learning on achievement. The results showed that cooperation promotes higher achievement and greater productivity than competitive or individualistic approaches to learning. These results were consistent across all subject areas, all age groups, and for a variety of cognitively challenging tasks.

In a follow-up meta-analysis of 111 studies, Johnson and Johnson (2002) examined the effects of cooperative, competitive and individual learning on a number of academic, personal and social dependent variables (e.g. achievement, interpersonal attraction, social support, self-esteem, perspective taking, and controversy) and found that the mean effect sizes (i.e. the strength of the relationship between the independent and dependent variables) for cooperative learning in comparison to competitive and individualistic learning ranged from 0.58 to 0.70. These are effect sizes that Hattie (2009) believes are noticeable and can make 'real-world differences' (p. 17) in educational interventions. In short, the results of this meta-analysis and the Johnson et al. (1981) meta-analysis indicate that cooperative learning in comparison to competitive or individualistic learning has very powerful effects on achievement, socialisation, motivation and personal self-development.

Given that previous investigations of small-group structure have highlighted the academic and social benefits students derive from working cooperatively together, Roseth, Johnson and Johnson (2008) examined the social-contextual view of the mechanisms and processes by which these benefits are promoted. In a meta-analysis of 148 studies that compared the effectiveness of cooperative, competitive and individualistic goal structures in promoting early adolescents' achievement and positive peer relationships, the authors found that higher achievement and more positive peer relationships were associated with cooperative rather than competitive or individualistic goal structures. Furthermore, cooperative goal structures were associated with a positive relationship between achievement and positive peer relationships. Slavin (2013), in a best evidence synthesis of research on primary and secondary mathematics, reading and programs for struggling readers, also reported that well-structured methods such as cooperative learning produce more positive effect sizes than those evaluating either curricula reforms or computer-assisted instruction. There is no doubt that cooperative learning as an instructional strategy has had a profound effect on student learning and socialisation.

What accounts for the success of cooperative learning?

It is well recognised that placing students in groups and expecting them to be able to work together will not necessarily promote cooperation. Groups often struggle with knowing what to do, and discord can occur as members grapple with the demands of the task as well as managing the process involved in learning, including how to deal with the opinions of different members or working with students who make minimal contribution to the group. In order to avoid these pitfalls, groups need to be established so that the five key components of successful cooperative learning are embedded in their structure (Johnson & Johnson, 2009).

The first of these key components involves establishing a state of positive goal independence: group members need to understand that they are required not only to

complete their part of the task but also to ensure that others do likewise. When students understand that they cannot succeed unless others do, and they must coordinate their actions to ensure that this occurs, cohesiveness develops in the group. This is a direct result of the perception of goal interdependence and perceived interdependence among group members. It is this psychological state of positive interdependence that creates the momentum for members to work together. When groups are formed in which positive goal interdependence is not evident, as often happens when groups are formed on an ad hoc basis, group members tend to work either independently by themselves or not at all (Gillies, 2003, 2006).

The second key component involves group members understanding that they are individually accountable for the contributions they make. This sense of accountability emerges when members accept responsibility for completing their part of the task while simultaneously encouraging others to do likewise. In classrooms, teachers will often establish requirements for individual accountability so that each student's contribution to the group can be identified, ensuring that each student is responsible for completing his or her assigned task.

Students cooperate and work better when they have been taught the interpersonal and small-group skills needed to manage group interactions and behaviours. These skills constitute the third key component and include the following behaviours: listening to others, sharing ideas and resources, taking turns, accepting responsibility for one's own behaviour, and engaging in democratic decision making.

The fourth key component that affects cooperative learning is promotive interaction. This occurs when students listen to each other, exchange ideas and offer explanations to assist understanding, provide constructive feedback to improve performance on a task, and facilitate access to resources and materials. These reciprocal exchanges lead to group members feeling more accepted and valued, less anxious and stressed, and more willing to reciprocate and help others in return. The more members interact with each other, the more they will get to know each other as individuals. This knowledge forms the basis for caring and committed relationships (Johnson & Johnson, 2009).

The last key component in cooperative learning is group processing. Group processing is critically important, as it allows members to discuss how well they are achieving their goals and maintaining effective working relationships. It involves members reflecting on what they have done well and what they need to do to achieve the group's goals. Group processing involves (a) summarising group members' ideas and information, (b) encouraging members to participate in group discussions, and (c) checking to see that decisions made by the group are supported by members. When this occurs, students demonstrate greater problem-solving success and higher achievement gains than when they participate in cooperative groups with no group processing or when they work individually by themselves (Johnson, Johnson, Stanne & Garibaldi, 1990). Possible explanations for these results include the following:

- the focus on metacognitive thinking increases awareness among members of the need to think carefully and clearly about the topics being discussed
- group processing assists members to gain insights into how to behave more effectively when interacting with others
- feedback on social skills increases the frequency of their use.

Group structure, composition and task

Given the importance of establishing cooperative groups that include the five key components outlined above, teachers often seek clarification on how groups can be structured to maximise learning, the composition of the groups, and the types of tasks that students find engaging. While the research clearly indicates that groups need to be structured so that the five key components of cooperative learning are embedded in their structure, it is also important to consider both the composition of the group and its size. In a meta-analysis of 66 studies that examined the effects of within-class grouping (i.e. establishing small groups in classes) on student achievement at the elementary, secondary and post-secondary levels, Lou et al. (1996) found that students achieved higher learning outcomes when they worked in small cooperating groups than when they were not grouped or remained in whole-class teaching arrangements. Furthermore, students worked better and achieved more when they worked in groups of three to four members than in groups of five to seven members. Interestingly, the effects of group ability composition were different for students of different relative ability: low-ability students learned more in heterogeneous groups (high, medium and low ability); medium-ability students benefited significantly

in homogeneous ability groups; and group composition made no difference to high-ability students.

Similar results were obtained in a meta-analysis of small-group and individual learning with technology by Lou, Abrami and d'Apollonia (2001), with small-group learning having significantly more positive effects than individual learning on students' individual achievement and group task performance. Student performance was higher in smaller groups (three to five members) than for those working individually, and students gained more individual knowledge in small groups than those working individually with computer technology. Bertucci, Conte, Johnson and Johnson (2010) also found that students' achievement was higher in pairs and in groups of four than when they worked individually. Furthermore, social support and self-esteem were higher when students worked in small groups than individually.

The type of task students undertake in their groups is also important. Cohen (1994) found that the type of task affects the discussion that occurs. Interaction among group members is critically important to the success of small-group activities. Shachar and Sharan (1994) argued that interaction will only happen when teachers create conditions that enable students to work in small groups on tasks that require cooperation among group members. When students recognise the importance of arriving at a synthesis of everyone's contributions and expect that the group product will be presented to the wider class, group cohesion is fostered and students are motivated to complete the task. When teachers structure small group activities so that these conditions are met, students are more interactive, use more words per turn of speech, communicate more equitably so that ideas are shared among group members, and elaborate more to explain the problem at hand.

The results of these meta-analyses indicate that students derive both academic and social benefits when they work cooperatively together rather than when they compete or work individually or alone. Furthermore, students are more likely to achieve more when they work in groups of four or less, preferably mixed-ability groups rather than homogeneous ones, and when they work on tasks that require them to cooperate.

Cooperation and research in neuroscience

There is very little research on the brain processes involved in cooperative learning. In particular, it is not known how the differences in brain processes engaged during cooperative rather than individual or competitive learning lead to more successful learning outcomes. Research in the field of neuroeconomics shows that cooperative behaviour leads to greater activation in regions of the brain associated with reward-based learning (Decety, Jackson, Sommerville, Chaminade & Meltzoff, 2004). It is therefore suggested that individuals experience greater reward during cooperation, which serves to reinforce that behaviour and lead to greater engagement during cooperative tasks.

Another relevant line of neuroscience research concerns neural 'mirroring' processes, or the emulation of others' mental states and experiences in the observer's own brain. It is thought that when we observe others' actions or emotions, the same neural states in their brains are mirrored or emulated in our own brain, as a form of shared experience, and that we come to understand others' intentions and goals through this neural emulation or mirroring process (Rizzolatti & Fogassi, 2014). Research on neural mirroring began with the discovery of monkeys' mirror neurons, which are active when a monkey performs a hand action and when the monkey observes the same actions being performed (Gallese, Fadiga, Fogassi & Rizzolatti, 1996). It appears that simply observing others' actions engages the same brain processes as when we generate and control our own actions, which is suggested to contribute to observational learning (Cattaneo & Rizzolatti, 2009). Indeed, motor learning through observation of actions is commonly used in sports training and used as 'mirror' therapy for movement rehabilitation following stroke (Garrison, Winstein & Aziz-Zadeh, 2010).

While early research on mirror neurons focused exclusively on movement and actions, it is now well accepted that similar mirroring processes operate in other domains and give rise to shared brain states between cooperating partners (Keysers & Gazzola, 2009). Crucially, this neural mirroring process is strongly influenced by social relationships between individuals. The degree to which brain states in one individual are mirrored in another depends on the relationship that individual has with the other, and the degree to which one perceives the other as a member of their own in-group (Hein, Silani, Preuschoff, Batson & Singer, 2010). This fits with well-known research on forming social relationships, showing that we tend to emulate or imitate people we like and we like people who imitate us (Chartrand & Bargh, 1999). Positive in-group relationships between cooperating partners therefore appear to be crucial for neural mirroring mechanisms.

The gap in current research in this area is linking neural mirroring processes to outcomes in cooperative learning. We currently do not know whether the emulation of others' brain states through neural mirroring plays any causal role in the successful outcomes associated with cooperative learning. We do know that mirroring processes play a role in motor skill learning, as widely used in sports training, and we know that positive interpersonal relationships, which are a key element in cooperative learning, also play a crucial role in neural mirroring between cooperating partners. Education neuroscience is a young and growing field and, by increasing understanding of the neural mechanisms that contribute to learning by co-operation, can provide an important new perspective by which to further inform pedagogical practice.

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References

Allen, V. (1976). Children helping children: Psychological processes in tutoring. In J. Levin & V. Allen (Eds.), *Cognitive learning in children: Theories and strategies* (pp. 241–299). New York: Academic Press.

Bertucci, A., Conte, S., Johnson, D., & Johnson, R. (2010). The impact of size of cooperative group on achievement, social support, and self-esteem. *Journal of General Psychology, 137*, 256–272.

Brown, I., Fenwick, N., & Klemme, H. (1971). Trainable pupils learn to teach each other. *Teaching Exceptional Children, 4*, 36–49.

Cattaneo, L., & Rizzolatti, G. (2009). The mirror neuron system. *Archives of Neurology, 66,* 557–560.

Chartrand, T., & Bargh, J. A. (1999). The chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology, 76,* 893–910.

Cohen, E. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research, 64*, 1–35.

Decety, J., Jackson, P. L., Sommerville, J. A., Chaminade, T., & Meltzoff, A. N. (2004). The neural bases of cooperation and competition: An fMRI investigation. *Neuroimage, 23*, 744–751.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti. G. (1996). Action recognition in the premotor cortex. *Brain, 119,* 593–609.

Garrison, K. A., Winstein, C. J., & Aziz-Zadeh, L. (2010). The mirror neuron system: A neural substrate for methods in stroke rehabilitation. *Neurorehabilitation and Neural Repair, 24,* 404–412.

Gartner, A., Kholer, M., & Riesman, F. (1971). *Children teach children: Learning by teaching*. New York: Harper & Row.

Gillies, R. (2003). The behaviours, interactions and perceptions of junior high school students during small-group learning. *Journal of Educational Psychology, 95*, 137–147.

Gillies, R. (2006). Teachers' and students' verbal behaviours during cooperative and small-group learning. *British Journal of Educational Psychology, 76*, 271–287.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.

Hein, G., Silani, G., Preuschoff, K., Batson, C. D., & Singer, T. (2010). Neural responses to ingroup and outgroup members' suffering predict individual differences in costly helping. *Neuron, 68,* 149–160.

Johnson, D., & Johnson, F. (2009) *Joining together: Group theory and group skills* (10th ed.). Upper Saddle River, NJ: Pearson Education.

Johnson, D., & Johnson, R. (2002). Learning together and alone: Overview and meta-analysis. *Asia Pacific Journal of Education, 22,* 95–105.

Johnson, D., Johnson, R., Stanne, M., & Garibaldi, A. (1990). Impact of group processing on achievement in cooperative groups. *Journal of Social Psychology, 130,* 504–516.

Johnson, D., Maruyama, G., Johnson, R., Nelson, D., & Skon, L. (1981). Effects of cooperative, competitive, and individualistic goal structures on achievement: A meta-analysis. *Psychological Bulletin, 89*, 47–62.

Keysers, C., & Gazzola, V. (2009). Expanding the mirror: Vicarious activity for actions, emotions, and sensations. *Current Opinion in Neurobiology, 19,* 666–671.

Lou, Y., Abrami, P., & d'Apollonia, S. (2001). Small group and individual learning with technology: A meta-analysis. *Review of Educational Research, 71,* 449–521.

Lou, Y., Abrami, P., Spence, J., Poulsen, C., Chambers, B., & d'Apollonia, S. (1996). Within-class grouping: A meta-analysis. *Review of Educational Research, 66,* 423–458.

Rizzolatti, G., & Fogassi, L. (2014). The mirror mechanism: Recent findings and perspectives. *Philosophical Transactions of the Royal Society of London, 369*(1644).

Roseth, C., Johnson, D., & Johnson, R. (2008). Promoting early adolescents' achievement and peer relationships: The effects of cooperative, competitive, and individualistic goal structures. *Psychological Bulletin, 134,* 223–246.

Shachar, H., & Sharan, S. (1994). Talking, relating, and achieving: Effects of cooperative learning and whole-class instruction. *Cognition and Instruction, 12,* 313–353.

Slavin, R. (2013). Effective programmes in reading and mathematics: Evidence from the Best Evidence Encyclopedia. *School Effectiveness and School Improvement, 24,* 383–391.

THE PREDICTIVE VALIDITY OF THE AEDI: PREDICTING LATER COGNITIVE AND BEHAVIOURAL OUTCOMES

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Dr Sally Brinkman is a social epidemiologist whose research focuses mainly on the impact of society on child development. Sally is the Co-Director of the Fraser Mustard Centre, an innovative new initiative between the Telethon Kids Institute and the South Australian Department of Education and Child Development aimed at improving research translation.

Sally is well known for spearheading the use of the Early Development Instrument (EDI) in Australia, being the first to pilot the instrument outside Canada. Sally continues to work across the country to help facilitate the use of the Australian EDI (AEDI), working with communities, service providers and governments. Locally, Sally consults with the Department of Children's Services Policy Directorate, primarily on data-linkage; the Children's Centres Operational Group on evaluation; and the SA AEDI Team on community advocacy and research translation.

Internationally, Sally works with governments and donor organisations such as the World Bank, UNICEF, AusAID; and the Bernard Van Leer Foundation on various measures of child development for monitoring and evaluation purposes.

Sally has over 60 publications, including books, chapters, monographs and journal articles, covering topics such as infant mouthing behaviours, child physical activity and nutrition levels, the measurement of alcohol-related violence, the evaluation of teenage pregnancy prevention programs, how child development varies across communities and the impact of socioeconomics and service integration on child development.

Sally brings locally, nationally and internationally recognised epidemiological skills, particularly in relation to population monitoring of child development and education. She has a commitment to practical, pragmatic and translatable research.

Abstract

The Australian Early Development Index (AEDI) is a measure of early childhood development based on an instrument developed in Canada that is now used internationally. In Australia, the AEDI is a Federal Government National Progress Measure, and provides an evidence base for communities, governments and service providers to use for advocacy, policy development and resource allocation. The Australian government administers the AEDI as a triennial census of all children across the country in their first year of full-time schooling. Although the 2009 AEDI provided the first Australia-wide population baseline, which future data collections will now be compared to, the instrument has been used in Australia since 2002. Despite some reliability and validity studies and its adoption as a National Progress Measure, the instrument is only now being validated in terms of its ability to predict later outcomes. This paper presented will investigate the (1) comparative associations, (2) sensitivity and specificity, and (3) discriminatory power of the AEDI to predict indicators of social and emotional wellbeing and educational outcomes (such as the National Assessment Program – Numeracy and Literacy [NAPLAN]) to 15 years of age. The results indicate that the Social Competence, Language and Cognitive Development and Communication Skills and General Knowledge domains of the AEDI are good predictors of both cognitive and behavioural outcomes. Further to that, the AEDI performs as well as or better than established instruments such as the SDQ, PEDS, PedsQL™ and PPVT-III, and shows high specificity with moderate sensitivity. The paper supports a universal population approach, coupled with selectively targeting regions that show high numbers of children who are developmentally vulnerable on one or more of the five AEDI domains.

Background

Predictive validity refers to how well an instrument predicts later outcomes—in this case, how well the AEDI predicts the later literacy, numeracy and other cognitive and behavioural outcomes of children. The aim is to determine if the AEDI has enough predictive validity so that it can be confidently used as a population measure to predict later capabilities. If the AEDI misclassifies too many children in a community or population group as having developmental vulnerabilities, needless worry could be caused for those communities or population groups that are then subsequently targeted with early childhood and parenting support programs on the basis of their results. The instigation of community-level early childhood and parenting support programs should be on the basis of robust population data.

Aims

This research investigates how well the AEDI predicts a child's later literacy, numeracy and other cognitive and behavioural outcomes.

Key findings

The AEDI is a population measure that focuses on all children in the community, in their first year of school. In focusing on the community rather than individual children we can better support efforts to create optimal early childhood development. All AEDI results are reported at the community, rather than individual child, level. Schools also receive their own school-specific AEDI results matched against their local community.

AEDI data from a study in Western Australia in 2002, which was then linked to later education records, showed that all five of the AEDI domains predicted literacy and numeracy outcomes for children as measured by the National Assessment Program – Literacy and Numeracy (NAPLAN) in Years 3, 5 and 7. The Language and Cognitive Development, and Communication Skills and General Knowledge domains of the AEDI at age 5 were the best predictors of scores on the NAPLAN assessments. The strengths of these relationships were very stable over time despite the continuing development of the children. The strength of the relationship between AEDI scores and both numeracy and reading scores was equivalent at Year 3. However, as the children got older, there was evidence that the AEDI was a better predictor of reading scores than of numeracy scores.

The research also indicated that children who were vulnerable on one or more of the AEDI domains at age 5 were more likely to be in the bottom 20 per cent of all students' scores on the NAPLAN assessments in Years 3, 5 and 7 than children who were not vulnerable

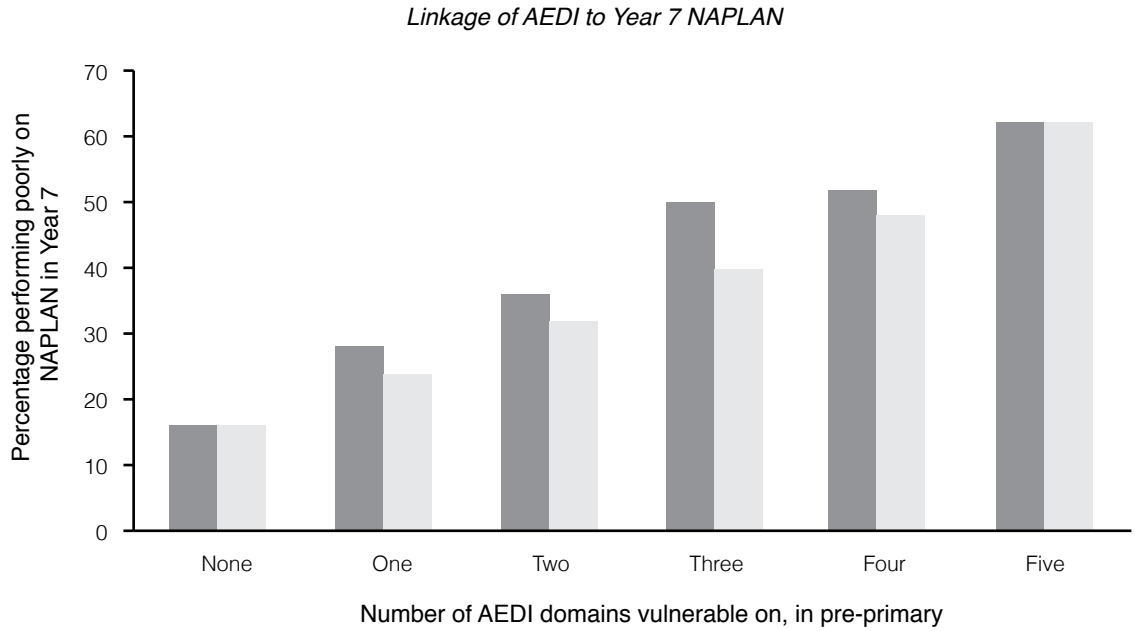

Figure 1 For every additional domain on the AEDI that a child is vulnerable on, there is an increased level of poor performance on the NAPLAN in Year 7

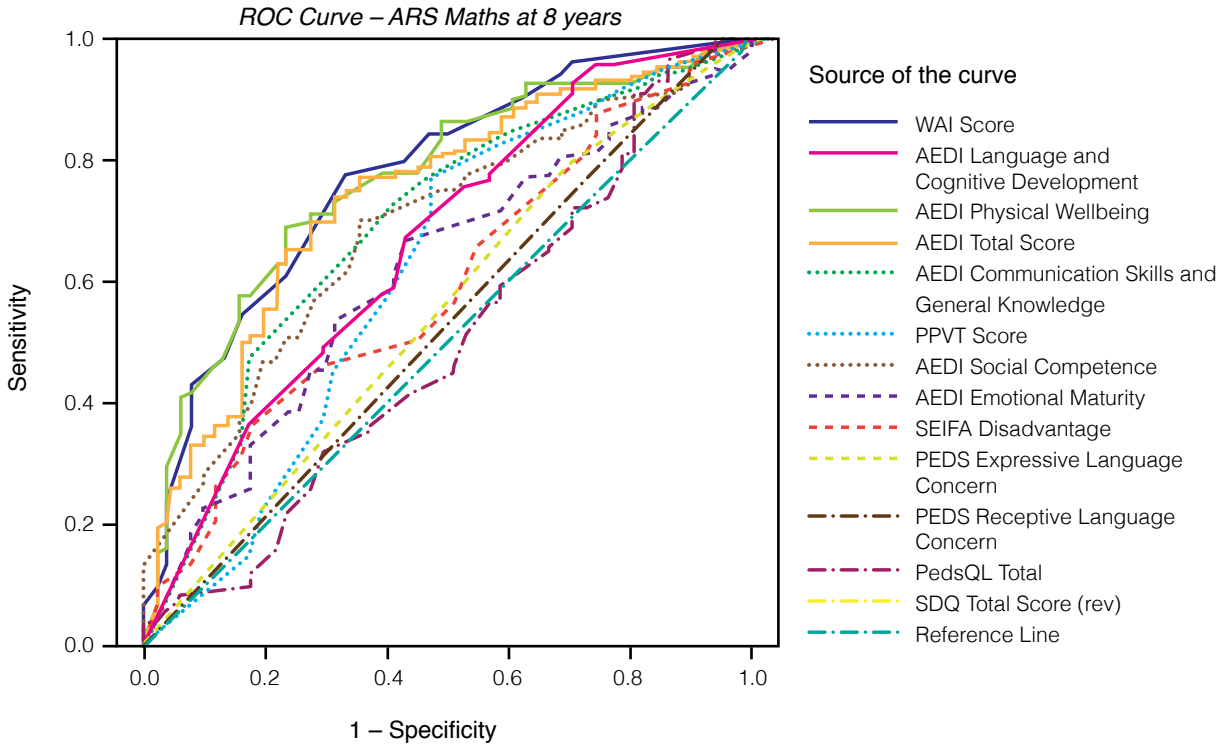

Figure 2 Overall validity of each instrument collected at 4 years of age predicting poor mathematical outcomes at the age of 8 years

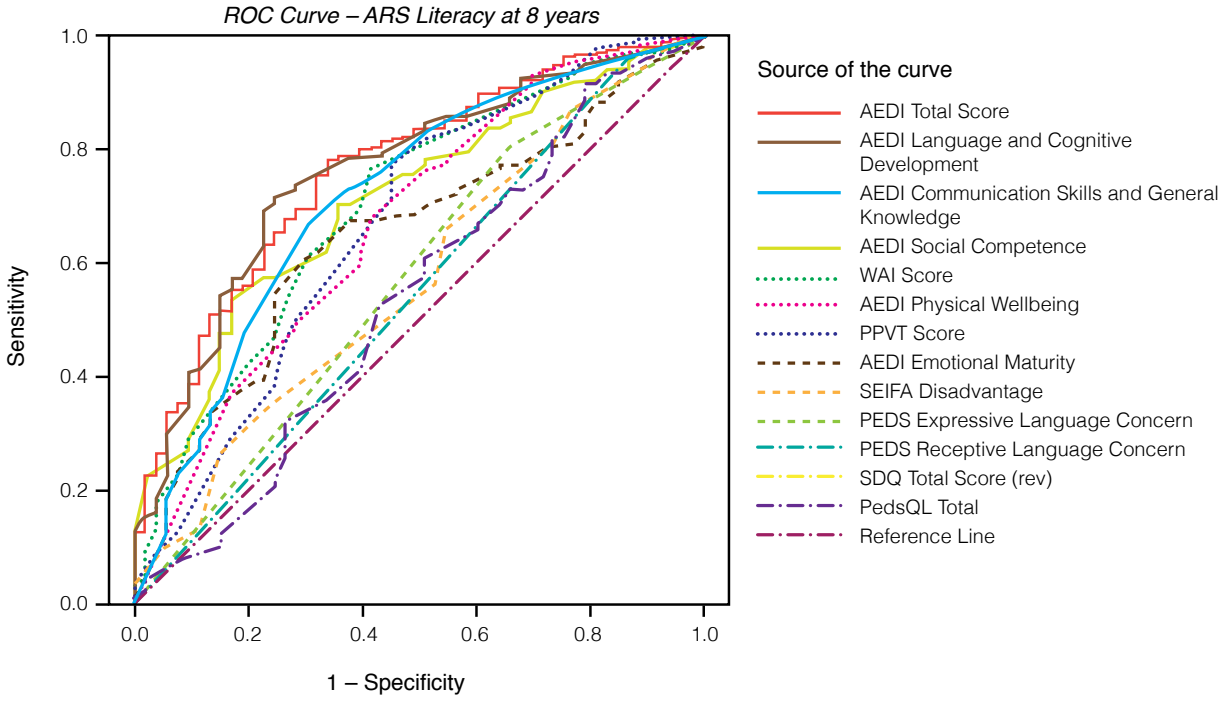

Figure 3 Overall validity of each instrument collected at 4 years of age predicting poor literacy at the age of 8 years

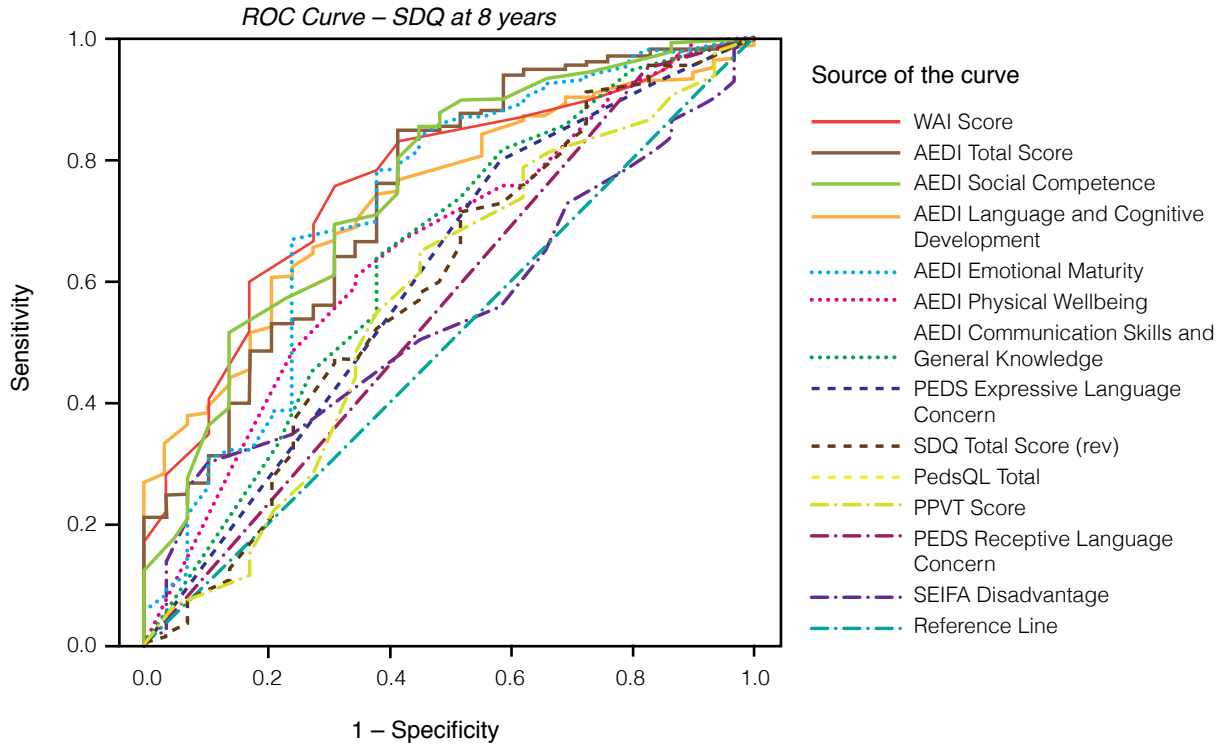

Figure 4 Overall validity of each instrument collected at 4 years of age predicting poor behaviour at the age of 8 years

on any AEDI domains. A child who was developmentally vulnerable on one of the AEDI domains (independent of which developmental domain) was more than twice as likely to have been in the bottom 20 per cent of students for reading skills in Year 7 than a child who was not developmentally vulnerable on any domains of the AEDI. Children who were developmentally vulnerable in four or five AEDI domains were much more likely to have difficulties in reading and numeracy over the next few years than those without vulnerabilities in four or five domains. Regardless of which of the five domains, for each additional domain a child was vulnerable on in pre-primary there was an increased percentage of children with low reading and numeracy scores in Year 7 (Figure 1).

In a second study, where the AEDI was used, we further investigated the predictive validity of the instrument. In 2004, the Longitudinal Study of Australian Children (LSAC) included the AEDI in a nested sub-sample of their 4-year-old cohort. This sample of children were all aged between 4 and 5 years and on average a year younger than the standard age of use of the AEDI in Australia (i.e. the first year of full-time schooling). The five domains of the AEDI measured at age 4 performed relatively well in predicting age 8 mathematical thinking, language and literacy and behavioural outcomes. The discrimination of each of the domains of the AEDI was measured relative to the other domains and a number of other measures designed to measure a child's development. The ROC curves in Figures 2, 3 and 4 show the relative discrimination of measures at 4 years and how they predict later outcomes at 8 years. The greater the area under the curve, the stronger the predictor. Discrimination in this context refers to the ability of an instrument to correctly differentiate between children who are doing poorly on a certain outcome from those that are doing well. In particular, the Language and Cognitive Development domain and the AEDI Total Score demonstrated moderate discrimination in mathematical thinking outcomes. When predicting the Language and Literacy Scale on the Academic Rating Scale at age 8, the AEDI Social Competence, Communication Skills and General Knowledge, and Language and Cognitive Development domains, as well as the AEDI Total Score at age 4, demonstrated moderate discrimination. The AEDI Social Competence domain, the Language and Cognitive domain and the AEDI Total Score all showed moderate discrimination against the age 8 Strengths and Difficulties Questionnaire (behavioural outcome) total score.

Key points

- The National AEDI progress measure (developmentally vulnerable on one or more domains) appears to be the strongest summary indicator.
- Analyses show that the AEDI performs as well or better than commonly used instruments when aiming to predict later academic and behavioural outcomes.
- All five of the AEDI domains predicted later literacy and numeracy outcomes for children as measured by NAPLAN.
- A child's development when they enter school has a strong and persistent relationship to how well they continue through primary school. With the AEDI being conducted across the country as a developmental census once every three years, we can now also look to the AEDI as an evaluation tool to further improve our knowledge around what are good investments to make in the early years.
- There are advantages in coupling a universal population approach with the selective targeting of areas showing high numbers of developmentally vulnerable children.

Implications

Overall, the results indicate that a combination of a universal and a targeted platform is likely to be of greater value than simply highly indicated/targeted interventions. Just targeting geographical regions or population groupings identified on the basis of the AEDI will indeed miss many children that could benefit from additional developmental supports.

Government departments of health, education and community development, as well as non-government agencies have traditionally worked independently in their delivery of early childhood care. From this research it is evident that the overall health and development of Australian children has implications for their success at school, and consequently there is a need for greater interagency collaboration to reduce the gap in service delivery between birth and school.

These are the first studies to investigate the relationship between the AEDI and later NAPLAN assessments as well as other cognitive and behavioural outcomes. The inclusion of the AEDI into the national data linkage networks means that there is increased opportunity to investigate the efficacy and efficiency of early child development and education interventions through pragmatic trials.

Methodology

Study 1

The data for the NAPLAN analyses came from the use of the AEDI across 121 primary schools in the North Metropolitan Health Service in Western Australia in 2003, resulting in a sample of 4420 children. These children have since undergone NAPLAN assessments in Years 3, 5 and 7. The children for whom the National 2009 AEDI was completed would have undertaken their first national school assessment (Year 3 NAPLAN) in 2012.

Study 2

In a separate study, the AEDI was embedded in a nested sample of participants in the 4-year-old cohort of the LSAC in 2004. LSAC is a nationally representative sample of two cohorts of Australian children: infants and 4-year-olds. LSAC data collection involves an interviewer spending time in a child's home, obtaining information from a parent or caregiver regarding their child. As part of this visit, the interviewer conducts direct measurement of the child via a number of instruments.

For this nested sample, teachers were also asked to provide some information on the child, including completion of the AEDI. These children were subsequently followed up, allowing us to investigate which instruments collected at age 4 (including the AEDI) best predicted later cognitive and behavioral outcomes at age 8.

For further details

Brinkman, S. A. (2012). Validity of the AEDI – Predictive validity through to cognitive and behavioural outcomes at age 8? (Chapter 3). In *The validation and use of a population measure of early childhood development in Australia: The Australian Early Development Index.* (Doctoral dissertation). University of Western Australia.

Brinkman, S. A., Gregory, T., Harris, J., Hart, B., Blackmore, S., & Janus, M. (2013). Associations between the early development instrument at age 5 and reading and numeracy skills at ages 8, 10 and 12: A prospective linked data study. *Child Indicators Research, 6*(4), 695–708. doi: 10.1007/s12187-013-9189-3.

BUBALAMAI BAWA GUMADA (HEALING THE WOUNDS OF THE HEART): THE SEARCH FOR RESILIENCE AGAINST RACISM FOR ABORIGINAL AUSTRALIAN STUDENTS

Abstract

Within the Australian research setting, a strong research base has emerged to articulate both the nature and impact of racism from the perspectives of Aboriginal and Torres Strait Islander peoples. It may be argued though that quantitative approaches to this research have been limited by simplistic measures that fail to capture the complexity of racism today. This limitation may have important implications for the identification of factors that could provide a buffer against the detrimental effects of racism, and thus promote a stronger and positive sense of resilience and engagement for Aboriginal and Torres Strait Islander youth. It is the purpose of this paper to summarise two studies that have sought to understand the impact of racism on Aboriginal and Torres Strait Islander student outcomes (e.g. achievement, engagement, aspirations) and to identify factors that may limit or negate the effects of racism. Using a mixture of both quantitative and qualitative research methodologies, the results identified a) a measure of racism that held strong psychometric properties for the Aboriginal and Torres Strait Islander students; b) that each dimension of racism revealed a range of significant and negative associations with educational outcomes; and c) multiple strategies to help combat racism and its negative effects.

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Dr Gawaian Bodkin-Andrews is a Senior Lecturer at Warawara – Department of Indigenous Studies at Macquarie University (funded by the Australian Research Council – ARC). He is also a member of the ARC special initiative, National Indigenous Research and Knowledges Network (NIRAKN). He completed his PhD in 2008 (examining the impact of self-concept, motivation and racism on Indigenous and non-Indigenous schooling outcomes), and has been a Chief Investigator on four ARC grants, one Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) grant, two internal university grants and two research tenures. Each of these projects has, using varying methodologies, investigated Indigenous Australian issues in education, wellbeing, self-concept, motivation, identity, peer-mentoring, bullying and racism. His projects have led to the development of a strong foundation in numerous research designs, including developing psychometrically sound instrumentation, conducting interviews across a wide range of age groups, and undertaking advanced quantitative data analyses (primarily within the Structural Equation Modelling framework). His research has also attracted a number of national and international awards (including the Australian Association for Research in Education [AARE] Betty Watts Indigenous Researcher award), and he currently has numerous journal publications, book chapters and peer-reviewed conference publications, all of which have a strong emphasis on Indigenous Australian affairs.

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Within the Australian research setting, numerous authors (e.g. Mellor, 2003) have suggested that early research on racism was too limited in its exploration of the attitudes of those who may hold some form of prejudice against people not from their own ethnic/cultural background. While the findings of such research have done much to contribute to the pursuit of a stronger and more respectful multicultural ethos within Australia, it has been argued that such research may not represent the voices of those whose everyday lived experiences may be influenced with racism (Bodkin-Andrews & Carlson, 2013). One of the first studies to attempt to identify how racism may be perceived by those forced to endure this stressor can be found in the work of Mellor (2003) who captured the voices of Aboriginal Australian adults, and found that it was 'the norm for participants in this study to have experienced racism in their daily lives' (p. 483). More recently, Dunn, Forrest, Pe-Pua, Hynes and Maeder-Han (2009) found that in a New South Wales survey of over 4000 participants, only 12 per cent of the sample reported being prejudiced towards other ethnic/cultural groups. In contrast though, over 63 per cent of Aboriginal and Torres Strait Islander participants and 45 per cent of Muslim Australian participants reported experiencing racism. This highlighted the wide discrepancy between those who report racism and those who report prejudicial attitudes.

Since Mellor's (2003) research, an array of findings has emerged, revealing that racism is frequently experienced by Aboriginal and Torres Strait Islander peoples, and may result in lower mental health, physical health, educational engagement, performance and educational aspirations, and an increased risk of undertaking health risk behaviours (Bodkin-Andrews, Denson & Bansel, 2013; Priest, Paradies, Gunthorpe, Cairney & Sayers, 2011). In consideration of the longstanding and negative impacts of racism on Aboriginal and Torres Strait Islander peoples, it is critical not only to prevent racism from occurring in the first place, but also to identify agents of resilience to help strengthen people against the negative impact of racism. Research though has suggested that the impact of discrimination may vary widely for individuals from various minority or disadvantaged backgrounds (Bodkin-Andrews, O'Rourke, Grant, Denson & Craven, 2010; Schmitt, Branscombe, Postmes & Garcia, in press). For example, in an international meta-analysis conducted by Schmitt et al. (in press), it was found the impact of discrimination varied across groups, and little consistency was found across moderators of discrimination (e.g. social support, identity, coping strategies). That is, the same moderation factor either buffered, exacerbated, or produced null effects on racism across different groups. Considering these findings, this paper will attempt to outline results from two studies that have attempted to identify agents of resilience against racism.

Study 1: Wingara Manamai[1] – positive psychology, resilience and racism

A number of educational and psychological researchers have emphasised the need to focus on positive constructs that may act as a potential agency for strength and resilience within Aboriginal and Torres Strait Islander and non-Indigenous Australian students (Craven & Marsh, 2008). While it may be argued that there is a plethora of research findings identifying the positive relations between a range of positive psychology constructs and various mental, physical, and educational outcomes (Marsh & Martin, 2011), there is some concern about positive psychology's potentially limited cross-cultural applicability for First Nations perspectives (Bodkin-Andrews, Denson, Finger & Craven, 2013; Christopher & Hickinbottom, 2008). As a result, this study examined survey responses drawn from 563 high school students from Years 7 to 11 (295 male, 260 female). While considerable cultural diversity was identified within the sample, considering the small sample sizes of some groups, they were collapsed into broader cultural groupings[2] of First Peoples (83, Aboriginal and/or Torres Strait Islander, Māori/Pacific Islander, African American), Asian/Eastern (201, Asian and Middle Eastern) and Anglo-Saxon (279, Australian and European).

Measures used in this survey identified issues related to:

- personal experiences of racism (Bodkin-Andrews, O'Rourke et al., 2010)
- identity through strength of self-identification (Phinney, 1992) and perceived respect from others (Bodkin-Andrews, O'Rourke et al., 2010)
- school self-perceptions through academic self-concept (Marsh, Ellis, Parada, Richards & Heubeck, 2005) and academic buoyancy (Martin & Marsh, 2008)

1 Roughly translated from D'harawal as 'Dream of understanding'.

2 It is requested that readers recognise the generality of these 'cultural groups' fails to represent the true cultural diversity within each group.

- emotional intelligence through emotional self-understanding, self-regulation and empathy (Bodkin-Andrews, 2011)
- school outcomes, including academic hopelessness (Bodkin-Andrews & Craven, 2008), English and maths self-ratings, and aspirations to go to university (adapted from Craven, Tucker, Munns, Hinkley, Marsh & Simpson, 2005).

The analyses conducted consisted of a range of preliminary Confirmatory Factor Analyses and Structural Equation Modelling techniques using MPLUS 7.0 (Muthén & Muthén, 2010). However, due to space limitations, the results will largely focus on latent interaction modelling (see Marsh, Wen & Hau, 2006 for an overview) to determine if the positive psychological constructs do act as agents of resilience.

Results and discussion

Based on the sample splitting of First Peoples, Anglo-Saxon and Asian/Eastern students, Table 1 reveals that, based on the multi-item racism measure (responses ranging from 1 = False to 6 = True), on average, most students disagreed with the proposition that they had experienced racism (with scores 3 or above indicating agreement).

Table 1 Mean scores and frequencies for racism-based measure

	Personal racism		
	Mean	SD	Frequency
First Peoples (n = 83)	2.79	1.66	53%
Anglo-Saxon (n = 279)	1.86	1.22	33%
Asian/Eastern (n = 201)	2.43	1.30	52%

Note: SD – standard deviation

However, these aggregate results may downplay potential experiences of racism, especially considering the nature of the items to form the combined factor (e.g. being called names, being ignored, etc.). Indeed, frequency analyses revealed that over 50 per cent of First Peoples and Asian/Eastern students experienced racism when the individual items were tallied.

With regards to the schooling outcomes, for university aspirations, 59 per cent of the First Peoples students,

Table 2 Mean scores for academic outcome measures

	Hopelessness		English ratings		Maths rating	
	Mean	SD	Mean	SD	Mean	SD
First Peoples (n = 83)	2.59	1.31	3.43	.83	3.24	1.13
Anglo-Saxon (n = 279)	2.41	1.23	3.49	.82	3.25	.97
Asian/Eastern (n = 201)	2.71	1.30	3.49	.78	3.42	1.00

Table 3 Multi-group confirmatory factor analysis for racism and educational outcomes

	Standardised correlations				
	Racism	Hopelessness	English rating	Maths rating	University aspirations
Racism	1.00				
Hopelessness	.48*/.29*/.44*	1.00			
English rating	–.25*/–.09/–.16*	–.21^/–.25*/–.24*	1.00		
Maths rating	–.19^/–.12^/–.08	–.22*/–.27*/–.22*	.45*/.32*/.27*	1.00	
University asp.	.08/–.22*/–.09	–.15/–.28*/–.32*	.00/.28*/.18*	–.04/.27*/.34*	1.00

Note: For standardised correlations First Peoples/Anglo-Saxon/Asian/Eastern. *p significant at .05, ^ p approaching significance at < .10.

53 per cent of the Anglo-Saxon students, and 76.1 per cent of the Asian/Eastern students aspired to go university after they left school. Table 2 reveals the mean scores for the remaining outcome variables, and it can be seen that all student groups, on average, disagreed with the proposition that they felt hopeless at school, and rated themselves positively in English and maths when compared to other students in their year.

Table 3 offers the standardised factor correlations between the racism measure and the student outcomes for all groups. These results suggest that greater experiences of racism are significantly associated with increased levels of hopelessness across all groups, lower level maths and English ratings for at least two of the cultural groups, and lower university aspirations for the Anglo-Saxon student group.

Positive identity, racism and schooling outcomes

Research on the link between identity and student outcomes has produced mixed results, with some evidence questioning its importance in the schooling system (Hattie, 2009), while other evidence has strongly attested to the worth of positive identity within the classroom (Purdie, Tripcony, Boulton-Lewis, Fanshawe & Gunstone, 2000). Conceptualised not as a driver of success, but rather an agent of resilience, this investigation found a number of significant interactions between racism and the identity measures (see Figure 1).

The visual summary of the interactions in Figure 1 shows that while a stronger sense of identity seems to protect the First Peoples student group against feelings of hopelessness when they do not experience racism, these positive effects are negated when students experience high levels of racism. For the Anglo-Saxon students, the reverse interaction effect is identified, namely that both a stronger sense of cultural identity and multiculturation (perceived cultural respect) seem to buffer the Anglo-Saxon students from the negative effects of racism.

Positive school self-perceptions, racism and schooling outcomes

Positive school self-perceptions have long been encouraged within the schooling environment, not only for Aboriginal and Torres Strait Islander students (Bodkin-Andrews, Dillon & Craven, 2010; Craven &

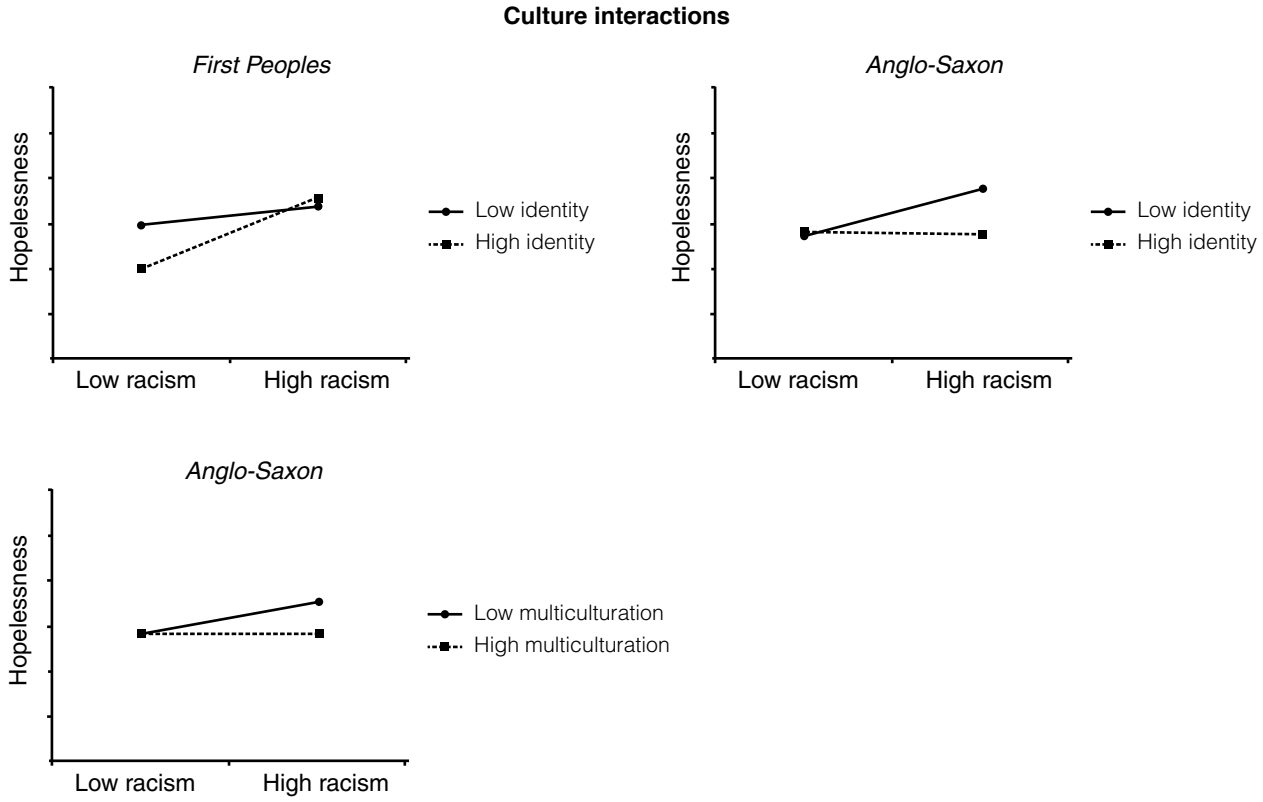

Figure 1 Significant latent interactions between the culture measures and racism

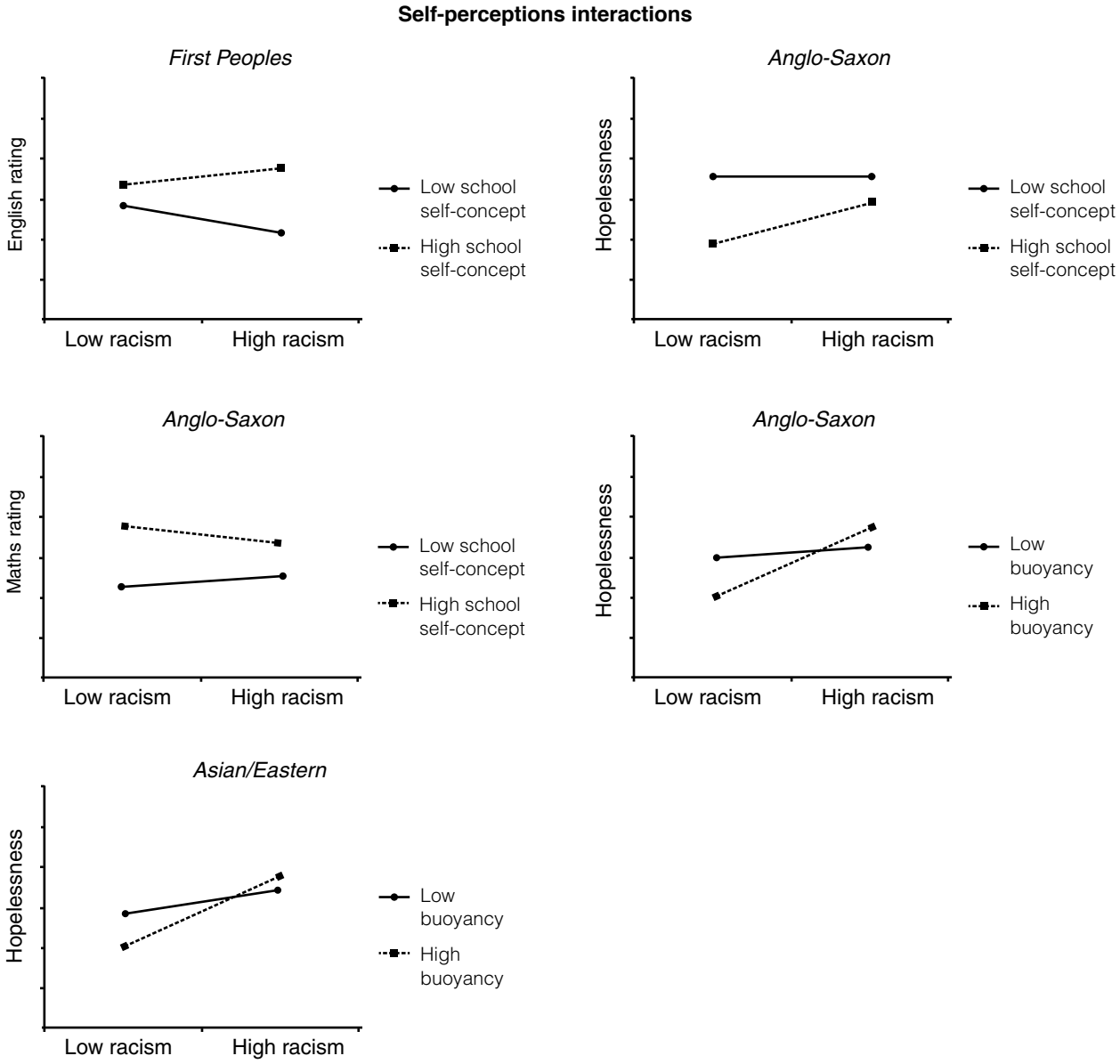

Figure 2 Significant latent interactions between the culture measures and racism

Marsh, 2008; Purdie et al., 2000), but for students from all cultural backgrounds (Huebner & Hills, 2011; Marsh & Martin, 2011). In this investigation, when testing positive school perceptions as agents of resilience, a range of significant interactions were identified across all student groups. The visual representation of the interactions in Figure 2 revealed that for the First Peoples student group and their English self-rating, not only did higher levels of school self-concept produce higher ratings when racism was low, but when racism was high, it negated the negative effects of racism to the extent that it may have reversed the effects of racism (that is, the positive effects of self-concept were even stronger when racism was high). For the Anglo-Saxon student group, a series of significant interactions were identified which suggest that, in part, school self-concept may buffer (although not negate) the effects of racism over hopelessness and maths achievement, yet academic buoyancy, somewhat paradoxically, may exacerbate the impact of racism over hopelessness. The final interaction can be noted for the Asian/Eastern students, and this interaction mimics the possible exacerbating effects of buoyancy as identified for the Anglo-Saxon students.

Emotional intelligence, racism and schooling outcomes

The final set of positively oriented psychological measures centres on notions of emotional intelligence (Goleman, 2001). While it may be argued that research (and opinion) on emotional intelligence has been predominantly popular in business and management literature, there has been an increasing push to recognise the value of emotional intelligence in schooling environments (Parker, Summerfeldt, Hogan & Majeski, 2004), with some evidence suggesting that emotional intelligence may not only directly impact upon higher levels of achievement, but also interact with cognitive intelligence in its influence over achievement (Qualter, Gardner, Pope, Hutchinson & Whiteley, 2012). When the emotional intelligence factors were assessed as agents of resilience, an array of significant interactions were identified for all student groups (although these effects did not include empathy). In Figure 3, it can be seen that the sole significant effect for the First Peoples reveals that if racism levels were low, students with high levels of self-regulation were less likely to feel hopeless. When racism levels were high, although this effect was still apparent, the benefits of higher levels of self-regulation were not as noticeable (suggesting a weak buffering effect). For the Anglo-Saxon students, both significant interactions were over university aspirations, and suggest that as racism increased, higher levels of self-understanding and self-regulation buffered these students from the negative impact of racism. Finally, for the Asian/Eastern student group, the numerous interactions across the outcomes variables revealed a relatively consistent picture; that is, across hopelessness and English and maths self-ratings, the emotional intelligence constructs failed to buffer the students from the negative effects of racism, and in some instances may have exacerbated these effects (e.g. a higher sense of self-understanding resulted in worse maths self-rating if racism levels were high).

Overall, the results from Study 1 revealed that the range of interplay between the positive psychological factors and racism is potentially quite diverse, not only within student groups, but also between them. These findings suggest that any attempt to identify broad constructs that act as agents of resilience against racism may be futile, as there seems to be considerable variation across cultural groups in this study. The implications then are that resilience should be identified through a detailed and open exploration sensitive to the cultural groups examined. This is especially relevant for Aboriginal and Torres Strait Islander research, as an increasing number of scholars are suggesting that research must be conducted from an Aboriginal and Torres Strait Islander lens, and not limited by the misconceptions that too often emerge from Western-based research lenses (Bodkin-Andrews & Carlson, 2013; Moreton-Robinson, 2011; Walter & Andersen, 2013).

Study 2: Bubalamai Bawa Gumada[3]– Healing the Wounds of the Heart project[4]

In this second study, in-depth interviews were conducted with 22 high-achieving and respected Aboriginal Australian representatives (including Elders, artists, academics, business owners and CEOs) across the Sydney Basin region. They freely spoke of their experiences of racism and how they combated racism throughout their lives. A number of key themes emerged with regard to possible agents of resilience. These are listed below.

Acknowledging racism. One of the strongest themes was the need to acknowledge racism and its impact within Australia. For example, one participant explained how racism influenced her self-perceptions:

> As a victim of racism, I had automatically assumed that every non-indigenous person was automatically better than me … I'm expecting that they will be superior to me in some way. (Senior lecturer)

She later explained that it was not until she was able to more fully educate herself about what racism is, and how it can be fought, that such negative self-perceptions were overcome.

Emotional distancing. All participants spoke of the need to emotionally distance themselves from racism, or externalise it, and often spoke of racism as a disease that someone else suffered from.

> The person that makes that comment is a sick person. They are generally –

3 Roughly translated from D'harawal as 'Healing the wounds of the spirit'.

4 The following is largely drawn from Bodkin-Andrews, G. H., Newey, K., O'Rourke, V., & Craven, R. (2013).

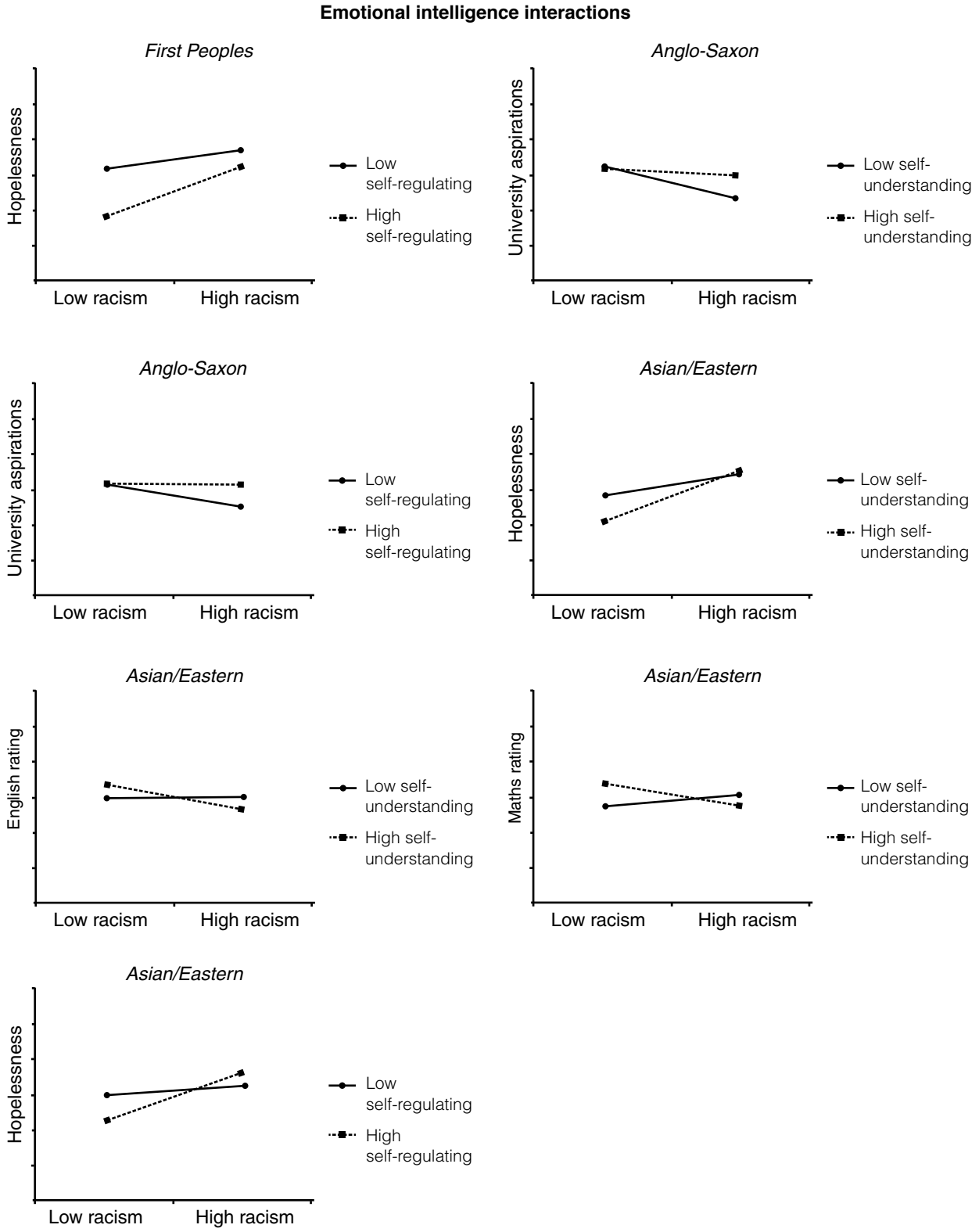

Figure 3 Significant latent interactions between the emotional intelligence measures and racism

> they may be highly educated – but they're uneducated. (Professor)

Staying positive. Throughout all the interviews, the respondents spoke of the need to remain positive despite the tension that racism may cause.

> Don't let the bastards grind you down. That was the one thing I would tell myself time after time … I would just say that and try and just get a bit more resilient … (University tutor, lecturer and business owner)

Sense of identity. Aligned to staying positive was the need to maintain the strength in one's own sense of Aboriginal identity. While most participants framed this theme as being proud of one's Aboriginality, an Elder explained that such pride comes from many sources.

> … there are people before you who had fought for your rights … Whether it was the Charlie Perkins of the world, whether it was your Nan, it is somebody who has stood up and said, we are who we are. We're Aboriginal and we will stand up and be counted … (Elder)

Staying calm. While the immediate negative emotional impact of racism was recognised, no participant supported responding in a violent manner. Instead, it was argued that violent responses would merely perpetuate and reinforce racism.

> The best advice I can give is count to 10 and take a big breath before you respond, because your response is going to be important to you for the rest of your life … (Member of Parliament)

Seeking support. Many respondents spoke of having people they could turn to and trust, and speaking to them was often seen as a way to avoid tension.

> Offload that incident immediately to your best friends. Do not hold it and let it fester. Have a joke with another Koori who will laugh with you … Just disburse it from your system, disburse it from your being. (Chief Executive Officer)

Challenging racism. The final theme to emerge was arguably the most powerful and also drew on the strengths promoted by the previous strategies. With recognition of the need to acknowledge racism comes the responsibility and motivation for action, for personal empowerment.

> I had a headmistress at school who hated me – she hated my mum. After my mum died, she sent a letter home to my father saying that I may as well leave school … That upset me … I planned and I waited and waited and when I got my first degree … I took it back to her and showed her … The revenge is there. You don't have to be physical about it and you don't have to be nasty about it. You can just prove they're wrong. (Elder)

Conclusion

The voices of Aboriginal and Torres Strait Islander people provide vital insights into buffering the impact of racism for both adults and youth. Whilst numerous strategies were identified within the interviews, there was no simple one-stop solution for mediating the negative effects of racism. These results suggest that it is critical that if research seeks to support Aboriginal and Torres Strait Islanders, then it must take the time to hear the lived voices and wisdom within Aboriginal communities, and to then develop multiple strategies that may more accurately represent the needs and wants of these communities.

Note. A number of the Aboriginal participants agreed to be re-interviewed for the *Healing the Wounds of the Heart* documentary. This can be viewed at: http://www.youtube.com/watch?v=H0RosRz_HtQ.

References

Bodkin-Andrews, G. H. (2011). *A short measure of emotional and social intelligence.* Unpublished manuscript.

Bodkin-Andrews, G. H., & Carlson, B. (2013). Higher education and Aboriginal identity: Reviewing the burdens from personal to epistemological racism. In R. Craven & J. Mooney (Eds.), *Diversity in Higher Education: Seeding success in Indigenous Australian higher education, Volume 14* (pp. 29–54). UK: Emerald Group Publishing.

Bodkin-Andrews G. H., & Craven, R. G. (2008). *A multi-dimensional measure of negative motivational outcomes.* Unpublished manuscript.

Bodkin-Andrews, G. H., Denson, N., & Bansel, P. (2013). The varying effects of academic self-concept, multiculturation and teacher discrimination as predictor of Indigenous and non-Indigenous Australian student academic self-sabotaging and disengagement. *Australian Psychologist*, *48*, 226–237.

Bodkin-Andrews, G. H., Denson, N., Finger, L., & Craven, R. (2013). Identifying the fairy dust effect for Indigenous Australian students: Is positive psychology truly a [Peter] Pan-theory? In R. G. Craven, G. H. Bodkin-Andrews, & J. Mooney (Eds.), *International Advances in Education: Global initiatives for equity and social justice* (pp. 183–210). Greenwich, CT: Information Age Publishing.

Bodkin-Andrews, G. H., Dillon, A., & Craven, R. G. (2010). Bangawarra'gumada –strengthening the spirit: Causal modelling of academic self-concept and patterns of disengagement for Indigenous and non-indigenous Australian students. *Australian Journal of Indigenous Education, 39*(1), 24.

Bodkin-Andrews, G. H., Newey, K., O'Rourke, V., & Craven, R. (2013). Promoting resiliency to counter racism: The lived wisdom within Aboriginal voices. *InPsych: The Bulletin of the Australian Psychological Society, 34*(4), 14–15.

Bodkin-Andrews, G. H., O'Rourke, V., Grant, R., Denson, N., & Craven, R. G. (2010). Validating racism and cultural respect? Understanding the educational impact of perceived discrimination and multiculturation for Indigenous and non-Indigenous students. *Educational Research and Evaluation, 16*(6), 471–493.

Christopher, J. C., & Hickinbottom, S. (2008). Positive psychology, ethnocentrism, and the disguised ideology of individualism. *Theory & Psychology, 18*(5), 563–589.

Craven, R. G., & Marsh, H. W. (2008). The centrality of the self-concept construct for psychological well-being and unlocking human potential: Implications for child and educational psychologist. *Educational & Child Psychology, 25*(2), 104–118.

Craven, R. G., Tucker, A., Munns, G., Hinkley, J., Marsh, H., & Simpson, K. (2005). *Indigenous students' aspirations: Dreams, perceptions and realities*. Canberra, Australia: Department of Education, Science and Training.

Dunn, K. M., Forrest, J., Pe-Pua, R., Hynes, M., & Maeder-Han, K. (2009). Cities of race hatred? The spheres of racism and anti-racism in contemporary Australian cities. *Cosmopolitan civil societies: An interdisciplinary journal, 1*(1), 1–13.

Goleman, D. (2001). An EI-based theory of performance. In D. Goleman, & C. Cherniss (Eds.), *The emotionally intelligent workplace: How to select for, measure, and improve emotional intelligence in individuals, groups, and organizations* (pp. 27–44). San Francisco, CA: Jossey-Bass.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York: Routledge.

Huebner, E., & Hills, K. J. (2011). Does the positive psychology movement have legs for children in schools? *Journal of Positive Psychology, 6*(1), 88–94.

Marsh, H. W., Ellis, L. A., Parada, R. H., Richards, G., & Heubeck, B. G. (2005). A short version of the Self Description Questionnaire II: Operationalizing criteria for short-form evaluation with new applications of confirmatory factor analyses. *Psychological Assessment, 17*(1), 81.

Marsh, H. W., & Martin, A. J. (2011). Academic self-concept and academic achievement: Relations and causal ordering. *British Journal of Educational Psychology, 81*(1), 59–77.

Marsh, H. W., Wen, Z., & Hau, K. T. (2006). Structural equation models of latent interaction and quadratic effects. *Structural equation modeling: A second course*, 225–265.

Martin, A. J., & Marsh, H. W. (2008). Academic buoyancy: Towards an understanding of students' everyday academic resilience. *Journal of School Psychology, 46*(1), 53–83.

Mellor, D. (2003). Contemporary racism in Australia: The experiences of Aborigines. *Personality and Social Psychology Bulletin, 29*(4), 474–486.

Moreton-Robinson, A. (2011). The white man's burden: Patriarchal white epistemic violence and Aboriginal women's knowledges within the academy. *Australian Feminist Studies, 26*(70), 413–431.

Muthén, L. K., & Muthén, B. O. (2010). Mplus: Statistical analysis with latent variables: User's guide. Los Angeles, CA: Muthén & Muthén.

Parker, J. D., Summerfeldt, L. J., Hogan, M. J., & Majeski, S. A. (2004). Emotional intelligence and academic success: Examining the transition from high school to university. *Personality and Individual Differences, 36*(1), 163–172.

Phinney, J. S. (1992). The multigroup ethnic identity measure: A new scale for use with diverse groups. *Journal of Adolescent Research*, *7*(2), 156–176.

Priest, N., Paradies, Y., Gunthorpe, W., Cairney, S., & Sayers, S. (2011). Racism as a determinant of social and emotional wellbeing for Aboriginal Australian youth. *Medical Journal of Australia, 194*(10), 546–550.

Purdie, N., Tripcony, P., Boulton-Lewis, G., Fanshawe, J., & Gunstone, A. (2000). *Positive self-identity for Indigenous students and its relationship to school outcomes*. Canberra: Department of Education, Training and Youth Affairs.

Qualter, P., Gardner, K. J., Pope, D. J., Hutchinson, J. M., & Whiteley, H. E. (2012). Ability emotional intelligence, trait emotional intelligence, and academic success in British secondary schools: A 5-year longitudinal study. *Learning and Individual Differences*, *22*(1), 83–91.

Schmitt, M. T., Branscombe, N. R., Postmes, T., & Garcia, A. (in press). The consequences of perceived discrimination for psychological well-being: A meta-analytic review. *Psychological Bulletin*.

Walter, M., & Andersen, C. (2013). *Indigenous statistics: A quantitative research methodology*. California: Left Coast Press.

GENDER AND MATHEMATICS: QUALITY AND EQUITY

Abstract

Over the past two decades, there have been no gender differences in mathematics achievement in Australia in large-scale international surveys such as the Trends in International Mathematics and Science Study (TIMSS). Similarly, when mathematical literacy was measured in the Programme for International Student Assessment (PISA) in 2003, there were no gender differences. However, PISA 2012 found that, while average scores in mathematics had declined in Australia, males in Australia were significantly outperforming females, and females had significantly higher average levels of anxiety about and significantly lower levels of confidence in mathematics. In light of the recent report of the Australian Council of Learned Academies, which points to an underrepresentation of women in science, technology, engineering and mathematics (STEM) careers in Australia, these trends are worrying, and point to the possibility of even fewer females progressing into these areas. This paper unpacks the PISA 2012 data to further investigate the achievement, attitudes and beliefs of young Australian females and males about mathematics. For whom is Australia providing a quality education in mathematics, and to what extent is this provided in an equitable way? It is hoped that a more differentiated view of the achievement, attitudes and beliefs of both males and females will assist governments in making policy decisions that will encourage participation and higher levels of achievement for females.

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Australian Council for Educational Research

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Dr Thomson has also fulfilled the roles of National Research Coordinator for Australia in the International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS) since 2002, National Project Manager for Australia in the OECD Programme for International Student Assessment (PISA) since 2004, and National Research Coordinator for Australia in the IEA Progress in International Reading Literacy Study (PIRLS) since 2008. In these roles she has contributed to the development of the instruments and questionnaires, particularly for TIMSS, for which she is a member of the Questionnaire Review Committee.

Dr Thomson's research at ACER has involved extensive analysis of large-scale national and international data sets – the Longitudinal Surveys of Australian Youth (LSAY), as well as TIMSS and PISA – and she is also involved in several projects involving analysis of the longitudinal data collection associated with the PISA surveys. She was engaged as an expert writer on the National Numeracy Review, and has consulted with a variety of government departments at both Commonwealth and state levels, as well as with the Catholic Education Commission, on a variety of data-analysis projects related to TIMSS and PISA.

The role of schools in preparing students for further study that will lead to future employment is an important one. However, while it has been estimated that 75 per cent of the fastest growing occupations require skills and knowledge in science, technology, engineering and mathematics (STEM) fields, a recent research report from the Australian Industry Group reveals what they describe as 'a disturbing picture in this area'. The report argues that young people in schools and universities are not acquiring the STEM skills we need for our future prosperity (Australian Industry Group, 2013). By increasing the proportion of students who stay in STEM through senior secondary school into university, including women and low socioeconomic status (SES) students, it is possible for a country to expand the talent pool from which future STEM high achievers will be drawn (Australian Council of Learned Academies (ACOLA), 2013, p. 14).

Unfortunately, the percentage of Year 12 students enrolled in higher level STEM in Australia has been declining for decades. Over the period 1992–2010, the proportion of Year 12 students in biology fell from 35 to 24 per cent, in chemistry from 23 per cent to 17 per cent, and in physics from 21 to 14 per cent (Office of the Chief Scientist, 2012, p. 43). The decline in the proportion of students enrolled in mathematics was not as sharp, dropping from 77 per cent to 72 per cent, but most students were enrolled in elementary mathematics subjects. Only 10 per cent participated in advanced mathematics at Year 12 level, with 20 per cent in intermediate mathematics. A growing proportion of high-achieving Year 12 students, particularly female students, participate in no mathematics at all.

Further, girls and women are less likely to choose careers in STEM areas, and more likely than males to drop out when they do enter those fields. This pattern has been called the 'leaky pipeline' (Watt, Eccles & Durik, 2006). Nonetheless, it is vital that we encourage girls and women to participate in STEM careers. Not only are jobs in such areas more likely to be better paid and more stable, but scientists and engineers work to solve some of the most difficult challenges of our time, and engineers design many of the things we use daily. When women are not involved in science and engineering, their unique experiences, needs, and desires may be overlooked, and the perspectives that these experiences may add to the body of scientific knowledge are lost. As an extreme example of this, a predominantly male group of engineers tailored the first generation of airbags in motor vehicles to suit adult male bodies, resulting in avoidable deaths for women and children (Margolis & Fisher, 2002, pp. 2–3).

Over the past four decades, there has been a steady stream of research on gender differences in mathematics, with the focus on discovering the reasons for females not participating in mathematics at the same levels as males. In one of the seminal studies in the area, Fennema and Sherman (1977), found that when two factors – the number of prior mathematics courses taken and experience with spatial activities – were taken into account, there were no statistically significant gender differences in abilities in mathematics. The researchers also found that males generally had more positive attitudes towards mathematics.

A large number of research studies over the intervening years have focused on affective and attitudinal variables and their impact on females' decision to continue studies in higher mathematics and science. Identified as critical are beliefs about the usefulness of mathematics and confidence in learning mathematics, with males generally indicating higher levels of confidence in learning mathematics than females, and males believing that mathematics was, and would be, more useful to them than did females. The importance of these variables, their long-term influence and their differential impact on females and males has been reconfirmed in many studies (Leder, 1992). In a study of participation in senior higher mathematics, Watt, Eccles and Durik (2006) also found that the strongest influence on maths participation for both males and females was the extent to which they were interested in and liked maths. This influence was stronger than that of their prior demonstrated mathematical achievement. A secondary factor was students' self-perceptions about their own maths talent and their expectations for mathematical success, particularly for females (p. 653).

Gender differences in mathematical literacy

Over the past two decades, the only significant gender difference in mathematics achievement in Australia in the Trends in International Mathematics and Science Study (TIMSS) was in 2007, and females' scores have recovered since then to show no gender difference in TIMSS 2012. Similarly, when mathematical literacy was measured in the Programme for International Student Assessment (PISA) in 2003, there were no gender differences; however, the most recent full assessment of mathematics in PISA 2012 found that while average

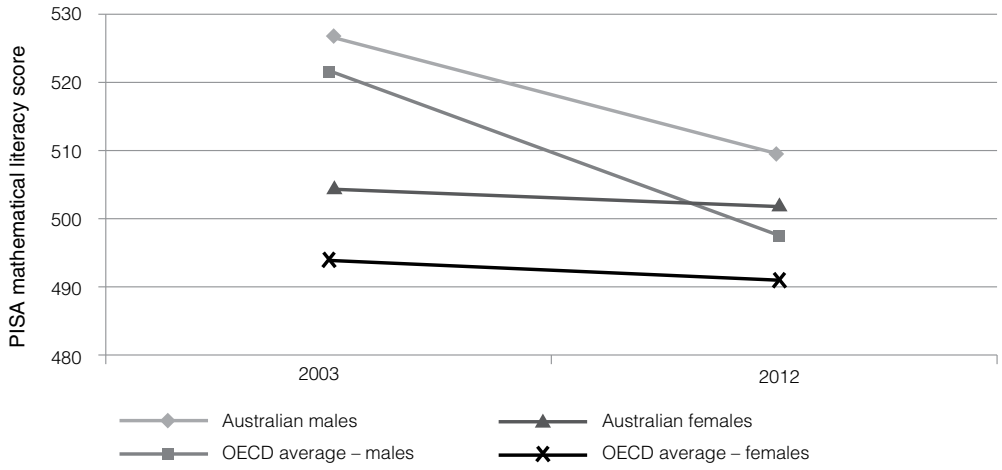

Figure 1 Scores for Australian males and females, and OECD averages for mathematical literacy, PISA 2003 and 2012

scores for both males and females had declined significantly, the average for females had declined more, and males in Australia were significantly outperforming females (Figure 1). While the difference is not great, it is important. Also important is that the average score for Australian females has declined to the extent that is now not significantly different from the OECD average score.

Analysis

A number of attitudinal variables that were used in PISA 2003 and PISA 2012 were also examined to see whether the differences in students' scores were reflected in differences on these variables. All of the variables were standardised to an average over the OECD of 0 and a standard deviation of 1.

- SELFCON. Students' self-concept in mathematics was measured from responses on a four-point Likert scale (strongly agree, agree, disagree, strongly disagree) to a number of items such as 'I get good grades in mathematics', 'I learn mathematics quickly', 'I am just not good at mathematics' (reversed).
- ANXMAT. Anxiety about mathematics was measured from responses on a four-point Likert scale (strongly agree, agree, disagree, strongly disagree) to items such as 'I often worry that it will be difficult for me in mathematics classes', 'I get very nervous doing mathematics problems', 'I feel helpless when doing a maths problem'.
- INSTMOT. Instrumental motivation was measured from responses on a four-point Likert scale (strongly agree, agree, disagree, strongly disagree) to items such as 'Making an effort in mathematics is worth it because it will help me in the work that I want to do later on', and 'I will learn many things in mathematics that will help me get a job'.
- INTMAT. Interest in mathematics, measured from responses on a four-point Likert scale (strongly agree, agree, disagree, strongly disagree) to items such as 'I look forward to my mathematics lessons' and 'I do mathematics because I enjoy it'.
- MATHEFF. Mathematics self-efficacy. Students' rating of their confidence in doing a number of mathematical tasks, such as 'understanding graphs presented in newspapers' and 'solving an equation such as $3x + 5 = 17$'.

Figure 2 summarises the attitudinal data for these variables, separately for males and females for 2003 and 2012.

This figure tells a number of interesting stories. For males, there have been very few changes in attitudes between PISA 2003 and PISA 2012. Self-concept in mathematics, instrumental motivation and mathematics self-efficacy were all significantly higher than the OECD average in 2003 and remained around the same level in 2012. Interest in mathematics, already significantly higher than the OECD average in 2003, increased significantly between 2003 and 2012. Anxiety about mathematics, on the other hand, already significantly lower than the OECD average in 2003, remained at about the same level in 2012.

For female students, the story is completely different, and in general could be summarised as poorer in 2012 than in 2003. Self-concept in mathematics, not significantly different from the OECD average in 2003, declined to

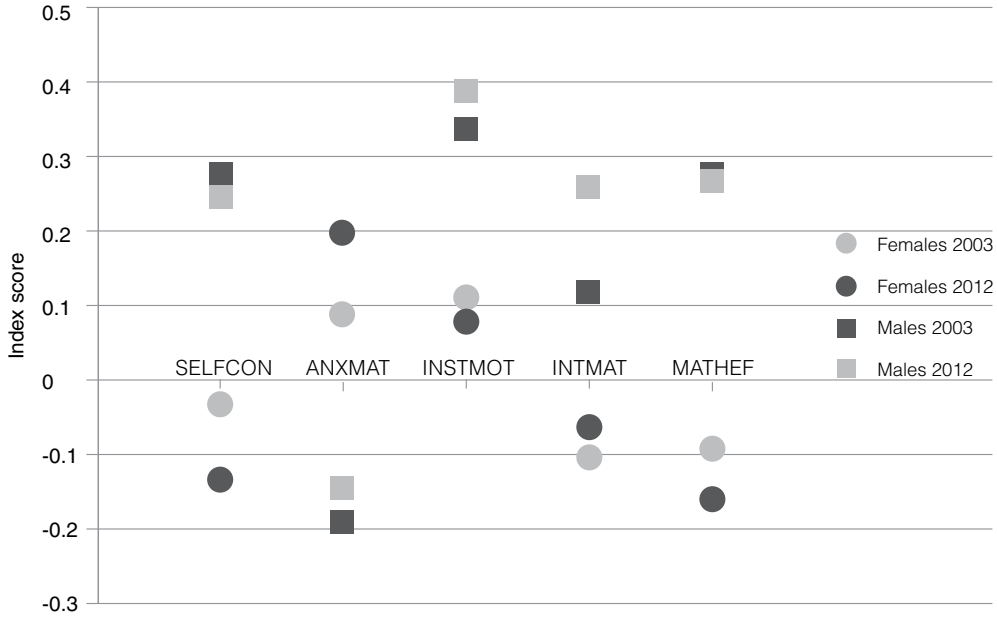

Figure 2 Attitudes to mathematics, by gender over time

be significantly lower than the OECD average in 2012. Anxiety about mathematics was significantly higher than the OECD average in 2003 and increased to be even higher in 2012. Interest in mathematics was lower than the OECD average in both 2003 and 2012, as was mathematics self-efficacy. The only bright spot was that the scores for instrumental motivation were significantly higher than the OECD average in both 2003 and 2012 and there was no decline – female students could see, although not as strongly as male students, that mathematics would be useful for them in their later lives.

Multiple regression analysis was conducted so that the individual effects of each of these attitudes could be examined while accounting for the effects of the others. This model accounted for 39 per cent of the variance in mathematics achievement of female students, and 35 per cent of the variance in mathematics achievement of male students. Table 1 contains adjusted effects and standard errors resulting from these models. Interest in mathematics was omitted from the final model due to collinearity with instrumental motivation.

As can be seen from Table 1, the strongest predictor of achievement for both males and females was mathematics self-efficacy, which showed an effect of 47 score points for females and 44 score points for males. The next strongest predictor for females was self-concept in mathematics, whereas for males this variable was not a significant influence on mathematics achievement. Instead, for males, the next strongest predictor was mathematics anxiety, which was surprisingly not a significant influence on the mathematics achievement of females.

Discussion

Between PISA 2003 and PISA 2012, in which mathematical literacy was the major focus, the achievement scores in mathematics for Australian male and female students declined significantly, more so among females than males. As a result, there are significant gender differences in mathematics in Australia for the first time in several decades. Further analysis was conducted using a number of attitudinal variables available in both years.

This analysis showed that there are subtle, but perhaps important, differences between the influences on the achievement of males and females. For both groups of students, mathematics self-efficacy had the strongest relationship with achievement – those students who believe that they are capable of tackling mathematics problems in everyday life were more successful in undertaking the PISA mathematics assessment items. Of course, it is likely that this relationship is reciprocal, with students who are stronger in mathematics being aware that this is the case, and so more likely to strongly agree with these statements. At the same time, higher levels of self-belief may lead these students to tackle more difficult problems and thus develop their mathematics abilities to a greater extent. Given

Table 1 Results from multiple regression models

	Change in mathematics score per unit increase of the index			
	Females		Males	
	Effect	SE	Effect	SE
MATHEFF	47	2.3	44	2.8
SELFCON	21	3.7	5	3.8
INSTMOT	6	1.9	6	2.8
ANXMAT	–3	2.9	–16	3.2

Note: SE – standard error

the strength of the relationship between mathematics self-efficacy and achievement, the significant decline in self-efficacy reported by females between 2003 and 2012 is a concern.

The finding here that neither interest in mathematics nor instrumental motivation in mathematics added to the explained variance in achievement for either males or females is of note, given previous attention paid to both of these factors as important influences on engagement with and achievement in mathematics. It could be hypothesised that students who had low levels of skills in mathematics (and were aware of this limitation) were unlikely to express an interest in the subject or in pursuing it further, and that while students may be told that mathematics will be useful for them in later life they do not make the connection between that and doing well at mathematics. There may be a degree of cognitive dissonance involved in holding a belief that a subject that one does not do well in is important to one's future.

Further research into the interrelationship between these attitudes and their influence on mathematics achievement may prove integral in addressing the re-emergence of a gender gap in mathematics achievement in Australia. Focusing interventions on such factors as instrumental motivation and interest in mathematics may have little impact without addressing other key influences, identified here as self-concept in mathematics and mathematics self-efficacy. For Australia to succeed in increasing the achievement of female students in mathematics and, more broadly, female participation in STEM subjects, we need to be sure that we are targeting the most important factors in this equation.

References

Australian Council of Learned Academies. (2013). *STEM: Country comparisons: International comparisons of science, technology, engineering and mathematics (STEM) education.* Retrieved from http://www.acola.org.au/PDF/SAF02Consultants/SAF02_STEM_%20FINAL.pdf

Australian Industry Group. (2013). *Lifting our science, technology, engineering and mathematics (STEM) skills.* Retrieved from http://www.aigroup.com.au/portal/binary/com.epicentric.contentmanagement.servlet.ContentDeliveryServlet/LIVE_CONTENT/Publications/Reports/2013/Ai_Group_Skills_Survey_2012-STEM_FINAL_PRINTED.pdf

Fennema, E., & Sherman, J. (1977). Sex-related differences in mathematics achievement, spatial visualization, and sociocultural factors. *American Educational Research Journal, 14,* 51–71.

Leder, G. C. (1992). Mathematics and gender: Changing perspectives. In D. A. Grouws (Ed.), *Handbook of Research on Mathematics Teaching and Learning* (pp. 597–622). New York: Macmillan.

Margolis, J. & Fisher, A. (2002). *Unlocking the clubhouse: Women in computing.* Cambridge, MA: Massachusetts Institute of Technology.

Office of the Chief Scientist. (2012). *Health of Australian science.* Retrieved from http://www.chiefscientist.gov.au/wp-content/uploads/OCS_Health_of_Australian_Science_LOWRES1.pdf

Watt, H. M. G., Eccles, J. S., & Durik, A. M. (2006). The leaky mathematics pipeline for girls: A motivational analysis of high school enrolments in Australia and the USA. *Equal Opportunities International, 25*(8), 642–659.

EARLY BIRD CATCHES THE WORM: THE CAUSAL IMPACT OF PRESCHOOL PARTICIPATION AND TEACHER QUALIFICATIONS ON YEAR 3 NAPLAN COGNITIVE TESTS

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Dr Diana Warren is an economist who joined the Australian Institute of Family Studies as a research fellow early in 2014. Her research focuses on the application of longitudinal data analysis for complex survey data, particularly using the data from the Longitudinal Study of Australian Children and the Household Income and Labour Dynamics in Australia (HILDA) Survey. Her main research interests are economics of education and labour economics. Prior to joining AIFS, Diana worked as a Research Fellow at the Melbourne Institute of Applied Economic and Social Research at the University of Melbourne, where her research work focused mainly on retirement decision-making and, more recently, early childhood education.

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Abstract

Using data from the Longitudinal Study of Australian Children (LSAC), this is the first analysis for Australia to evaluate the impact of attendance at preschool programs on matched Year 3 nation-wide National Assessment Program – Literacy and Numeracy (NAPLAN) test outcomes in the domains of numeracy, reading, spelling, writing and grammar. We also disaggregate the impact of specific teacher qualifications on children's cognitive outcomes. While one year of learning in Year 3 is represented by about 50 NAPLAN points, we find average preschool domain effects as much as 10–15 points. The impacts for NAPLAN scores in numeracy, reading and spelling domains are the strongest and are significant. The highest increases in NAPLAN scores were attained by children whose preschool teachers had diploma- or degree-level qualifications, identifying for the first time the crucial nature of teacher qualifications in driving nationally representative long-run preschool treatment outcomes.

EDUCATIONAL DISADVANTAGE AND REGIONAL AND RURAL SCHOOLS

Abstract

While there is much to be valued in regional and rural education, studies in Australia have identified location and isolation as key dimensions of additional need in the provision and delivery of education. Forty years ago, in the report to the Australian Schools Commission, Karmel identified several aspects of educational disadvantage experienced by schools in country areas – including high teacher turnover, low retention rates, less confidence in the benefits of education, limited cultural facilities in the community, lack of employment opportunities for school completers, and a less relevant curriculum – that led to lower levels of attainment (Karmel, 1973). These issues are still relevant today. This study uses a range of indicators, including National Assessment Program – Literacy and Numeracy (NAPLAN) results, attainment, post-school transition and student engagement and well-being data, to set out some of the dimensions of rural and urban differences in schooling. Results show that some, but not all, of the challenges facing regional and rural schools arise from the social, economic and community differences between city and rural environments.

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Sara is a highly regarded policy and research expert in the field of education. Most recently she was an Executive Director at the Victorian Department of Education and Early Childhood Development, where she was responsible for the strategic development of an integrated research and evaluation program to deliver a powerful evidence base for policy and practice. Prior to her role in state government, Sara was the Director of Education and Training and a principal researcher at the Centre for Adolescent Health at the Royal Children's Hospital/University of Melbourne for 8 years.

Anne Walstab

Victoria University

In 2013, the Organisation for Economic Co-operation and Development (OECD) reported an 'urban advantage' in student performance in every country that participated in the Programme for International Student Assessment (PISA) 2009 (OECD, 2013). The average urban–rural gap in performance translated to about 20 PISA score points, or the equivalent of half a year of schooling. Research in Australia also suggests that young people living in rural and isolated parts of the country have poorer educational and labour market outcomes than their urban counterparts (e.g. Lamb & Mason, 2008). One reason for this is that urban areas offer better employment prospects, particularly for highly skilled workers, and families in rural and regional areas tend to have lower levels of socioeconomic status, backgrounds more often correlated with lower academic achievement and poorer outcomes. However, the OECD observed that differences in student socioeconomic background explained only part of the performance gap between students who attend urban schools and those who attend schools in non-urban (rural and regional) areas. So what can account for the urban and rural and regional differences?

This paper presents an analysis of the urban–rural/regional education gap, followed by a discussion of the factors contributing to the gap. The paper draws mainly on data from the state of Victoria because of the availability of relevant school and student information provided by the Victorian Department of Education and Early Childhood Development.

Defining rural and regional

In this study, 'rural' and 'regional' refer to locations outside urban centres that have populations of 100 000 or more, which for Victoria means locations outside Melbourne and Geelong. Combining measures of population sparsity (persons per square kilometre) with scores from the Accessibility/Remoteness Index of Australia (ARIA) provided a means for ranking schools and populations and dividing them into seven categories:

1. Major city (Melbourne and Geelong)
2. Provincial city (e.g. Ballarat and Bendigo)
3. Provincial centre (e.g. Mildura, Swan Hill)
4. Large town (e.g. Leongatha, Lorne)
5. Small town (e.g. Terang, Skipton)
6. Rural (e.g. Bright, Donald)
7. Remote (e.g. Orbost).

The urban–rural/regional education gap

Achievement

In Victoria, as early as Year 3, students from urban schools outperform students from rural and regional schools in reading. Figure 1 shows mean scores in reading by location for students attending government schools. The mean score for students in major city areas is about 20 points higher than for students in other locations, and the scores are consistently lower across all rural and regional locations. A gap of around 22 points represents about 7 months learning, on average, if the points on the NAPLAN scale are translated into weeks of learning.

One of the factors driving rural and regional gaps in achievement is the difference in educational attainment of parents and communities. Rural and regional students are more likely than urban students to come from families with lower socioeconomic backgrounds. The parents of rural students tend to be less educated and less likely to be employed in professional occupations, such as doctors, lawyers and bankers. For example, while nearly six in ten adults living in Melbourne have completed Year 12, this falls to four in ten in provincial centres and one in three adults in rural and remote areas. These differences, however, do not explain all of the gap in performance between urban students and rural and regional students. When scores are adjusted to take into account population differences in socioeconomic status and other differences, the urban–rural literacy gap is reduced, but not eliminated, suggesting that population differences alone do not account for the size of the literacy gap. There appears to be a 'rural' and 'regional' factor or dimension that is at play (see the second panel of Figure 1).

Figure 2 presents relative achievement gains in literacy from Year 3 to Year 5. The results show that outside the major city areas, the NAPLAN achievement gains in reading are lower, and lower across all regions. A difference of about 8 points equates to about 3 months less literacy skill acquisition from Years 3 to 5. This applies to children in provincial centres, large towns and remote areas compared to students in major cities. It suggests that rural and regional children already behind at Year 3 make lower NAPLAN gains on average to Year 5, and at Year 5 therefore fall further behind.

Attendance

Absenteeism and school attendance are measures of student engagement. Absence rates, measured as

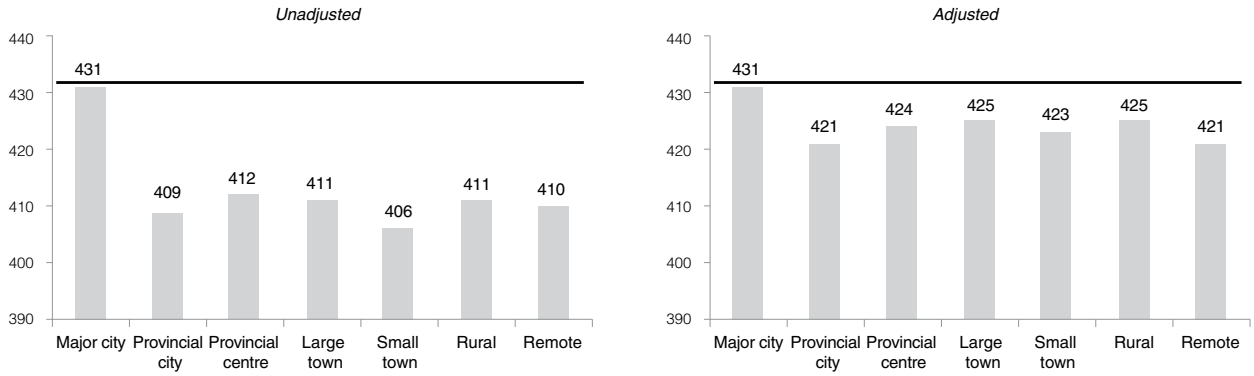

Figure 1 Year 3 mean NAPLAN reading scores, by location: unadjusted and adjusted mean scores for students in government schools, 2012

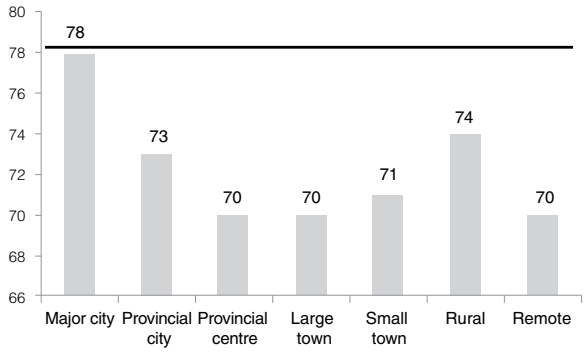

Figure 2 Mean NAPLAN gain scores in reading: Year 3 to Year 5, government schools

Table 1 VCE and VCAL attainment by location (2007 Year 9 cohort, all students)

	VCE completion (%)	VCAL completion (%)	All completion (%)
Major city	68	6	74
Provincial city	58	7	65
Provincial centre	56	8	64
Large town	53	6	59
Small town	55	6	61
Rural	54	8	62
Remote	60	6	66

the average number of days absent from school per student, are higher in rural and regional areas. Major city students are absent, on average, for 16 days, or about three weeks a year. Provincial city students are absent for about 23 days, or four and a half weeks a year, while the rate for students in provincial centres is 18.8 days, in large towns 20.3 days, in small towns 22.4 days, in rural areas 19.4 days and in remote areas 17.1 days. So on average, students in rural and regional areas receive less classroom learning time than city students, by virtue of being absent from school.

Year 12 certificate completion

Year 12 completion rates are lower in rural and regional areas. In a statewide 2007 Year 9 cohort of government and private school students tracked until 2012, rates varied by location, as shown in Table 1. Nearly three-quarters

of students in the major city regions completed the Victorian Certificate of Education (VCE) or Victorian Certificate of Applied Learning (VCAL), attaining Year 12 at a higher rate than students across all rural and regional locations. Overall completion rates were lowest in large towns, followed by small towns and rural areas.

Year 12 achievement

With fewer students completing VCE, meaning an over-selected population of completers, it might be expected that rural and regional students would achieve study scores on more equal terms with major city students. However, even here there are differences. For example, the mean VCE English study scores, English being a subject taken by most students, vary by region as shown below.

Major city	30.9
Provincial city	28.2
Provincial centre	28.6
Large town	27.6
Small town	28.7
Rural	28.3
Remote	29.2

The gaps in student scores between regions are not necessarily large, but the scores for rural and regional students are consistently lower. There is some improvement for students in remote areas, but students in large and small towns and remote areas have, on average, the lowest scores.

Transition from school

Students living in rural and regional areas face greater vulnerability in transition from school to further study and work. Using results from the *On Track* survey (Department of Education and Early Childhood Development, 2012) on the destinations of the 2010 Year 12 completers surveyed in 2011, about six months after leaving school, 13.4 per cent of major city students were looking for work or in part-time work only, compared to 21.7 per cent in provincial cities, 19.8 per cent in provincial centres, 23.0 per cent in large towns, 18.4 in small towns and rural areas, and 19.3 per cent in remote areas. Young people in rural and regional areas more often find themselves in a less secure and more marginalised position after leaving school.

They are also less likely to access university study. The proportion of Year 12 school leavers surveyed as part of *On Track* who were enrolled at university varies substantially by location. From major city areas, 54.2 per cent of the 2010 cohort of Year 12 leavers were at university in 2011, compared to 36.1 per cent of leavers from provincial cities, 37.6 per cent from provincial centres, 32.3 per cent from large towns, 33.9 per cent from small towns, 36.5 per cent from rural areas and 42.4 per cent from remote locations.

These findings regarding the post-school destinations of rural young people are reinforced by other studies that have shown that remoteness and proximity to education services influence the education and labour-force activities of young people across Australia once they leave school (Lamb & Mason, 2008). The proportion of 19-year-olds in full-time education decreases markedly with level of remoteness. Almost half of all city dwellers are in full-time education compared to just 5.8 per cent of those in the most remote areas of Australia. Conversely, the proportion of young Australians in the more precarious position of no full-time work and no full-time study increases with level of remoteness.

What accounts for urban–rural/regional differences in educational outcomes?

While economic conditions, linked to industry structure and occupational and employment opportunities that provide greater returns on investment in education for urban populations, are likely to play a part in the urban–rural/regional education divide, school provision factors are also relevant.

School size

Rural and regional schools tend to be smaller than urban schools. This can have a number of disadvantages as well as benefits for rural and regional students. On the one hand, class sizes tend to be smaller, students enjoy more individual attention from their teachers, and teachers often know most, if not all, the students. On the other hand, smaller schools tend to have fewer resources, are often less able to employ specialist staff or offer specialist subjects or programs, have to use composite multigrade classes, provide fewer opportunities for professional development, have more difficulty recruiting and retaining teachers, provide less support for special needs students and offer fewer options for courses.

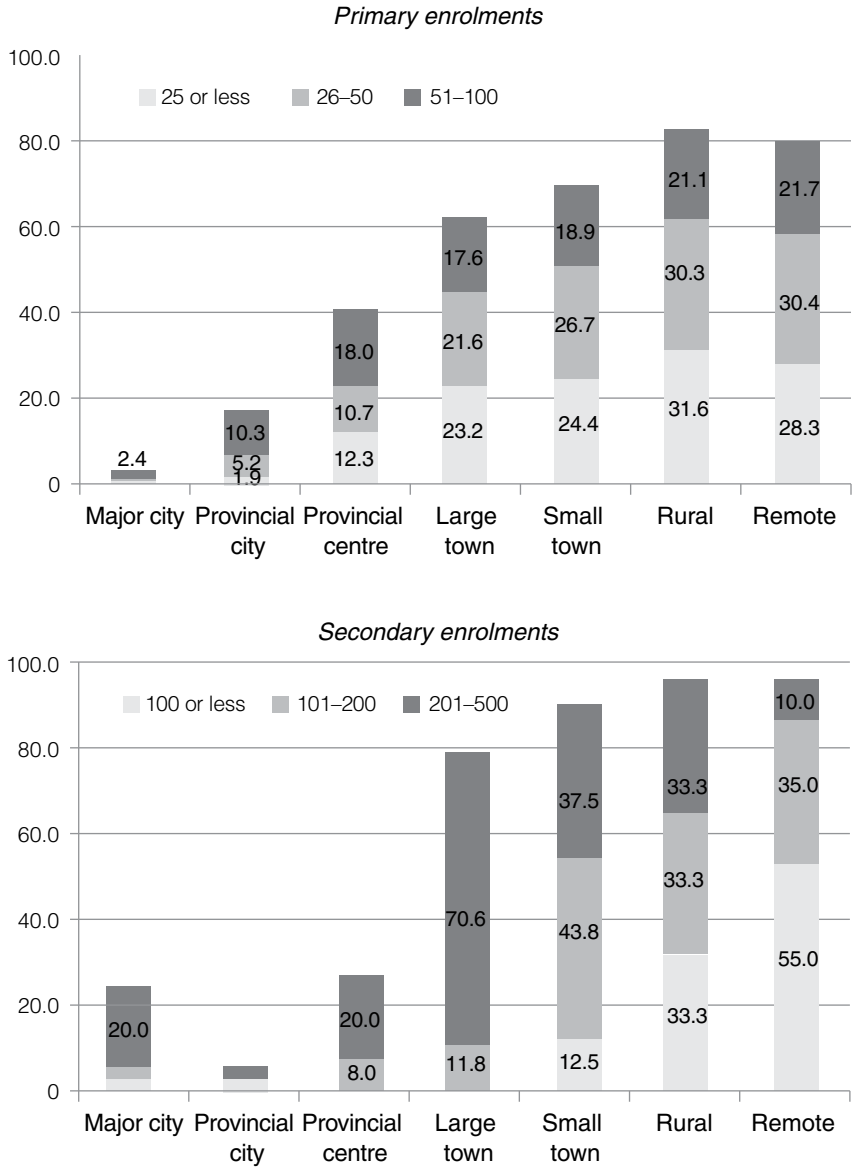

Figure 3 Distribution of small government schools across areas, by school size (number of enrolments)

Figure 3 shows the relationship between school size and location. For schools with primary enrolments, it is clear that school size decreases with remoteness. There are very few small schools (less than 100 enrolments) in the cities, but from large towns moving outward, more than half of the schools with primary enrolments have fewer than 100 students, and for rural and remote schools the figure jumps to 80 per cent. Small schools dominate in the rural and remote areas, where there are many with fewer than 25 enrolments.

Nearly all schools with secondary enrolments in large town through to remote locations have fewer than 500 students, whereas in the more urbanised areas there are very few secondary schools with fewer than 500 enrolments. Small school size is a structural feature of rural secondary provision.

School staffing

Smaller schools have fewer teachers and potentially less flexibility, thanks to their funding and resources. Research for this study found that rural and regional schools tend to have a more expensive teacher profile, as they have a higher proportion of Principal Class and Leading Teachers relative to all teachers. For example, the proportion of 'accomplished' and 'graduate' teachers declines with remoteness, making up 31 per cent of all

teachers in remote primary schools compared to 50 per cent in city schools. In small schools, principals are more likely to be undertaking classroom teaching, which also adds to the costs of the staffing profile in large and small towns, and rural and remote areas, where small schools are concentrated.

In addition to the classification and cost profiles of staff linked to school size and location is the capacity for schools to employ specialist teachers, such as music and physical education staff. With much smaller budgets linked to size, primary schools in particular across rural and remote areas are much more constrained in their capacity to employ specialist staff.

Program breadth

The tendency for schools in rural and remote areas to be smaller in size exerts increased resource pressures on these schools in their pursuit of the same educational goals as schools in city areas. From a simple fiscal viewpoint, smaller schools are less efficient because they have higher per capita funding needs to provide the same level of services provided in larger schools (Lamb, Rumberger, Jesson & Teese, 2004). Large high schools have traditionally been considered more economical and able to support a broader curriculum than smaller ones (Lee, Smerdon, Alfeld-Liro & Brown, 2000). As schools contract in size, they lose resource flexibility and their program options are more limited. This is the case for Victorian rural schools, where there is a substantial impact on program breadth at the senior secondary level, with fewer options for VCE and fewer options for Vocational Education and Training (VET) in Schools.

An examination of VCE options delivered in different regions shows there are some subjects without any enrolments in rural and remote areas, including Classical Studies; English Language; English (ESL); Environmental Science; History (Renaissance Italy); Music Style and Composition; Philosophy; Religion and Society; Sociology; and Theatre Studies.

An analysis of the mean number of VCE units available by school size is also revealing. Small schools of fewer than 500 enrolments make, on average, 16 subjects available to their senior students. This is just over half the number available at large schools of over 1500 secondary enrolments (30 subjects). Similarly, there are fewer VET in Schools certificates on offer outside the major city areas, as well as reduced offerings at the higher Australian Qualifications Framework levels. Course areas not offered outside cities include Applied Design, Fashion, Dance, and Sport and Recreation.

Smaller schools, more often located in rural and remote locations, cannot by virtue of their size deliver the same number of subject options, yet curriculum breadth is needed to retain students in school and address diversity of student interests and needs.

Capacity to raise funds

As schools become more isolated, their capacity to supplement government income with locally raised funds (LRF) is also more limited, largely due to their size. Rural and regional schools are less able to raise funds from their school communities. In 2012, primary schools in Melbourne were able to raise on average $262 000 from LRF ($728 per capita). Primary schools in remote areas, however, were able to raise $30 000 on average ($642 per capita). The rate in rural areas is the equivalent of being able to employ an extra teacher two days per week, while the rate in major city areas is an additional three full-time teachers.

Conclusion

This analysis of the educational outcomes of students in rural/regional and urban schools shows that rural and regional students do not perform as well as their urban counterparts. The gaps are primarily related to differences between rural and urban communities, in particular the average educational attainment of adults in the community, community industry and labour force conditions, and the educational requirements and earning capacity of jobs in the community.

Studies in other countries point to the importance of community factors and the need for responses recognising the role of community. A Canadian study reporting sizeable rural and urban gaps in education showed that the differences were most strongly related to community factors (Cartwright & Allen, 2002). The factors were characterised in rural areas by lower levels of educational attainment in the adult population, fewer, lower paid jobs, and jobs not requiring tertiary qualifications. The authors theorise that these variables, related to the educational level of jobs in the community, limit the educational aspirations of the students because young people become aware of the lack of employment opportunities in their community requiring high-level qualifications (Cartwright & Allen, 2002). Within the community, students are also less likely to have contact with adults who are able to demonstrate the value of good literacy skills (Canadian Council on Learning, 2008). Low aspirations within a

community are a significant barrier to students seeking and undertaking educational opportunities (The Senate Rural and Regional Affairs and Transport References Committee, 2009).

Even after considering the effects of community characteristics, there are many school characteristics that can influence student performance. Rural schools are smaller and more expensive to operate, they are more likely to experience teacher shortages, and they have fewer resources (OECD, 2013). For students attending rural schools, the impact of location can mean fewer opportunities for involvement in cultural activities and for experiencing the performing and visual arts; fewer opportunities for social interaction with peers; and restricted access to the range of work/career role models and to information about careers and the range of adult life opportunities (Victorian State Board of Education, 1985). For schools and teachers, the effects of location include limited opportunity for involvement in broad policy discussions, limited opportunities for professional exchange and development, restricted access to support systems such as specialist resources, and restricted access to resource provision.

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References

Canadian Council on Learning. (2008). *Closing Canada's rural/urban literacy gap*. Ontario: Canadian Language and Literacy Research Network.

Cartwright, F., & Allen, M. K. (2002). *Understanding the rural-urban reading gap*. Ontario: Statistics Canada.

Department of Education and Early Childhood Development. (2011). *The On Track survey 2011: The destinations of school leavers in Victoria state-wide report*. Melbourne: Author.

Karmel, P. (1973). *Schools in Australia: Report of the Interim Committee of the Australian Schools Commission*. Canberra: Australian Government Publishing Service.

Lamb, S., & Mason, K. (2008). *How young people are faring '08*. South Melbourne: Foundation for Young Australians & Education Foundation.

Lamb S., Rumberger R., Jesson J., & Teese R. (2004). *School performance in Australia: Results from analyses of school effectiveness: Report for the Victorian Department of Premier and Cabinet*. Melbourne, Victoria: Department of Education and Training.

Lee, V. E., Smerdon, B. A., Alfeld-Liro, C., & Brown, S. L. (2000). Inside large and small high schools: curriculum and social relations. *Educational Evaluation and Policy Analysis, 22,* 147–71.

Organisation for Economic Development and Co-operation (OECD). (2013). What makes urban schools different? *PISA in Focus*, *28*.

The Senate Rural and Regional Affairs and Transport References Committee. (2009). *Rural and regional access to secondary and tertiary education opportunities*. Canberra: Commonwealth of Australia.

Victorian State Board of Education. (1985). *The changing context and structures of postcompulsory schooling in Victoria: Education in rural areas. Working Paper No. 10*. Melbourne: State Board of Education.

CONFERENCE PAPERS

Tuesday 5 August

QUALITY AND EQUITY ISSUES RELATED TO THE INTEGRATION OF IMMIGRANT STUDENTS IN EDUCATION

Abstract

The integration of immigrant students is a major concern in many countries. Children who immigrate with their parents to another country (first generation) typically face a number of challenges in adjusting to the new environment. Yet, even children of immigrants who were born and raised in their parents' new country of residence (second generation) are often less successful in school than their peers from native families. The process of integration is complex and involves several aspects, as the distinction between structural, cultural, social and identity-related integration implies. In addition, factors at various levels have been suggested to affect the integration process in education, such as state-level regulations for immigration and integration, the composition of neighbourhoods and schools, and approaches to language teaching and learning. The presentation will provide an overview of research findings on some of these facets, with a special focus on factors that are specific to an immigration background rather than the socioeconomic status of the family. These include issues related to identity and language. If time permits, research findings on effects of the student composition in classrooms will be discussed as well. The presentation will close with an outline of remaining challenges and open questions.

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Immigration and integration: The context

Every year, millions of people leave their homes and move to another country. In 2007, more than 4.4 million people settled in one of the Organisation for Economic Co-operation and Development (OECD) countries. Although immigrant inflows decreased to below 3.8 million in 2010, they seem to be on the rise again since 2011 (OECD, 2013a). These immigration movements also affect the student composition in schools. According to the Programme for International Student Assessment (PISA), in 2012 about 11 per cent of 15-year-olds in OECD countries had an immigration background (OECD, 2013b). Among the OECD countries where the proportion of immigrant students (first and second generation) in schools was higher than 20 per cent were Australia, Canada, Luxembourg, New Zealand, Switzerland and the United States. In another 11 OECD countries, including Germany, the proportion ranged between 10 and 20 per cent (OECD, 2013b).

These numbers imply that many countries face the challenge of integrating immigrant students into their school systems. Yet, the nature of this challenge varies considerably. In addition to the proportion of first- and second-generation students, immigrant populations differ between countries in terms of their socioeconomic and educational background. This is partly due to variations in immigration policies (Stanat & Christensen, 2006). While some countries, including Australia, typically base entry decisions for immigrants on their qualifications and other background factors, this is much less prevalent in, for example, European countries. Accordingly, while in Europe the PISA index of economic, social and cultural status (ESCS) is generally lower for immigrant students than for their peers from native families, this is not the case in Australia (OECD, 2013b). Here, even the ESCS of first-generation students is, on average, comparable to that of non-immigrant students. Most importantly, both first-generation and second-generation immigrant students in Australia reached significantly higher scores on the PISA 2012 mathematics test than their peers from native families, suggesting that structural integration is ensured at the system level (OECD, 2013b).

This, however, does not imply the absence of challenges. One general challenge immigrant students typically have to master is the negotiation of two cultural contexts: the cultural context of their family's country of origin and the cultural context of their family's country of residence (Berry, 1980, 1997). These two broad perspectives are relevant for several aspects, most notably for identity development as well as for language use and proficiency. The question, then, becomes what role the orientations toward the two contexts play for the structural integration of immigrant youth, namely their educational success.

Acculturation orientations[1]

Acculturation refers to the changes that occur when two cultures come in contact with each other for extended periods of time. This entails changes on the collective level as well as on the individual level. In his seminal work on acculturation, Berry (1980, 1997) distinguishes two theoretically independent dimensions: a person's orientation toward the cultural context of the country of origin (CO-culture) and an orientation toward the cultural context of the country of residence (CR-culture). Depending on the degree to which these dimensions are high or low, four prototypical orientations can result. These are depicted in Figure 1.

This distinction suggested by Berry has also been applied to the concept of cultural identity, which can be construed as an aspect of psychological acculturation (e.g. Phinney, 1990; Phinney, Berry, Vedder & Liebkind, 2006). Within the framework of social identity theory (Tajfel & Turner, 1979), cultural identity is conceptualised as the sense of belonging to a specific social group (e.g. Horenczyk, 2008; Phinney, 1990, 1992). The identification with a social group, then, is assumed to influence how people see themselves and their self-esteem.

The extent to which the four prototypical identity orientations are more or less conducive to immigrant students' psychological adaptation and education success is unclear. At least five theoretical positions are discussed in the literature (Edele, Stanat, Radmann & Segeritz, 2013):

- (Neo-)assimilation theory suggests that a strong orientation toward the cultural context of the country of residence is decisive for the integration of immigrants. According to this view, students identifying with the CR-culture (assimilated or integrated) should be most successful in school, whereas the degree to which they also identify with the CO-culture should largely be irrelevant.

1 This section is largely based on Edele, Stanat, Radmann and Segeritz (2013).

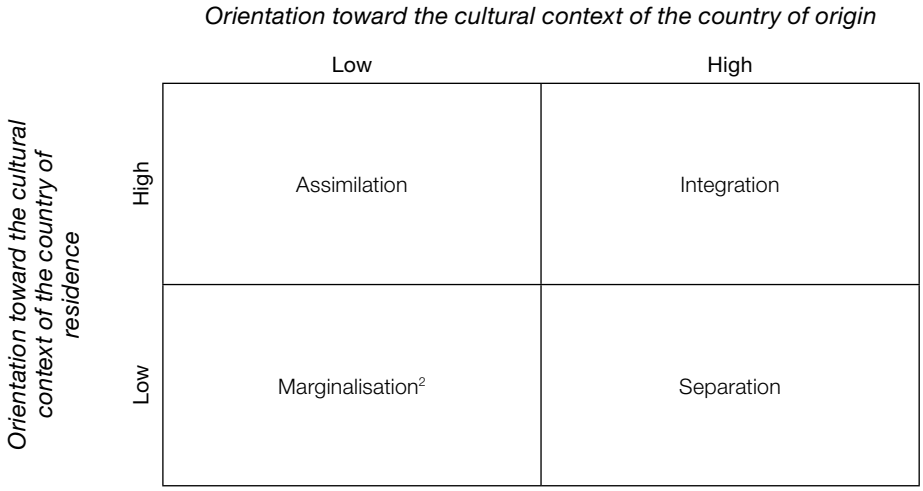

Figure 1 Prototypical acculturation orientations of immigrants (based on Berry, 1980, 1997)

- A second, contrasting view assumes that a strong orientation toward the cultural context of the country of origin is conducive to psychological adaptation and, hence, to educational success (e.g. Phinney, 1990; Portes & Rumbaut, 2001; Zhou, 1997). Students with strong ties to the CO-culture presumably have access to resources that can, for example, motivate learning and serve as a buffer against experiences of prejudice and discrimination (e.g. Caldwell, Kohn-Wood, Schmeelk-Cone, Chavous & Zimmerman, 2004; Wong, Eccles & Sameroff, 2003). With regard to the role of a person's identification with the CR-culture, however, this theoretical position makes no explicit predictions.
- Another frequently advanced hypothesis is that a strong orientation toward both the CO-culture and the CR-culture presents the optimal constellation for psychological adaptation and structural integration of immigrant youth (e.g. Altschul, Oysermann & Bybee, 2008; Berry, Phinney, Sam & Vedder, 2006; Berry, 1997; Oysermann, Kemmelmeier, Fryberg, Brosh & Hart-Johnson, 2003). According to this view, then, students with an integrated orientation should be most successful in school.
- In addition, some researchers predict negative effects of a separation orientation; that is, the combination of a strong identification with the CO-culture and a weak identification with the CR-culture (e.g. Esser, 2009; Oysermann et al., 2003). Oysermann et al. (2003), for example, suggest that immigrant students who do not relate to the CR-culture may also distance themselves from the educational institutions associated with this culture and hence from trying to be successful in school.
- Finally, most theoretical accounts view a lack of identification with both the CO-culture and the CR-culture (marginalisation) as problematic, and suggest that students with this type of orientation are likely to disengage from school.

A few studies have explored the relationship between immigrant students' cultural identity and indicators of school success, but the evidence is mixed. Some findings support the neo-(assimilation) perspective, indicating that students' orientation toward the CR-culture is a significant predictor of achievement, whereas their orientation toward the CO-culture is largely irrelevant (e.g. Hannover et al., 2013; Horenczyk, 2010; Trickett & Birman, 2005). The findings of other studies, in contrast, provide support for the notion that an integrated orientation is most conducive to educational success (e.g. Berry et al., 2006; Oysermann et al., 2003). In addition, various investigations found that separation and marginalisation tend to be associated with poorer educational outcomes than other patterns (e.g. Altschul et al., 2008; Berry et al., 2006; Hannover et al., 2013; Oysermann et al., 2003).

One major shortcoming of this research, however, is that most studies relied on self-reported grades rather than on objective measures of achievement. To address this shortcoming, Edele et al. (2013) explored the relationship between cultural identity orientations

2 The term 'marginalisation' has been criticised in the literature, as weak ties to both the CO and the CR do not necessarily result in social exclusion, as the label implies (Maehler, 2012; Rudmin & Ahmadzadeh, 2001). Because it is the most commonly used term in the international literature, however, it is adopted here as well.

and student performance in PISA 2009. In Germany, the national PISA 2009 consortium (Klieme et al., 2010) included two items in the student questionnaire that pertained to immigrant students' cultural identity. More specifically, the students were asked to indicate the degree to which they feel that they belong to each of the following social groups: a) 'the people from the country of your parents' and b) 'the people from Germany'. The 3-point rating scale had the response options 'not at all', 'somewhat' and 'very much'. Controlling for socioeconomic background, gender and the language spoken at home, immigrant students with an integrated cultural orientation reached similar levels of reading achievement as their peers from native families. This was also the case for students with an assimilated orientation, whose mean achievement even exceeded that of non-immigrant students when the language spoken at home was controlled. Mean achievement of students with a marginalised identity orientation, in contrast, was significantly lower than mean achievement of students from native families. Thus, marginalised youth seems to be particularly at risk of falling behind. Due to the cross-sectional nature of the PISA data, however, the causality underlying this association cannot be discerned; this would require longitudinal analyses.

Language

For questions related to language acquisition of immigrant students, the two general dimensions distinguished by Berry (1980, 1997) are relevant as well (Esser, 2006). Immigrant students often have to learn the language used in classroom instruction as a second language (L2), and most school systems respond to this challenge by providing some kind of support for second-language learners (Stanat & Christensen, 2006). The role that students' first language (L1) plays for second-language learning, however, is highly controversial and unclear. According to the highly influential transfer hypothesis by Cummins (1979, 1980), promoting immigrant students' proficiency in their L1 will have positive effects on their L2 development. This prediction was based on the notion that conceptual and linguistic knowledge in L1 would feed into a common underlying proficiency and thereby transfer to the L2. Thus far, however, the transfer assumption has only been explored in small-scale studies, typically involving very small numbers of students.

In an attempt to test the transfer hypothesis more generally, based on data from a larger sample, we developed basic listening comprehension tests in the two most common first languages of immigrant students in Germany, namely Turkish and Russian (Edele, Schotte, Hecht & Stanat, 2012). These tests were administered in the 9th grade cohort of the National Educational Panel Study (NEPS) in Germany (Blossfeld, von Maurice & Schneider, 2011). Starting from the Simple View of Reading (Hoover & Gough, 1990), which holds that (in addition to decoding skills) listening comprehension is a major determinant of reading comprehension, we tested the prediction that listening comprehension in L1 would be positively associated with reading comprehension in L2 (Edele, Stanat, Kristen & Schroeders, 2013; Edele, Stanat & Kristen, 2014). Based on Cummins's (1979) threshold hypothesis, moreover, we expected this relationship to be more pronounced at higher levels of L1, thus showing a polynomial trend. The results of our analyses largely supported these predictions, although the polynomial relationship emerged only for the Turkish-speaking group (Edele et al. 2013; Edele et al. 2014).

These findings thus lend support to the transfer hypotheses purported by Cummins (1979, 1980, 2000) and others, but they need to be replicated with longitudinal data before definite conclusions can be drawn. Most importantly, establishing the occurrence of transfer has no direct implications for the question of how language support for immigrant youth should be organised. To establish whether L2 support is more effective if the L1 is supported as well, it is necessary to carry out intervention studies. Due to methodological limitations of the investigations published thus far (e.g. Limbird & Stanat, 2006; Söhn, 2005), it is currently not possible to draw sound conclusions on this issue.

References

Altschul, I., Oysermann, D., & Bybee, D. (2008). Racial-ethnic self-schemas and segmented assimilation: Identity and the academic achievement of Hispanic youth. *Social Psychology Quarterly, 71*(3), 302–320.

Berry, J. W. (1980). Acculturation as varieties of adaptation. In A. Padilla (Ed.), *Acculturation: Theory, models and some new findings* (pp. 9–25). Boulder, CO: Westview.

Berry, J. W. (1997). Immigration, acculturation, and adaptation. *Applied Psychology: An International Review, 46*(1), 5–68.

Berry, J. W., Phinney, J. S., Sam, D. L., & Vedder, P. (2006). Immigrant youth: Acculturation, identity,

and adaptation. *Applied Psychology: An International Review, 55*(3), 303–332.

Blossfeld, H.-P., von Maurice, J., & Schneider, T. (Eds.) (2011). The National Educational Panel Study: Need, main features, and research potential. *Zeitschrift für Erziehungswissenschaft, Special Issue 14.*

Caldwell, C. H., Kohn-Wood, L. P., Schmeelk-Cone, K. H., Chavous, T. M., & Zimmerman, M. A. (2004). Racial discrimination and racial identity as risk or protective factors for violent behaviors in African American young adults. *American Journal of Community Psychology, 33*(1–2), 91–105.

Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research, 49*(2), 222–251.

Cummins, J. (1980). The cross-lingual dimensions of language proficiency: Implications for bilingual education and the optimal age issue. *TESOL Quarterly, 14*(2), 175–187.

Cummins, J. (2000). *Language, power and pedagogy: Bilingual children in the crossfire.* Cleveden: Multilingual Matters.

Edele, A., Schotte, K., Hecht, M., & Stanat, P. (2012). Listening comprehension tests of immigrant students' first languages (L1) Russian and Turkish in grade 9: Scaling procedure and results. *NEPS Working Papers, 13.*

Edele, A., Stanat, P., & Kristen, C. (2014). *The role of first-language listening comprehension in second-language reading comprehension.* Manuscript submitted for publication.

Edele, A., Stanat, P., Kristen, C., & Schroeders, U. (2013). Die Rolle herkunftssprachlicher Kompetenz (L1) für die Beherrschung der Sprache des Aufnahmelandes (L2) bei Jugendlichen aus zugewanderten Familien. Paper presented at the First Conference of the Gesellschaft für Empirische Bildungsforschung (GEBF), Kiel, Germany.

Edele, A., Stanat, P., Radmann, S., & Segeritz, M. (2013). Kulturelle Identität und Lesekompetenz von Jugendlichen aus eingewanderten Familien. In N. Jude & E. Klieme (Eds.), PISA 2009 – Impulse für die Schul- und Unterrichtsforschung. *Zeitschrift für Pädagogik, Beiheft 59,* 84–110.

Esser, H. (2006). *Sprache und Integration: Die sozialen Bedingungen und Folgen des Spracherwerbs von Migranten.* Frankfurt am Main: Campus Verlag.

Esser, H. (2009). Pluralisierung oder Assimilation. Effekte der multiplen Inklusion auf die Integration von Migranten. *Zeitschrift für Soziologie, 38*(5), 358–378.

Hannover, B., Morf, C., Neuhaus, J., Rau, M., Wolfgramm, C., & Zander-Music, L. (2013). How immigrant adolescents' self-views in school and family context relate to academic success in Germany. *Journal of Applied Social Psychology, 43,* 175–189.

Hoover, W. A., & Gough, P. B. (1990). The simple view of reading. *Reading and Writing, 2*(2), 127–160.

Horenczyk, G. (2008). Cultural identities, perceived discrimination, and adaption: Immigrant adolescents in Israel. In A. Stavans & I. Kupferberg (Eds.), *Studies in language and language education. Essays in honor of Elite Olshtain* (pp. 395–410). Jerusalem: Magnes Press.

Horenczyk, G. (2010). Language and identity in the school adjustment of immigrant students in Israel. In C. Allemann-Ghionda, P. Stanat, K. Göbel & C. Röhner (Eds.), Migration, Identität, Sprache und Bildungserfolg. *Zeitschrift für Pädagogik, Beiheft 55,* 44–58.

Klieme, E., Artelt, C., Hartig, J., Jude, N., Köller, O., Prenzel, M., Schneider, W., & Stanat, P. (Eds.) (2010). *PISA 2009. Bilanz nach einem Jahrzehnt.* München: Waxmann.

Limbird, C. & Stanat, P. (2006). Sprachförderung bei Schülerinnen und Schülern mit Migrationshintergrund: Ansätze und ihre Wirksamkeit. In J. Baumert, P. Stanat & R. Watermann (Eds.), *Herkunftsbedingte Disparitäten im Bildungswesen: Differenzielle Bildungsprozesse und Probleme der Verteilungsgerechtigkeit* (pp. 257–307). Wiesbaden: VS Verlag für Sozialwissenschaften.

Maehler, D. B. (2012). *Akkulturation und Identifikation bei eingebürgerten Migranten in Deutschland (Reihe Internationale Hochschulschriften).* Münster: Waxmann.

Organisation for Economic Co-operation and Development (OECD). (2013a). *International Migration Outlook 2013.* Paris: OECD Publishing.

Organisation for Economic Co-operation and Development (OECD). (2013b). *PISA 2012 Results: Excellence Through Equity: Giving Every Student the Chance to Succeed (Volume II).* Paris, OECD Publishing.

Oysermann, D., Kemmelmeier, M., Fryberg, S., Brosh, H., & Hart-Johnson, T. (2003). Racial-ethnic self-schemas. *Social Psychology Quarterly, 66*(4), 333–347.

Phinney, J. S. (1990). Ethnic identity in adolescents and adults: Review of research. *Psychological Bulletin, 108*(3), 499–514.

Phinney, J. S. (1992). The Multigroup Ethnic Identity Measure: A new scale for use with diverse groups. *Journal of Adolescent Research, 7*(2), 156–176.

Phinney, J. S., Berry, J. W., Vedder, P., & Liebkind, K. (2006). The acculturation experience: Attitudes, identities, and behaviors of immigrant youth. In J. W. Berry, J. S. Phinney, D. L. Sam & P. Vedder (Eds.), *Immigrant youth in cultural transition: Acculturation, identity and adaptation across national contexts* (pp. 1–14). Mahwah, New Jersey: Lawrence Erlbaum.

Portes, A., & Rumbaut, R. G. (2001). Not everyone is chosen: Segmented assimilation and its determinants. In A. Portes & R. G. Rumbaut (Eds.), *Legacies: The story of the immigrant second generation* (pp. 44–69). Berkeley: University of California Press.

Rudmin, F. W., & Ahmadzadeh, V. (2001). Psychometric critique of acculturation psychology: The case of Iranian migrants in Norway. *Scandinavian Journal of Psychology, 42*, 41–56.

Söhn, J. (2005). *Zweisprachiger Schulunterricht für Migrantenkinder. Ergebnisse der Evaluationsforschung zu seinen Auswirkungen auf Zweitspracherwerb und Schulerfolg.* Berlin: Arbeitsstelle Interkulturelle Konflikte und gesellschaftliche Integration (AKI), Wissenschaftszentrum Berlin für Sozialforschung (WZB).

Stanat, P. & Christensen, G. (2006). *Where immigrant students succeed – a comparative review of performance and engagement in PISA 2003.* Paris: OECD.

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W.G. Austin & S. Worchel (Eds.), *The social psychology of intergroup relations* (pp. 33–47). Monterey, CA: Brooks, Cole.

Trickett, E., & Birman, D. (2005). Acculturation, school context, and school outcomes: Adaptation of refugee adolescents from Former Soviet Union. *Psychology in the Schools, 42*(1), 27–38.

Wong, E., Eccles, J., & Sameroff, A. (2003). The influence of ethnic discrimination and ethnic identification on African American adolescents' school and socioemotional adjustment. *Journal of Personality, 71*(6), 1197–1232.

Zhou, M. (1997). Segmented assimilation: Issues, controversies, and recent research in the new second generation. *International Migration Review, 31*(4), 975–1008.

LEARNING, EARNING AND YEARNING: DISRUPTION, INNOVATION AND EXPANSION IN INDIGENOUS EDUCATION

Abstract

'What for, I do this?' asks an Aboriginal young man who has just become the first in his community to finish high school. Rather than celebrating his achievement, he felt the need to ask one of the most profound questions in education – what for or why? This particular story, discovered during the course of my PhD research, leads to an even larger question: How do we personalise education?

The question seems a mile away from the perennial debate in education – 'back to basics' versus an expansive education agenda. Conservatives in the 'back to basics' corner rightly point out that proficiency in literacy and numeracy is fundamental to successful economic and social participation later in life, while progressives in the expansion corner justifiably point to the need for all learners to become producers and not mere consumers of learning, by learning to learn, by thinking critically and creatively, by developing self-identity and expression, and by becoming more entrepreneurial and culturally engaged in a globalised world.

A new paradigm that synthesises these forces is necessary, if not urgent. This presentation proposes such a paradigm by drawing upon national and international theory, data and literature calling for greater disruption, innovation and expansion in education; by gifting Indigenous young people with educational experiences that go to relevance, context and 'place', identity and character, agency and enterprise, aspiration, culture and a sense of learning, earning and yearning.

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Tony Dreise descends from the Guumilroi people of north-west New South Wales and south-west Queensland. He is currently a Principal Research Fellow, Indigenous Education, at ACER. He is in the final stage of a PhD at the Australian National University, where he has been researching the relationship between Australian philanthropy and Indigenous education. He holds a Bachelor of Teaching degree and was one of the inaugural graduates of the Executive Masters of Public Administration with the Australian and New Zealand School of Government.

Tony has over 20 years high-level experience in public policy, research and education, having served as a Research Officer with Queensland's Aboriginal Justice Advisory Council; National Equity Manager with the Australian National Training Authority; National Executive Officer of Australia's Indigenous Training Advisory Council; Principal Education Officer within the NSW Education Department; Executive Director of Indigenous Policy in the Queensland Government; and Social Inclusion Director with TAFE NSW North Coast Institute.

Tony has served on a number of regional and national boards, including as a former President of the Northern Rivers Social Development Council; former Deputy Chair of the Northern Rivers Board of Regional Development Australia; and former Member of the National Vocational Equity Advisory Council. He currently sits on the Board of Adult Learning Australia.

If you were asked to score the nation's performance in providing education to Indigenous Australians, what would you give it? You would most probably come up with a report card with mixed results. When one looks at performance by educational sector, it could be argued (hypothetically) that vocational education and training (VET) should score a 'B', schools a 'C' and universities a 'D'.

Data show that Indigenous participation in VET increased by 48 per cent between 2002 and 2011. Further, Indigenous Australians made up 3 per cent of all apprentices and trainees in 2011, which is slightly higher than the Indigenous share of the general population at 2.5 per cent (National VET Equity Advisory Council [NVEAC], 2013). Meanwhile, the gap between Indigenous and non-Indigenous student retention to Year 12 has reduced from 37 percentage points to 28 percentage points over the past decade (Australian Bureau of Statistics, ABS, March 2014). At the university level, approximately 10 000 Indigenous people were enrolled across Australian universities in 2009. While this figure might look impressive, it actually means that Indigenous Australians make up a mere 0.7 per cent of university enrolments despite comprising approximately 2.5 per cent of the Australian population (Pechenkina & Anderson, 2011).

Encouragingly, participation by Aboriginal and Torres Strait Islander people in education has come a long way since the days when Indigenous people were actively excluded from attending schools (Broome, 2010). Today, young Indigenous Australians can look up to and hopefully be inspired by Indigenous doctors, professors, teachers, nurses and qualified tradespeople. However, recent data also show that the Year 12 retention rate for Indigenous students in 2013 sat at 55 per cent, compared with 83 per cent for their non-Indigenous peers (ABS, 2014) and that Indigenous youth can be up to two and a half years behind their peers in maths, science and reading literacy (Dreise & Thomson, 2014).

Lifting Indigenous young people's attendance, retention and successful completion of secondary schooling represents a sizeable and ongoing challenge for Australia. It opens up questions about the types of investments and interventions that Australia's education systems should be making to close gaps. The Australian government appears to be operating on the basis that getting young people to school is the most important first step by recruiting 400 school attendance officers to bolster school attendance. According to the government, the truancy officers have helped increase school attendance by 14 per cent in the first month of operation in the Northern Territory, Western Australia and Queensland (Stewart, 2014). However, will truancy officers be enough to close the ongoing gaps in educational outcomes?

This paper draws upon international educational research that could be considered in Australia's approach to secondary schooling choices for many Indigenous young people. It presents a model called 'Learning, Earning, Yearning', which is built on an expansive approach to education. It responds to a sense of 'yearning' among Indigenous young people as defined by their quest for safety, connection to culture and place, jobs, inclusion and support measures aimed at reducing the stresses of schooling and life outside school. The paper begins by capturing ongoing challenges in Indigenous education before presenting a case for curriculum expansion and greater choices for Indigenous learners.

An ongoing challenge

For approximately one in two Indigenous young people, school education is not engaging them through to successful completion of Year 12. This impacts on their ability to go on to learn at university and earn reasonable incomes through employment. Hunter (2010) highlights the importance of first overcoming the 'barriers' to education and training by beginning with the crucial recognition of the 'diverse and distinct cultural and social life experiences of Indigenous school leavers' (p. 1). Haswell, Blignault, Fitzpatrick & Jackson-Pulver make similar observations in their report on the social and emotional wellbeing of Indigenous young people:

> … many Aboriginal and Torres Strait Islander young people experience life circumstances that seriously challenge their social and emotional wellbeing and limit their capacity to fulfil their life potential. This most likely contributes to and results from the visible disparities across most measures of health, education, employment and involvement in the justice system. (2003, p. 11)

Similarly, research undertaken through the 'What Works'[1] program in Indigenous education highlights

1 http://whatworks.edu.au

a range of determinants of Indigenous participation and retention in school, including family expectations and responsibilities, poor health and family finance, language and culture, bullying and harassment, teacher attitudes and school atmospheres, past educational performance and educational relevance[2]. When this multitude of issues is seen in its entirety, it is not surprising that the latest Programme for International Student Assessment (PISA) survey of Australian 15-year-olds conducted by the Australian Council for Educational Research found higher degrees of anxiety about school testing among Indigenous students (Dreise & Thomson, 2014).

The case for curriculum expansion

Purdie, Milgate and Bell (2011) highlight the importance of culturally reflective and relevant education. Fogarty (2012) also argues that learning content for Indigenous students needs to be:

> engaging, accessible and culturally responsive with a school culture that supports this and builds on high expectations for all students. Second, you need to empower, support and engage Aboriginal and Torres Strait Islander students to enhance their own learning capacity, while also building and sustaining teacher capacity.

The call for more engaging learning experiences for young people is an international one. For instance, the Association for Supervision and Curriculum Development (n.d.) in the United States contends that:

> For too long in too many schools, young people have been provided a learning experience that so undermotivates, undereducates and underprepares that they are left reaching for remedial preparation for the careers, further education, and civic participation they seek. In the worst situations, young people are neither healthy nor safe, neither engaged nor supported, and certainly not challenged.

2 http://whatworks.edu.au/upload/1250830979818_file_5Engagement.pdf

Lucas, Claxton and Spencer (2013) in their book *Expansive education: Teaching learners for the real world* suggest that future education programs will need to cultivate 'learning dispositions' among young people. This includes the ability to be adaptive, creative and collaborative. Similarly, Voogt and Roblin (2012), in their comparative analysis of competencies in the 21st century, highlight the importance of learning dispositions. They refer to 'mind workers' as being critical in a future that is likely to be complex and unpredictable (p. 300).

As complexity is part and parcel of contemporary Indigenous Australia, our ability to help grow the 'mind workers' of the future is critically important to the very future of Indigenous Australia as a whole. Given that approximately 40 per cent of the Indigenous Australian population is under the age of 17 years, it is vital that they are being prepared – and are preparing themselves – for the opportunities and challenges of tomorrow. To this end, their personal 'agency' is key. Hannon, Gillinson and Shanks (2013) help explain this notion: 'Agency is all about the ability to take control of our lives – to see, understand and act on what we believe to be important' (p. 137).

Research points to the importance of contextualisation and personalisation of learning. Neal (2013), for instance, contends that secondary schools are less 'student centred' and more 'subject centred' than primary schools. He cites a number of characteristics of student-centred approaches, including: 'being based on a challenging curriculum connected to students' lives, catering for individual differences in interest, achievement and learning styles, and developing students' abilities to take control over their own learning' (p. 18).

McCombs and Miller (2009) criticise the notion of one-size-fits-all models of learning, standardised curriculum and enforced testing. Instead, they draw upon large-scale research that finds that 'learner-centred education' reaps dividends for students and teachers alike. They identity a sizeable meta-analysis to support their claim that person- and learner-centred education is associated with large increases in student participation and motivation. The analysis also shows positive effects in self-esteem and fewer incidents of school drop-out. McCombs and Miller (2009) and Meier (2002) highlight the need for learning that is relevant, meaningful and authentic. Meier suggests that inquiry-based learning and project-based learning enjoy high levels of success, particularly with struggling students.

Leadbeater and Wong (2010) advocate for learning innovation by suggesting that while school reform

is important, it is not enough to provide learning experiences that are meaningful, relevant and impactful for students from disadvantaged areas. Instead, they call for 'disruptive innovation' through a blend of formal and informal learning.

Hannon, Gillinson and Shanks (2013) provide highly relevant conceptual guidance for the types of learning challenges and opportunities that Indigenous young people potentially face. They write about empowering learners to develop personal agency that takes them from being mere consumers of learning to active producers of it. They identify a model whereby young people are facilitated through a process of skills updating and matching, to generating solutions to local challenges, to creating local economic and social possibilities.

Fadel (2012) posits that 'knowledge' needs to be connected to the real world to ensure that learners are engaged and motivated. He argues for a greater balance between conceptual and practical learning and consideration for knowledge that sparks student entrepreneurialism and ethical behaviour. With regard to 'skills', he highlights the '4 Cs': creativity, critical thinking, communication and collaboration. He is concerned by curriculum that is overloaded with content when students should be 'deep diving' into projects. Fadel's model emphasises the importance of 'character' and moral traits (integrity, justice, empathy, ethics), along with young people's capacity to learn how to learn. He highlights the significance of interdisciplinarity in helping position young people to respond to current and future demands.

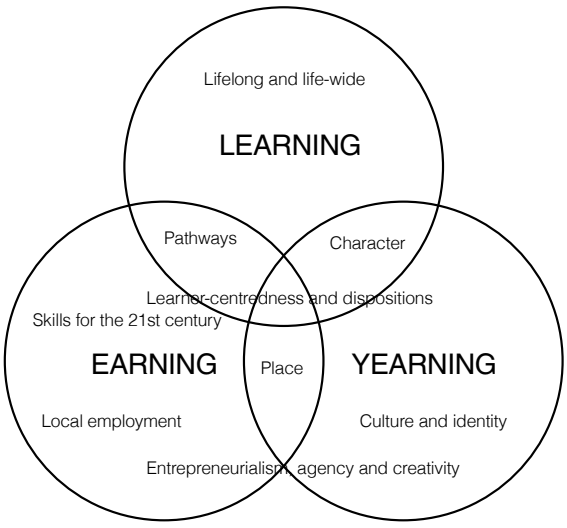

Figure 1 Learning, earning, yearning

Conclusion: A way forward

If Australia wants to see more Indigenous young people complete Year 12 and go onto university or participate fully in civic life, then complementary action is required both outside school gates (in overcoming the significant obstacles they face, such as poverty) and inside school gates (including the provision of learning experiences that truly engage). Customised curriculum (without losing intellectual rigour) provides a way forward.

The following model, illustrated in Figure 1, draws upon the above-mentioned themes by placing them in an Indigenous Australian context.

At the heart of the model is the notion of 'learner-centredness'. 'Place' is another key driver, given that approximately 85 per cent of Indigenous young people attend a local public school and in light of Indigenous cultural preferences for staying on country. Developing entrepreneurial mindsets, supporting personal agency and fostering creativity underpins the model so that learners are not simply consumers of learning, but producers of it. Further, the model simultaneously embraces the idea that young people should grow not only their identity but their character. Lifelong and life-wide learning is at the top of the model to symbolise the need for learning dispositions.

The model is partly inspired by a program from the United States that simultaneously embraces 'mainstream subjects' with Indigenous goals. Sorenson (2013) documents the Navajo School Model in the United States, in which students engage in both a science, technology, engineering and mathematics program and what they call the 'STAR' program, meaning 'Service to All Relations'. STAR involves project-based learning, which is designed to create benefits for the community and the environment.

The future choices we make in educational research, policy and practice will have a significant bearing on the types of positive choices that Indigenous young people can make about their futures. We should be all yearning for stronger futures and choices.

References

Association for Supervision and Curriculum Development. (n.d.). *A whole child approach to education and the Common Core State Standards Initiative*. Retrieved from http://www.ascd.org/ASCD/pdf/siteASCD/policy/CCSS-and-Whole-Child-one-pager.pdf

Australian Bureau of Statistics. (2014). *Media release: Aboriginal and Torres Strait Islander students staying at school longer; national student/teacher ratios stable*. Canberra: Author.

Broome, R. (2010). *Aboriginal Australians: A history since 1788*. Sydney: Allen & Unwin.

Dreise, T., & Thomson, S. (2014). *Unfinished business: PISA shows Indigenous youth are being left behind*. Camberwell: ACER. Retrieved from http://rd.acer.edu.au/article/a-way-forward-in-improving-indigenous-learning

Fadel, C. (2012). *What should students learn in the 21st century?* OECD. Retrieved from http://oecdeducationtoday.blogspot.com.au/2012/05/what-should-students-learn-in-21st.html

Fogarty, B. (2012). *Learning for the western world? The Indigenous education dilemma*. Retrieved from http://theconversation.com/learning-for-the-western-world-the-indigenous-education-dilemma-11326

Hannon, V., Gillinson, S., & Shanks, L. (2013). *Learning a living: Radical innovation in education for work*. New York: Bloomsbury Academic.

Haswell, M. R., Blignault, I., Fitzpatrick, S., & Jackson-Pulver, L. (2013). *The social and emotional wellbeing of Indigenous youth: Reviewing and extending the evidence and examining its implications for policy and practice*. University of New South Wales: Muru Marri.

Hunter, B. H. (June 2010). Pathways for Indigenous school leavers to undertake training or gain employment, *Resource sheet No. 2* produced for the Closing the Gap Clearinghouse. Canberra: Australian Institute for Health and Welfare.

Leadbeater, C., & Wong, A. (2010). *Learning from extremes*. San Jose, CA: Cisco Systems Inc.

Lucas, B., Claxton, G., & Spencer, E. (2013). *Expansive education: Teaching learners for the real world*. Camberwell: ACER.

McCombs, B., & Miller, L. 2009. *The school leader's guide to learner-centred education*. Thousand Oaks, CA: Corwin.

Meier, D. (2002). *In schools we trust: Creating communities of learning in an era of testing and standardization*. Boston, MA: Beacon Press.

National VET Equity Advisory Council (NVEAC). (2013). *National Report on Social Equity in VET 2013*. Canberra: Australian Government.

Neal, G. (2013). Accommodating new learning in different school cultures. In T. McKenna, M. Cacciattolo & M. Vicars (Eds.), *Engaging the disengaged: Inclusive approaches to teaching the least advantaged*. Melbourne: Cambridge University Press.

Pechenkina, E., & Anderson, I. (2011). *Consultation paper on Indigenous Australian higher education: Trends, initiatives and policy implications*. Canberra: Australian Government.

Purdie, N., Milgate, G., & Bell, H. R. (2011). *Two way teaching and learning: Toward culturally reflective and relevant education*. Camberwell: ACER.

Sorensen, M. (2013). The STAR (Service to all Relations) Navajo School Model. In Four Arrows, K. England-Aytes, G. Cajete, R. M. Fisher, B. A. Mann, E. McGaa, & M. Sorensen, *Teaching Truly: A Curriculum to Indigenize Mainstream Education*. New York: Peter Lang Publishing.

Stewart, A. (2014). *Truancy officers boost attendance at remote Indigenous schools*. Retrieved from http://www.abc.net.au/news/2014-02-27/truancy-officers-remote-indigenous-schools-attendance-up-figures/5287606

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competencies: Implications for national curriculum policies. *Journal of Curriculum Studies*, *44*(3), 299–321.

TOWARDS QUALITY AND EQUITY: THE CASE FOR QUALITY TEACHING ROUNDS

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With a background in PE teaching in Adelaide, a Masters degree from the University of British Columbia (1983) and a PhD from the University of Wisconsin-Madison (1990), Jennifer Gore's research interests have consistently centred on quality and equity, ranging across such topics as teacher socialisation, alternative pedagogy, power relations in teaching, teacher education reform, pedagogical reform and teacher development. She has held executive roles for the Australian Association for Research in Education, the Australian Council of Deans of Education, and the NSW Deans' Council. She was Associate Editor for Teaching and Teacher Education: An International Journal of Research and Studies and is on the Editorial Boards of the Australian Journal of Education and Sport, Education and Society. At the University of Newcastle, she has just completed six years as Dean of Education and Head of School. She is currently Director of the Teachers and Teaching Research Program.

Jennifer Gore is widely published and cited. She has won more than $4 million in external research funding, including having held Australian Research Council (ARC) grants since 1992. Her research related to Quality Teaching has led to significant consultancy across government, Catholic and independent school systems, especially in New South Wales, South Australia, the Australian Capital Territory and Queensland.

Abstract

Improving the quality of school teaching through the professional development of teachers is a global concern echoed with growing urgency in a vast array of political and educational circles. In this paper, I outline our research on Quality Teaching and Quality Teaching Rounds, emphasising the importance of a strong pedagogical framework and adherence to principles of effective professional development in systematically avoiding the weaknesses associated with many approaches to pedagogical improvement. The power of combining evidence about professional learning communities, instructional rounds and Quality Teaching in our approach to teacher professional development, known as 'Quality Teaching Rounds', will be demonstrated using evidence from New South Wales and Australian Capital Territory schools. Our data indicate significant impact on the quality of teaching, the level of productive collaboration among teachers, and student outcomes (using NAPLAN data).

Interviews with teachers and principals corroborate these positive impacts, with many describing Quality Teaching Rounds as the most powerful professional development in which they have participated. With systematic observation and feedback on teaching high on national and international agendas, these encouraging results demonstrate how we can better support all teachers to produce high-quality teaching for all of their students.

In this paper, I summarise results from a program of research in which we have made a number of conceptual and methodological moves with important consequences for understanding how to improve both quality and equity. I argue that the Quality Teaching model of pedagogy and Quality Teaching Rounds approach to teacher development provide a powerful framework for enhancing teaching practice and offer tremendous potential for increasing both quality and equity in schools. In NSW and ACT schools – where Quality Teaching and Quality Teaching Rounds are already in use – we are already seeing this potential realised.

Quality and equity have long been joint concerns of teachers, parents, education systems, and politicians, and yet systematically achieving both has been somewhat elusive in Australian schooling. While Australia ostensibly has a 'high quality, high equity' schooling system (Organisation for Economic Co-operation and Development, 2012, 2013), it is undeniable that we have more work to do in improving the schooling experience of large numbers of students who are bored, disengaged, failing and/or underachieving.

In this paper I summarise results from a program of research in which we have made a number of conceptual and methodological moves with important consequences for understanding how to improve both quality and equity. We have: (1) defined and mapped quality in teaching; (2) demonstrated the impact on students of improvements in teaching quality (including a positive impact on equity); and (3) identified a powerful way of supporting teachers in improving their individual and collective practice in order to enhance student learning outcomes.

The analysis of findings from this body of research demonstrates that our approach to the development of teaching – which we call Quality Teaching Rounds – not only increases both quality and equity but simultaneously addresses a number of other enduring challenges for researchers and policy makers in the fields of teaching and teacher development. Specifically, our approach provides: (1) measures of teaching quality that are both based in research and resonate with teachers, where such measures have been hard to come by (Bill and Melinda Gates Foundation, 2010, 2012; Polikoff & Porter, 2014); (2) a powerful framework for enacting a research-based clinical approach to teacher development (Cordingley, 2013; Furlong, 2014), providing concepts and language with which to engage in deep discussions about teaching practice and how to refine it; and, given (1) and (2), (3) a mechanism for ensuring strong professional and social support for teachers at all stages of their careers.

In this paper, I argue that the Quality Teaching model of pedagogy and Quality Teaching Rounds approach to teacher development provide a productive framework for enhancing teaching practice with tremendous potential for increasing both quality and equity. In NSW and ACT schools – where Quality Teaching and Quality Teaching Rounds are already in use – we are already seeing this potential realised.

The challenge of education reform

Before outlining this research, it is worth reflecting on why, despite the efforts of governments, education systems and dedicated teachers, and so many attempted reforms, we are still struggling with both quality and equity. After decades of intervention with such initiatives as the Disadvantaged Schools Program (1974–1990), the Australian Government Quality Teacher Program (2006–2009), and the National Partnerships program (2008–2015), significant systemic change has been painfully slow.

Bryk (2014) argues that one of the main reasons why so many reforms fail is the tendency to implement new ideas quickly and on a wide scale, but then abandon those ideas because they appear not to have worked, and replace them with new ones, which perpetuates a cycle of minimal change. Bryk argues instead for an approach to reform that embraces the need to learn quickly in order to implement well. That is, change efforts require quick knowledge of whether it is even possible to effect change on a small scale and then apply and refine proposed reforms based on evidence from multiple sites. As one example of the problem of quick and wide implementation, Bryk reports on data from the United States that showed that small high schools might provide a solution for students who were failing, especially in disadvantaged communities. A total of 2600 new small schools were established and the Gates Foundation provided $2 billion to support the reform (Ravitch, 2008). Unsurprisingly, this initiative made little difference to student outcomes for a host of reasons, including a lack of small-school experience for many teachers, teacher resistance to the externally imposed reform, and many of the new schools differing significantly from the exemplars. As Bryk points out, failures are not typically the result of bad people; they are fundamentally problems of organisation – organisation of work and the social systems in which that work occurs.

For the past 15 years, I have been engaged with colleagues in a research agenda that meets Bryk's conditions for quick learning by iteratively developing practice-based evidence and supporting the view that if you want to fix something, you are first obliged to understand it (Gawande, 2012). For the remainder of this paper, I will outline this agenda and provide evidence of how quality and equity can be addressed simultaneously in Australian schools.

Defining and mapping quality in teaching

One of the biggest challenges in moving toward greater quality is defining what quality is. While 'quality' as measurable student outcomes on standardised tests is reasonably widely used and accepted (despite contestation), consensus about 'quality' as it pertains to teaching has proved much harder to achieve. As City, Elmore, Fiarman and Teitel put it:

> We have worked, collectively and separately, in dozens of school districts where there was no common point of view on instruction, where ten educators from the same district could watch a fifteen-minute classroom video and have ten different opinions about its quality, ranging the full gamut from high praise to excoriation. *Gaining an explicit and widely held view of what constitutes good teaching and learning in your setting is a first step toward any systematic efforts to scaling up quality* [emphasis added]. (2009, p. 173)

Building on our original research in the Queensland School Reform Longitudinal Study, during which we developed the Productive Pedagogy model (Education Queensland, 2001), the studies reported on here are all underpinned by what is known as the Quality Teaching model, a model of pedagogy that I developed with James Ladwig in 1993 for the New South Wales Department of Education and Training (Gore, 2007; Ladwig, 2005; NSW Department of Education and Training, 2003).

The Quality Teaching model is a three-dimensional model of pedagogy (with six elements per dimension). It focuses on the intellectual quality of learning experiences, the quality of the learning environment and the significance of the learning for students, all of which must take into account what and who are being taught. The Quality Teaching materials that are used for both research and professional development are based on a 1–5 coding system for each element of the model. For each element, a key question is asked and those who are analysing a lesson or assessment task are asked to make judgements about the degree to which the practice they observe is commensurate with the descriptors on the coding scale. For example, teachers are asked in relation to the element *deep knowledge*: 'To what extent is the knowledge being addressed focused on a small number of key concepts and the relationships between and among concepts?' Or for *explicit quality criteria*: 'To what extent are students provided with explicit criteria for the quality of work they are to produce?' Or for *cultural knowledge*: 'To what extent do lessons regularly incorporate the cultural knowledge of diverse social groupings?' While the coding system is numerical, the numbers are primarily a means for analysing, diagnosing and discussing good teaching, and not an end in themselves. Our surveys of teachers conducted over the past decade[1] show strong agreement with the fundamental tenets of the model. Whole sample ratings in all of the studies we have conducted are no lower than 21 on a scale from 4 to 24, indicating strong agreement with the idea that intellectual quality, a quality learning environment and significance are important standards for addressing teaching quality and supporting equity.

When we used the Quality Teaching model to map the quality of teaching in NSW public schools, we found that on average the quality of pedagogy was below the theoretical mid-point of the scales for each dimension, indicating substantial room for improvement. Importantly, we also found that some teachers, including beginning teachers, were delivering pedagogy that scored high on the Quality Teaching measures. This finding was critical in addressing the first question in our research program: Can teachers do it? Can they teach in ways that are commensurate with the model? We found that some can.

Teaching quality and student equity

Having established that, in general, teachers' beliefs aligned with the principles of the Quality Teaching model and that some were producing quality teaching as defined by the model, we wanted to check that Quality Teaching would support better outcomes for students, including equity outcomes. To address this question, we investigated differences in the quality of teaching for different students and found that Aboriginal

1 Studies include Gore, J. M., Ladwig, J. G., Griffiths, T., & Amosa, W. A. *Systemic implications of pedagogy and achievement in New South Wales public schools (SIPA)*, ARC Linkage Grant 2003–2007; Gore, J. M., & Amosa, W. A. *Effective implementation of pedagogical reform* (EIPR), ARC Linkage Grant, 2009–2012; Gore et al., 2012.

students and students from low socioeconomic status (SES) backgrounds on average received poorer quality pedagogy, as measured by the model, than their non-Aboriginal or higher SES peers, as did students with lower prior attainment, who often overlapped with students in these equity target groups (Amosa, Ladwig, Griffiths & Gore, 2007).

It is not surprising that equity problems persist when students with the lowest prior achievement receive, on average, poorer quality pedagogy, a factor that plays a significant role in our failure as a nation to achieve greater equity in education. Schools do not simply reproduce societal inequalities, they contribute to the production of inequality. For instance, given our finding that students typically do not receive explicit criteria for the quality of work they are to produce, it makes sense that students who are already succeeding at school are more easily able to figure out what is required. Providing all students with a chance to succeed includes letting them all in on what counts as success. Given that expectations of students were modest, higher order thinking was not a feature of every lesson, and substantive communication happened infrequently in typical classrooms, as just a few additional examples, it is predictable that student learning and engagement would be hampered. We also found that teachers' dispositions were related to the context in which they were working, with many teachers struggling to focus on learning in some of the lower SES schools. These findings demonstrate the now widespread view that teachers and teaching have a significant impact on student outcomes.

Most importantly, we found that when students received better quality pedagogy, in the form of assessment tasks that scored high on Quality Teaching, improvements resulted both in student performance overall and in narrowing equity gaps for low-SES and Aboriginal students, thus signalling the potential for Quality Teaching to enable more equitable outcomes. Reinforcing these findings, we also found improvements in NAPLAN outcomes in schools that were participating in Quality Teaching Rounds (see next section), including in schools with relatively low Index of Community Socio-Educational Advantage (ICSEA) scores (see Australian Curriculum, Assessment and Reporting Authority, 2012), thus demonstrating the potential of Quality Teaching to positively impact on student outcomes.

Supporting teacher development through Quality Teaching Rounds

If Quality Teaching can be produced by some teachers and impact positively on students, our next major question was: Can professional development, using the Quality Teaching model, support more teachers in producing better teaching? Despite talk of a consensus about principles of effective professional development for teachers (Hawley & Valli, 1999), a vast array of empirical studies has shown limited impact on teaching practice and/or student outcomes (Vescio, Ross & Adams, 2008). We were aware that the Quality Teaching model, available to teachers in the form of a document and associated resources, was never going to be sufficient for bringing about systemic improvements focused on quality and equity. Its impact would depend on its use.

In three major studies since 2009, we have been testing the efficacy of an approach to professional development we call Quality Teaching Rounds, developed with Julie Bowe. Quality Teaching Rounds involves teachers in a small, highly focused and critically supportive 'professional learning community', each teaching a lesson observed by the other members of the learning community, using the Quality Teaching model and materials to guide their observations, coding, feedback, discussion and planning for improvement. The emphasis is on the conversations teachers have about teaching and learning and what it means to teach well – not just for the lesson observed, but for how that lesson characterises the way they teach. Quality Teaching Rounds draw on such exemplars of collaborative professional development as professional learning communities and instructional rounds (e.g. Elmore, 2007; Stoll & Louis, 2007). But its critical point of distinction is the Quality Teaching model, which is used as a lens for guiding teachers' diagnostic work, through the use of shared concepts and a shared language with which to engage in rigorous professional conversations. As one participant in Quality Teaching Rounds reported its impact on her teaching:

> I know there's no turning back, I'd never go back to the way I was teaching, even though I thought it was fine and getting good results … It wasn't as exciting as teaching

> is now. Like now I guess I've been re-energised to teach in a different way … You know, it's a big awakening too, just cruising along the way I was, which was getting through to them and doing the things you had to do and following the syllabus and all this kind of thing, but it wasn't exciting. And now I'm excited about it. It's not the humdrum, it's great stuff all the time.

Such excitement and re-energising of teachers is likely to be a key factor in teaching that makes a difference to quality and equity.

In a study with the Parramatta Catholic Education Office, we found that Quality Teaching Rounds were effective under ideal conditions. Subsequently, we worked with the ACT Education and Training Department, where 18 schools conducted 'design experiments' in order to enable us to test the power of the Quality Teaching Rounds approach across a different system and different school types, and using a modified form of the intervention (Gore et al., 2012). Having found positive impacts on teaching quality (including effect sizes over 1.0) and student outcomes (including NAPLAN results, as noted above), we are now testing the approach through a cluster randomised controlled trial (RCT) in NSW public schools. Following Cochran-Smith and Zeichner (2005), who argue that RCTs are only meaningful in education after many iterative studies, we believe our theoretical and empirical work provides enough evidence to design competing interventions that reflect the most promising combinations of components and conditions shown to have a positive impact on teacher learning, teaching quality and student outcomes.

Using the RCT protocols, observations of the quality of teaching of 192 teachers before and after the Quality Teaching Rounds intervention, and again 6 months later, is being supplemented by qualitative data on how participation in Quality Teaching Rounds impacts on teachers' identities, teaching culture and teachers' career commitments. This study will produce robust evidence of the kind needed (but too seldom available) to advise education system leaders and policy makers about the impact of their investments in teacher development in a way that, we hypothesise, can be tailored to the needs of different schools across whole, highly diverse, education systems. The impact of this approach on teachers is best captured in the words of one participant, a deputy principal who at the time had been teaching for 20 years: 'For the first time in my career, I feel I'm actually teaching students, not just giving them work to do.'

With this kind of impact on teaching quality, and given our earlier findings of improved outcomes for students, including narrowing of equity gaps, this Quality Teaching program of research demonstrates the potential for quality and equity to be simultaneously realised. Through Quality Teaching Rounds we are supporting the development of new teachers, supporting the professional growth of all teachers, re-energising and leveraging high-performing teachers, and ensuring that all student groups are receiving better quality teaching. Educational reform is glacially slow. Our approach, developed and tested over many years, is showing promising quick gains.

References

Amosa, W., Ladwig, J., Griffiths, T., & Gore, J. (2007). *Equity effects of Quality Teaching: Closing the gap.* Paper presented at the Australian Association for Research in Education conference, Fremantle.

Australian Curriculum, Assessment and Reporting Authority. (2012). Guide to understanding ICSEA. Sydney, NSW: Author.

Bill and Melinda Gates Foundation. (2010). *Learning about teaching: Initial findings from the Measures of Effective Teaching Project.* Seattle, WA: Author.

Bill and Melinda Gates Foundation. (2012). *Gathering feedback for teaching: Combining high-quality observations with student surveys and achievement gains.* Seattle, WA: Author.

Bryk, A. S. (2014). *Improving: Joining improvement science to networked communities.* Distinguished Lecture presented at the American Educational Research Association, Philadelphia, Pennsylvania. Retrieved from http://convention2.allacademic.com/one/aera/aera14/index.php?cmd=Online+Program+View+Event&selected_box_id=165082&PHPSESSID=ehvpf2svmltu7u3dhvee8c9ul7

City, E. A., Elmore, R. F., Fiarman, S. E., & Teitel, L. (2009). *Instructional rounds in education: A network approach to improving teaching and learning.* Cambridge, MA: Harvard Education.

Cochran-Smith, M., & Zeichner, K.M. (2005). *Studying teacher education: The report of the AERA panel*

on research and teacher education. NJ: Lawrence Erlbaum.

Cordingley, P. (2013). *The contribution of research to teachers' continuing professional learning and development*, London: British Educational Research Association.

Education Queensland. (2001). *The Queensland School Reform Longitudinal Study*. Brisbane: School of Education, University of Queensland.

Elmore, R. F. (2007). Professional networks and school improvement. *School Administrator, 64*(4), 20–25.

Furlong, J. (2014). *Research and the teaching profession: Building the capacity for a self-improving education system.* Final report of the BERA-RSA Inquiry into the Role of Research in Teacher Education. London: British Educational Research Association.

Gawande, A. (2012). How do we heal medicine. TED talks. Retrieved from https://www.ted.com/talks/atul_gawande_how_do_we_heal_medicine

Gore, J. M. (2007). Improving pedagogy: Challenges of moving teachers toward higher levels of Quality Teaching. In J. Butcher & J. Asher (Eds.), *Making a difference: Challenges for teachers, teaching and teacher education* (pp. 15–33). New York: Sense.

Gore, J. M., Bowe, J., Mockler, N., Smith, M., Ellis, H., & Lyell, A. (2012). *Investigating 'Quality Teaching Rounds' to support teacher professional learning: Research report*. Newcastle, NSW: University of Newcastle.

Hawley, W.D., & Valli, L. (1999). The essentials of effective professional development: A new consensus. *Teaching as the learning profession: Handbook of policy and practice* (pp. 127–150). San Francisco: Jossey-Bass.

Ladwig, J. G. (2005). Monitoring the quality of pedagogy. *Leading and Managing, 11*(2), 70–83.

Ladwig, J. G., Smith, M., Gore, J. M., Amosa, W. A., & Griffiths, T. (2007). *Quality of pedagogy and student achievement: Multi-level replication of authentic pedagogy*. Paper presented at the Australian Association for Research in Education Annual Conference, Fremantle, Australia. Retrieved from http://www.aare.edu.au/07pap/lad07283.pdf

NSW Department of Education and Training. (2003). *Quality Teaching in NSW public schools: A classroom practice guide*. Sydney: Professional Support and Curriculum Directorate, NSW Department of Education and Training.

Organisation for Economic Co-operation and Development. (2012). *Equity and quality in education: Supporting disadvantaged students and schools* [Adobe PDF version]. doi:10.1787/9789264130852-en

Organisation for Economic Co-operation and Development. (2013). *PISA 2012 results: Excellence through equity: Giving every student the chance to succeed (Volume II)* [Adobe PDF version]. doi:10.1787/9789264201132-en

Polikoff, M. S., & Porter, A. C. (2014). *Instructional alignment as a measure of teacher quality*. Paper presented at the American Educational Research Association, Philadelphia, Pennsylvania.

Ravitch, D. (2008). Bill Gates and his silver bullet. Retrieved from: http://www.forbes.com/2008/11/18/gates-foundation-schools-oped-cx_dr_1119ravitch.html

Stoll, L., & Louis, K. S. (Eds.). (2007). *Professional learning communities: Divergence, depth and dilemmas*. London and New York: Open University Press/McGraw Hill.

Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Teacher Education, 24*(1), 80–91.

UNPACKING EDUCATIONAL INEQUALITY IN THE NORTHERN TERRITORY

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Abstract

This paper discusses how publicly available community-level data and confidentialised unit-record information from existing longitudinal, administrative population datasets can be used to investigate the early life antecedents and contemporary factors associated with educational inequality in the Northern Territory. The recent development of the SA–NT DataLink facility has enabled integration of selected information from separate NT health, education and community datasets. This is being used to investigate policy-relevant questions not previously possible. Two examples of data-linkage analysis are presented to illustrate how such research can advance understanding of the individual, family and community factors associated with patterns of school attendance and National Assessment Program – Literacy and Numeracy (NAPLAN) achievement.

Getting a good education and doing well in school are widely acknowledged as essential preparations for future success in life. Sadly, for a substantial proportion of children in the Northern Territory, their experience of school seems unlikely to offer a path to a better future. According to the 2013 NAPLAN results, 47 per cent of NT Indigenous children had Year 3 reading scores at or below the national minimum standard. This compares with 18 per cent for all Australian Indigenous children (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2014). This suggests that almost half of NT Indigenous children are highly likely not to progress as they should through school. These children have a high risk of leaving school early with little or no functional literacy.

In seeking to understand why so many NT Indigenous children have this level of educational disadvantage, it is necessary to consider their sociocultural, geographic and economic contexts of child rearing and school education. It is also important to investigate how these contexts compare with those of Indigenous and non-Indigenous children elsewhere in Australia.

One of the headline targets of the 2008 Council of Australian Governments (COAG) Closing the Gap strategy is to halve the gap in the percentage of Indigenous and non-Indigenous children scoring at or above the national minimum standard (NMS) on the annual NAPLAN within 10 years (Steering Committee for the Review of Government Service Provision, 2011). However, after 5 years of NAPLAN testing, the national trend data suggest that the Year 3 Reading target is only likely to be reached in 2018 (Australian Medical Association, 2013). Furthermore, the NAPLAN trends for Indigenous children in the NT fall far short of their national counterparts and indicate that the Closing the Gap target may not be achieved for a further two decades (Australian Institute of Health and Welfare, 2012).

These continuing educational disparities will have very significant consequences for the health and wellbeing of the NT Indigenous population. Unless more effective preventive and remedial action is taken, the high proportion of Indigenous students leaving school early and/or functionally illiterate can be expected to involve substantial costs to communities, governments and society. This is why it is essential that policies, services and programs to improve Indigenous education are based on reliable evidence and a proper understanding of the complex interplay between individual, environmental and social forces shaping the lives of Indigenous children.

Most of the current policy discourse on improving outcomes in Indigenous education is focused on what is happening within schools, for example the quality of teaching in remote schools, the merits of different instructional approaches, the importance of setting high expectations, and the ways in which parent engagement and student motivation can be improved through school leadership. While all of these are clearly relevant, what is missing from the discourse is systematic consideration of schools' community contexts and the extent to which family and early-life health issues affect children's opportunity and capacity to benefit from the learning environment of school.

Using publicly available community-level data

We have recently been investigating how publicly available data on community-level socio-demographic factors can help explain the significant variation that exists between remote community schools in their levels of school attendance and achievement. The My School website (http://www.myschool.edu.au/) has proved to be a very useful source of such data – particularly when these data are combined with census data such as those available from the Australian Bureau of Statistics (ABS) Community Profiles (ABS, 2013; ACARA, 2014).

One example of how this has been used is an investigation we made of community factors associated with school attendance in the NT 'growth towns'. These are 20 of the larger remote NT communities selected for targeted government investments to improve remote service delivery. Using the My School website, we matched schools in these communities with their nearest 'like' schools in Western Australia and Queensland. This provided a study sample of 40 remote school-communities across northern Australia for which comparable data were available regarding school attendance rates, as well as school and community factors potentially relevant to attendance.

The socio-demographic community variables examined were:

- community size (number of usual residents)
- Indigenous residents (percentage)
- Australian Remoteness Index for Areas (ARIA+) (Trewin, 2006)
- community age structure (percentage of residents less than 15 years of age)

- education (percentage of residents with Year 10 education and percentage of residents with Year 12 education)
- English speakers (percentage of residents with English as their main language)
- income (median income of residents more than 15 years of age)
- bedroom occupancy (mean number of people per bedroom)
- school size (total student enrolment)
- Index of Community Socio-Educational Advantage (ICSEA) (ACARA, 2012)
- student to staff ratio
- qualified teacher to total school staff ratio.

Initial examination of the distribution of these variables revealed significant differences between communities and jurisdictions. For example, the scatter plot shown in Figure 1 illustrates the extent to which adult levels of education and the percentage of adults speaking English varies between communities.

Similarly, it was observed that the NT remote communities had much higher levels of housing overcrowding (i.e. average number of people per bedroom), lower average weekly income, fewer adults with Year 10 or more education, and far fewer English-speaking adults than their 'like' communities in Queensland and Western Australia.

Multi-variable linear regression was then used to investigate how these aspects of disadvantage operated together in predicting school attendance. Those variables with weakest associations were iteratively dropped from each of the regression models examined. The final model having the best fit in predicting school attendance revealed the socio-demographic factors with the strongest associations were: the percentage of adults in the community with Year 12 education (B = 0.426), the youthful age structure of the community (i.e. the percentage of residents age 15 and younger (B = –0.293), the level of geographic remoteness (i.e. ARIA+ score) (B = –0.28), the percentage of adults who speak English (B = –0.267), and housing overcrowding (i.e. mean number of people per bedroom) (B = –0.22). Of note is the fact that community information on these variables served much better than ICSEA in the prediction of school attendance rates. Also, the magnitude of the effect

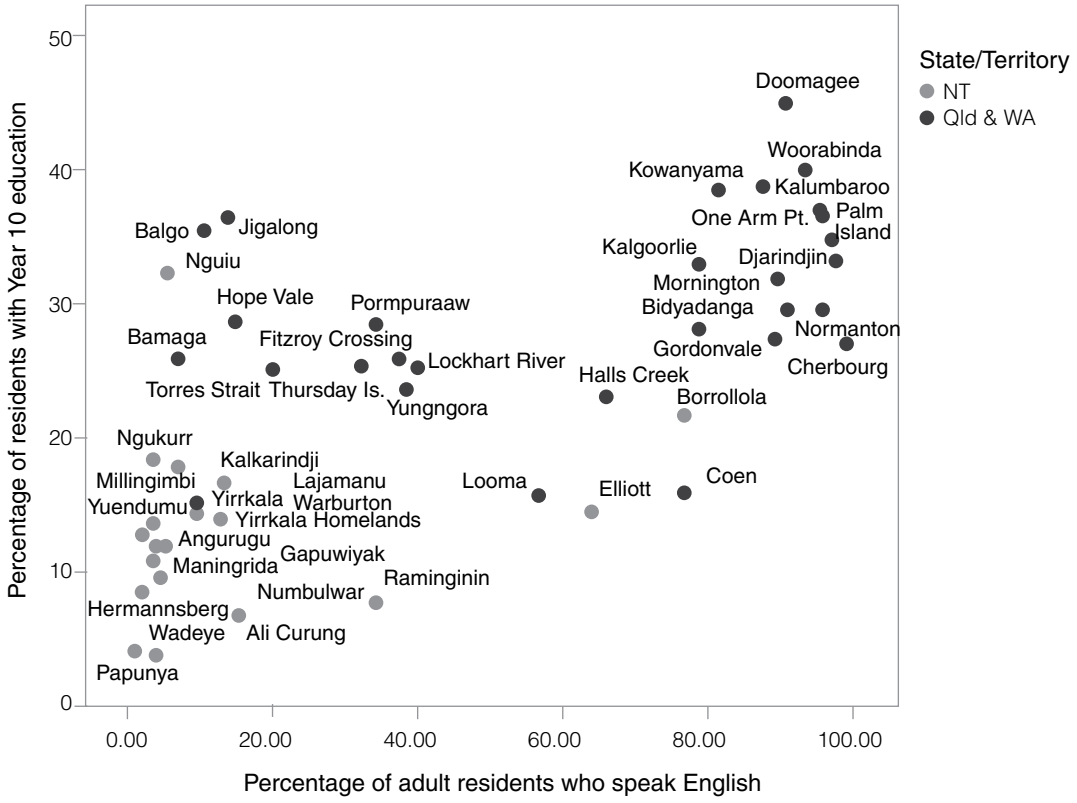

Figure 1 Comparison between NT and Qld & WA remote communities: percentage of adults with Year 10 education by percentage of adults who speak English

size of the association of these community factors with attendance highlights the importance of policy and planning taking these issues into account in their targeting of programs and allocation of resources to improve school attendance.

Confidentialised linkage of individual-level data

There are some research questions that can only be investigated by combining information from separate datasets. The recent establishment of the SA–NT DataLink facility has developed new capacity for data-linkage research in the NT. In a demonstration study of the feasibility and effectiveness of the linkage of NT administrative datasets, we assembled a research dataset of 17 584 perinatal records for all live-born children, born to NT resident mothers, between 1999 and 2004. From these perinatal health data, 7601 children (4603 Indigenous and 2998 non-Indigenous) were successfully linked to government school enrolment data and NAPLAN Year 3 results for the period 2008 to 2012.

Using this linked dataset, we examined the complete individual school attendance histories of 6448 of the study children for whom we had linked data from their birth, health and school records. The distribution of the cumulative percentage of the possible school days that each of these children had attended over their school career is shown below in Figure 2.

Here it can be seen that 66 per cent of Indigenous children had attended fewer than 80 per cent of the school days that they could have attended. In contrast, just 5 per cent of non-Indigenous children had attended school this infrequently. Given that in NT schools, 80 per cent attendance is generally accepted as the minimum for students to progress as they should through school, the large proportion of Indigenous students with much lower rates of attendance highlights the appropriateness of the recent policy focus on better enforcement of school attendance and improving support to school communities to enable this.

This study next used logistic regression modelling to investigate the relationship between a range of socio-demographic and early life health factors and NAPLAN Year 3 literacy outcomes. This required the NAPLAN scores being categorised as either 'below' or 'at and above' the NMS in reading to establish the binary outcome for the analysis. Covariates included in the analysis were selected on the basis of previous research on perinatal inequalities (Brinkman et al., 2012; Li, Guthridge, Tursan d'Espaigne & Paterson, 2007; Li, Jacklyn, Carson, Guthridge & Measey, 2006; Malacova et al., 2009; Noble, Fifer, Rauh, Nomura & Andrews, 2012; Williams et al., 2013; Zubrick et al., 2006).

The perinatal covariates were:

- maternal age at the time of birth
- birth weight
- Apgar score at 5 minutes after birth

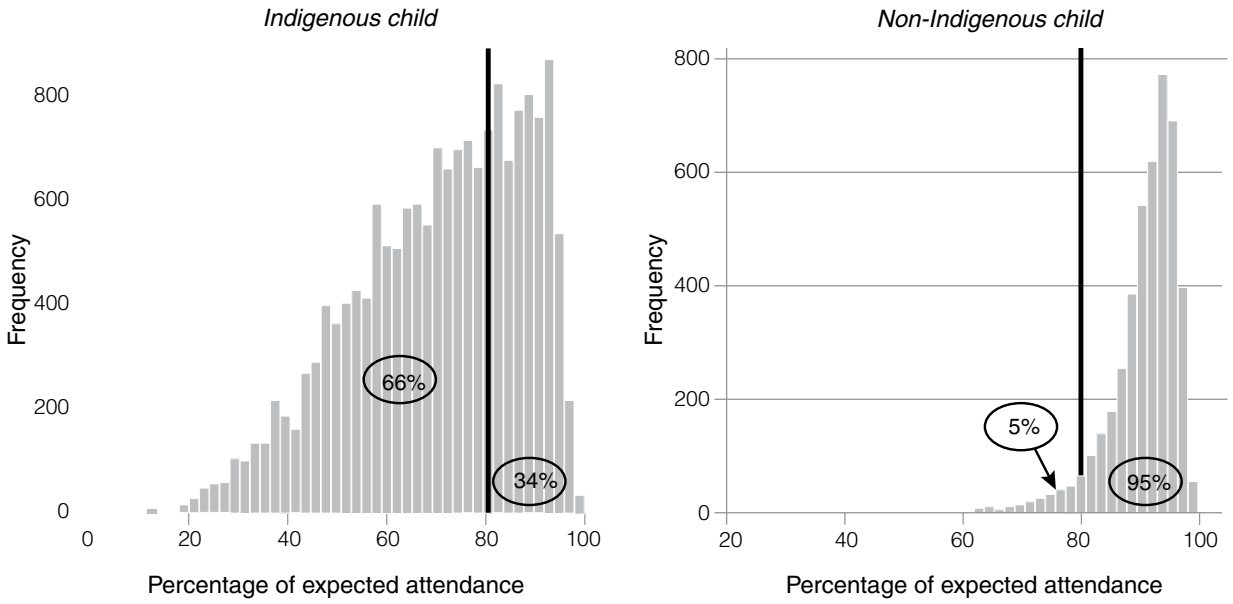

Figure 2 Individual school attendance: Children born in the NT 1994–2004 (N = 6448)

- gestational age, sex, remote residence (based on Trewin, 2006)
- birth order
- plurality (i.e. the number of the mother's prior live births or stillbirths)
- mother's self-report of having smoked or used alcohol during pregnancy.

The covariates available from student enrolment and school records were:

- child's Indigenous status
- child's age at the time of taking the NAPLAN test
- school education level of the child's primary caregiver.

The analysis was first undertaken at a univariate level to estimate the unadjusted risk of each covariate with children's NAPLAN outcomes. Multivariate fully adjusted models were then used to estimate the adjusted odds ratios (ORs) and 95 per cent confidence intervals (CIs) for all the selected risk factors. Knowing the size of the adjusted risk for each risk factor and the percentage of children in the population exposed to each risk, it was then possible to calculate the population attributable fraction (PAF). This is an epidemiological measure commonly used in public health research for evaluating the relative importance of potentially preventable risk factors. Put simply, PAF is an indication of the theoretical reduction in an outcome of interest which could result if one or more of the risk factors were somehow eliminated or reduced. As the details of this study and its findings are currently under review for a separate journal publication, they are not to be presented here. However, they will be discussed in the presentation at the ACER Research Conference.

Discussion

This paper has described how publicly available community-level data and confidentialised unit-record linkage of information from existing longitudinal population datasets can be used to investigate how early life antecedents and contemporary factors are associated with educational inequality in the NT. These data examples illustrate the value of investigating non-school factors for gaining a broader understanding of the role of local socio-demographic contexts and individuals' early life health factors in determining Indigenous education outcomes.

Much of the variation between Indigenous communities in their rates of school attendance is associated with: high ratios of children to adults, parents being of younger age and having low levels of school education, the small percentage of adults in the community who speak English, geographic remoteness, and level of housing overcrowding. While schools and education services have limited ability to directly address many of these community issues, they can ensure that governments understand the urgency of addressing those that are potentially amenable to change.

The second example of the analysis using unit-record linked data confirmed that much of the variation in Indigenous Year 3 literacy outcomes in the NT is attributable to the high proportion of Indigenous children living in very remote communities with poor access to services. Though not included in this analysis, these communities have a high proportion of adults who do not speak English. Importantly, the analysis also indicated that the high proportion of NT Indigenous mothers who have children at an early age, and who have limited education themselves, are factors which account for a surprisingly sizeable proportion of children with NAPLAN literacy below the NMS.

As the age of child bearing and the mother's level of education are both potentially preventable factors, these need to be factored into the current government and community efforts to improve educational outcomes in remote Indigenous communities. This is also why school outreach programs such as the NT Families as First Teachers program and the Central Australian Aboriginal Congress Preschool Readiness Program are so important in building parent and family capacity to support children's early childhood development and readiness for school.

Finally, the compounding effect of the multiple areas of disadvantage experienced early in life by Indigenous children highlights the importance of high-quality preschool being universally available in both urban and remote areas to maximise these children's opportunities for a successful transition into school learning.

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References

Australian Bureau of Statistics. (2013). *Community profiles*. Retrieved from http://www.abs.gov.au/

websitedbs/censushome.nsf/home/communityprofiles

Australian Curriculum, Assessment and Reporting Authority. (2012). *Guide to understanding ICSEA*. Sydney: Author. Retrieved from http://www.acara.edu.au/verve/_resources/guide_to_understanding_icsea.pdf

Australian Curriculum, Assessment and Reporting Authority. (2014). *National report on schooling in Australia 2009*. Sydney: Author. Retrieved from http://www.acara.edu.au/naplan/naplan.html

Australian Institute of Health and Welfare. (2012). *A picture of Australia's children 2012*. Canberra: Author. Retrieved from http://www.aihw.gov.au/publication-detail/?id=10737423343

Australian Medical Association. (2013). *Aboriginal and Torres Strait Islander health report card 2012–2013: The healthy early years – getting the right start in life*. Retrieved from https://ama.com.au/2012-13-ama-indigenous-health-report-card-healthy-early-years-getting-right-start-life

Brinkman, S. A., Gialamas, A., Rahman, A., Mittinty, M. N., Gregory, T. A., Silburn, S., Goldfeld, S., Zubrick, S. R., Carr, V., Janus, M., Hertzman, C., & Lynch, J. W. (2012). Jurisdictional, socioeconomic and gender inequalities in child health and development: Analysis of a national census of 5-year-olds in Australia. *BMJ open, 2*(5), e001075. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3437432/

Li, S. Q., Guthridge, S. L., Tursan d'Espaignet, E., & Paterson, B. A. (2007). *From infancy to young adulthood: Health status in the Northern Territory 2006*. Darwin: Department of Health and Community Services.

Li, S. Q., Jacklyn, S. P., Carson, B. E., Guthridge, S. L., & Measey, M. L. (2006). *Growing up in the Territory: Social-emotional wellbeing and learning outcomes*. Darwin: Department of Health and Community Services.

Malacova, E., Li, J., Blair, E., Mattes, E., de Klerk, N., & Stanley, F. (2009). Neighbourhood socioeconomic status and maternal factors at birth as moderators of the association between birth characteristics and school attainment: A population study of children attending government schools in Western Australia. *Journal of Epidemiology and Community Health, 63*(10): 842–849.

Noble, K. G., Fifer, W. P., Rauh, V. A., Nomura, Y., & Andrews, H. F. (2012). Academic achievement varies with gestational age among children born at term. *Pediatrics, 130*(2), e257–e264.

Steering Committee for the Review of Government Service Provision. (2011). *Overcoming Indigenous disadvantage: Key indicators 2011*. Canberra: Productivity Commission.

Trewin, D. (2006). *Statistical Geography Volume 1 – Australian Standard Geographical Classification (ASGC)* (ABS Cat. No. 1216.0). Canberra: Australian Bureau of Statistics.

Williams, B. L., Dunlop, A. L., Kramer, M., Dever, B. V., Hogue, C., & Jain L. (2013). Perinatal origins of first-grade academic failure: Role of prematurity and maternal factors. *Pediatrics, 131*(4), 693–700.

Zubrick, S. R., Silburn, S. R., De Maio, J. A., Shepherd, C., Griffin, J., Dalby, R. B., Mitrou, F. G., Lawrence, D. M., Hayward, C., Pearson, G., Milroy, H., Milroy, J., & Cox, A. (2006). *The Western Australian Aboriginal child health survey: Improving the educational experiences of Aboriginal children and young people.* Perth: Curtin University of Technology and Telethon Institute for Child Health Research.

STUDENTS' USE OF GOOD QUALITY LEARNING STRATEGIES: A MULTILEVEL MODEL OF CHANGE OVER FIVE YEARS OF SECONDARY SCHOOL

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Her particular areas of research are:

- *students' and teachers' knowledge about what helps people to learn*
- *students' motivational, cognitive and metacognitive strategy knowledge*
- *mental health interventions in educational settings (e.g. KidsMatter and KidsMatter Early Childhood Evaluations)*
- *building capacity for wellbeing in school communities (e.g. Australian Research Council [ARC] Linkage Grant)*
- *developing a transnational, multilevel framework for mental health promotion in educational settings (e.g. collaboration with international partners with the support of an Australian Academy of Science Grant).*

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Abstract

As students progress through school we expect that their knowledge about the various subject matters, such as biology or maths, becomes more extensive, more structured and readily available for application in diverse contexts. A substantial amount of research has demonstrated that students need to employ good-quality learning strategies and reflect upon their learning processes and outcomes in order to develop their subject-matter knowledge: students need to be effective self-regulators of their learning. Thus, alongside subject-matter instruction we would expect attention to be paid to developing students' cognitive and metacognitive knowledge and strategies for learning. If we asked, 'Do biology students increase their knowledge about biology during secondary school?' we would expect the answer, in general, to be 'Yes'. Instead, we asked, 'Do students report increased use of good-quality cognitive and metacognitive strategies for learning as they progress through five years of secondary school?' Results from students attending three South Australian schools showed, at the whole-group level, moderate use of learning strategies. Hierarchical linear modelling showed significant differences among subgroups. Disappointing growth trajectories raise questions about whether five years of secondary schooling adds value to students' self-regulatory learning capacities.

A generation ago, Weinstein and Mayer (1986) provided an overview of useful strategies to enable students to learn. In that same era, Klauer (1988, p. 351) argued that 'teachers should be qualified not only to teach the respective subject matter but also to teach students how to learn this subject matter'. Since then, a wealth of research has demonstrated the beneficial effects of cognitive and metacognitive strategies for good-quality learning.

Cognitive strategies can include generating questions, taking notes, making mental images and drawing concept maps (Kiewra, 2002; Novak, 1990). Meanwhile, metacognitive knowledge (declarative, procedural, conditional) and regulation (planning, monitoring, evaluation) directs the use of cognitive strategies (Schraw, Crippen & Hartley, 2006). Hattie's (2009) meta-analysis of instruction involving cognitive, metacognitive and affective components revealed an average effect size (Cohen's d) of 0.59, with a higher average effect of 0.69 for metacognitive strategy instruction.

Van der Stel and Veenman's (2010) study of the development of early adolescents' metacognitive skilfulness found a continuous growth of metacognitive skills with increasing age, accompanied by intellectual growth. However, Schwonke et al. (2013) argued that the development of metacognition is neither an automatic nor a guaranteed partner to increased domain knowledge.

A consistent message from the literature is that some learners continue to demonstrate learning strategy deficits (e.g. Winne, 2005), suggesting that some students do not acquire effective learning strategies as they grow older. Indeed, Schneider (2010) argued that memory development is not necessarily due to maturation, but rather to education and practice. However, longitudinal studies about students' cognitive and metacognitive growth usually deal with relatively short time frames, typically of a few months to a couple of years (e.g. van der Stel & Veenman, 2010). In this paper we address this gap in the literature with a five-year study that investigated students' reported use of selected cognitive and metacognitive strategies as they progressed through their secondary schooling.

Research questions

Do students report increased use of good-quality cognitive and metacognitive strategies for learning as they progress through secondary school?

Do students' reports vary by gender, school, year level and learning strategy groups?

Method

Sample

We administered a questionnaire to students attending three secondary schools in Adelaide, South Australia, at the end of each academic year for five consecutive years. Two schools were rated as minimum disadvantage schools[1] with, respectively, 12 per cent and 17 per cent of students receiving school fee relief. The third school was rated as a high disadvantage school, with approximately 79 per cent of students receiving school fee relief.

Questionnaire design

In developing the cognitive items in the questionnaire, we reviewed Mayer's (1998) three stages of knowledge acquisition, namely focusing attention, elaborative processing, and organising and summarising. For the metacognitive items, we adopted the conceptual categories of monitoring of knowledge, and control of thinking processes and learning activities (Nelson, 1996). After a process of broad selection and then refinement, we created an 11-item (see Table 1, on p. 100) Learning Strategies questionnaire. Students were asked to think about the subject that they 'do best at', and respond on 7-point Likert scales (strongly disagree [1] to strongly agree [7]).

Ethics

Ethics approvals were obtained from the Flinders University Social and Behavioural Research Ethics Committee and from the Department of Education and Child Development. Agreement to conduct the study was obtained from each school principal. Consent to participate was obtained from parents and students. Participation in the study was informed, voluntary and confidential.

Procedure

Questionnaires were distributed in class to students who were present on the day of data collection. Response rates in each class, in each year, were almost 100 per cent. Participant attrition occurred over the 5 years due to a number of factors, including administrative arrangements

1 The Index of Educational Disadvantage was developed using a combination of Education Department and Australian Bureau of Statistics data. It groups all schools into one of seven ranks of educational disadvantage based on four measures: parental income; parental education and occupation; Aboriginality; and student mobility.

Table 1 Cognitive and metacognitive strategies items

I draw pictures or diagrams to help me understand this subject
I make up questions that I try to answer about this subject
When I am learning something new in this subject, I think back to what I already know about it
I discuss what I am doing in this subject with others
I practise things over and over until I know them well in this subject
I think about my thinking, to check if I understand the ideas in this subject
When I don't understand something in this subject I go back over it again
I make a note of things that I don't understand very well in this subject, so that I can follow them up
When I have finished an activity in this subject I look back to see how well I did
I organise my time to manage my learning in this subject
I make plans for how to do the activities in this subject

in schools, student absences, student transfers, and students not completing 5 years of secondary schooling. A limitation of this study is the possibility that students who dropped out of the study may have different characteristics from students who remained.

Data analysis

Questionnaires with invalid responses comprised less than 1 per cent of the sample and were discarded, leaving 4145 valid questionnaires. Students' ages ranged from 11 to 18 years, with approximately equal numbers of boys and girls in each year. The proportion of students identifying as Aboriginal or Torres Strait Islander was less than 1 per cent in each of two schools, and approximately 9 per cent in the third school.

The 11 questionnaire items were subjected to Principal Components Analysis[2] (PCA). A Learning Strategies factor was identified, accounting for 42.2 per cent of the variance in 2007 to 50.5 per cent of the variance in 2011. Following the PCA we calculated a Learning Strategies score for each student based upon each student's averaged (mean) item scores in each year of the study.

Four Learning Strategies groups were calculated from the students' initial Learning Strategies scores, namely Low, Low–Medium, Medium–High and High. Next, students' averaged Learning Strategies scores were corrected to account for potential regression to the mean (Nielsen, Karpatschof & Kreiner, 2007).

We undertook two-level HLM (V6), as specified in Equation 1.

Equation 1 The two-level random coefficients model

Level-1 Model
LEARNING STRATEGIES = P0 + P1*(TIME) + E
Level-2 Model
P0 = B00 + B01*(GENDER) + B02*(SCHOOL A) + B03*(SCHOOL B) + B04*(LEARNING STRATEGIES: LOW) + B05*(LEARNING STRATEGIES: LOW–MEDIUM) + B06*(LEARNING STRATEGIES: MEDIUM–HIGH) + R0
P1 = B10 + B11*(GENDER) + B12*(SCHOOL A) + B13*(SCHOOLB) + B14*(LEARNING STRATEGIES: LOW) + B15*(LEARNING STRATEGIES: LOW–MEDIUM) + B16*(LEARNING STRATEGIES: MEDIUM–HIGH) + R1

Results

The likelihood ratio test indicated a reduction in deviance, from the null 3 parameter model to the 18-parameter final model, of 10902.858, an amount significant at $p < 0.000$, indicating a better fitting model.

Table 2 shows the results of the final model. The Level 2 intercept has a variance component of 0.067, and in the final model does not exert a significant effect on the mean Learning Strategies score. Meanwhile, the 'TIME slope' term has a variance of 0.046, and although small is significant at $p < 0.000$.

Figure 1 displays the fixed effects for the final model. There are seven fixed effects significant at $p < .05$, controlling for other variables in the model. From Figure 1, beginning with effects on the intercept, the coefficient for GENDER is not significant. The coefficient for School B is significantly different from the reference group, School C ($p < 0.05$), with a very small effect size. Of most interest are the effects for the Learning Strategies GROUPS, which show significant differences, with large effect sizes ranging

2 Details about the factor structure of the questionnaire can be obtained from the corresponding author.

Table 2 HLM model fit and random effects

Final estimation of Level-1 and Level-2 variance components (random intercepts and random slopes)					
Random effect	Standard deviation	Variance component	df	Chi-square	P-value
INTERCEPT1, RO	0.258	0.067	1071	816.427	>0.500
TIME slope, R1	0.215	0.0467	1071	1269.668	0.000
Level-1, E	0.765	0.5857			

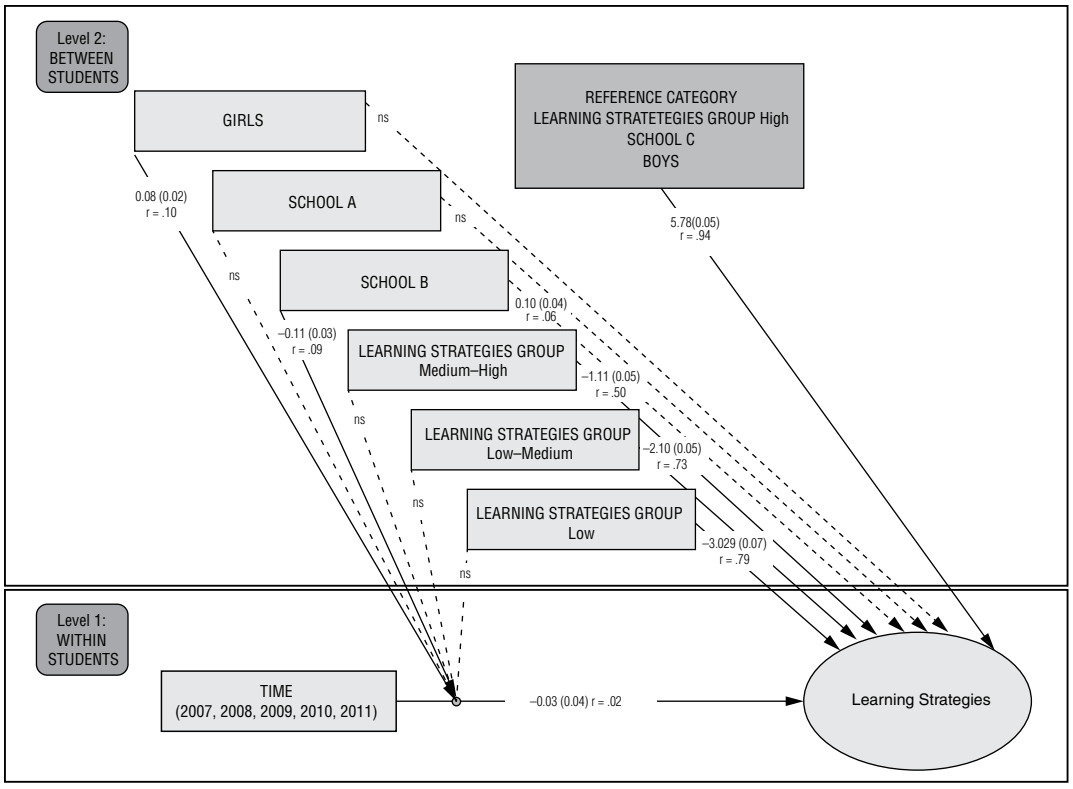

Figure 1 Visual representation of HLM results

from 0.50 to 0.80. For example, from Figure 1, the mean Learning Strategies score for the reference group (High) was 5.78. The coefficient for the Low group was –3.029. The difference (5.78 – 3.029) indicates a mean Learning Strategies score for the Low group of 2.65, which is well below the middle of the 7-point Likert scale.

Next, the slope for TIME shows that for each 1-year increase in TIME, the Learning Strategies score reduced by –0.03, which was not significant. The change over time for girls was significantly more positive than for boys ($p < 0.001$), with a small effect size. The change over time for School B was significantly more positive than the change over time for the reference group, School C ($p < .01$), with a small effect size. There were no apparent differences between Learning Strategies groups in their rate of change over time.

To summarise, the major findings are the large Learning Strategies GROUP effects on the intercept, associated with the lack of significant change in students' Learning Strategies scores over five years of secondary schooling. Small differences between the three schools and boys/girls were also apparent. Figure 2 provides a visual representation of these results for School C.

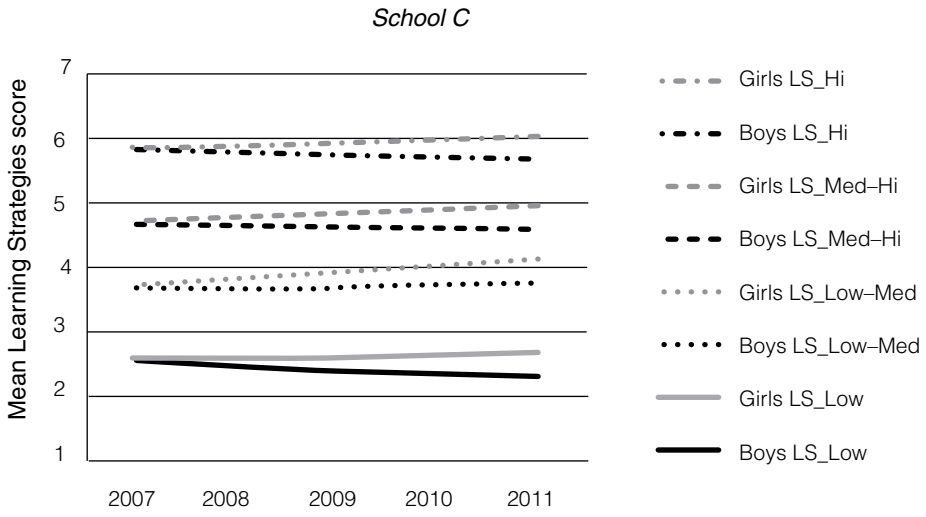

Figure 2 Estimated mean Learning Strategy scores for students in the reference group (School C)

Conclusions

Students' reports of their learning strategy use did not increase much over five years, even though it might be anticipated that as school work increases in complexity, the development of good-quality learning strategies would be highly advantageous. It is notable that the separation between the Learning Strategy groups, which was determined in the first year of data collection, remained over the five years. Lower groups did not move up into the trajectories of higher groups. Furthermore, the mean score trajectories for the lowest two groups do not rise above the mid-point of the Learning Strategies Scale, indicating that students in those lower groups report that they use the strategies identified in our questionnaire relatively infrequently at the beginning, and at the end, of their schooling.

Our findings did not give general support to our expectation that as students progressed through high school there would be evidence of more frequent use of useful learning strategies. Why might this be so? Perhaps students do not see the advantages associated with such strategies. Perhaps teachers also do not see such an advantage, and so the strategies are not the topic of explicit instruction.

These possibilities have been canvassed in the literature. According to Dignath-van Ewijk and van der Werf (2012, p. 8), 'the area of direct strategy instruction has somehow got lost in teachers' minds (or has never existed)'. Similarly, Dunlosky (2013) proposed that teachers overemphasise the importance of the subject-matter content of their lessons and undervalue the advantages associated with detailed learning strategy knowledge. Teachers who do this are content to rely heavily on strategies such as highlighting and repetition, which, while important, cannot substitute for strategies that support other key components of self-regulated learning, such as metacognitive knowledge. However, students do need knowledge about cognitive and metacognitive strategies, because in a typical classroom group-learning situation they must direct much of their own learning: a single teacher has very limited time for one-on-one interaction with students (Galton & Pell, 2012). The study reported in this paper lends support to the need for explicit cognitive and metacognitive strategy instruction throughout the secondary school years.

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References

Dignath-van Ewijk, C., & van der Werf, G. (2012). What teachers think about self-regulated learning: Investigating teacher beliefs and teacher behavior of enhancing students' self-regulation. *Education Research International, 2012*, 1–10. doi: 10.1155/2012/741713

Dunlosky, J. (2013). Strengthening the student toolbox: Study strategies to boost learning. *American Educator, 37,* 12–21.

Galton, M., & Pell, T. (2012). Do class size reductions make a difference to classroom practice? The case of Hong Kong primary schools. *International Journal of Educational Research, 53,* 22–31. doi: 10.1016/j.ijer.2011.12.004

Hattie, J. (2009). *Visible learning.* Oxford, UK: Routledge.

Kiewra, K. A. (2002). How classroom teachers can help students learn and teach them how to learn. *Theory into Practice, 41,* 71–80. doi: 10.1207/s15430421tip4102_3

Klauer, K. J. (1988). Teaching for learning-to-learn: A critical appraisal with some proposal. *Instructional Science, 17,* 351–367. doi: 10.1007/BF00056221

Mayer, R. (1998). Cognitive, metacognitive, and motivational aspects of problem solving. *Instructional Science, 26,* 49–63. doi: 10.1023/A:1003088013286

Nelson, T. O. (1996). Consciousness and metacognition. *American Psychologist, 51*(2), 102–116. doi: 10.1037/0003-066X.51.2.102

Nielsen, T., Karpatschof, B., & Kreiner, S. (2007). Regression to the mean effect: When to be concerned and how to correct for it. *Nordic Psychology, 59,* 231–250. doi: 10.1027/1901-2276.59.3.231

Novak, J. D. (1990). Concept maps and Vee diagrams: Two metacognitive tools to facilitate meaningful learning. *Instructional Science, 19,* 29–52. doi: 10.1007/BF00377984

Schneider, W. (2010). Metacognition and memory development in childhood and adolescence. In H. S. Waters & W. Schneider (Eds.), *Metacognition, strategy use, and instruction* (pp. 54–81). New York: Guilford Press.

Schraw, G., Crippen, K., & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. *Research in Science Education, 36*(1–2), 111–139.

Schwonke, R., Ertelt, A., Otieno, C., Renkl, A., Aleven, V., & Salden, R. J. C. M. (2013). Metacognitive support promotes an effective use of instructional resources in intelligent tutoring. *Learning and Instruction, 23*(1), 136–150. doi: 10.1016/j.learninstruc.2012.08.003

van der Stel, M., & Veenman, M. V. J. (2010). Development of metacognitive skillfulness: A longitudinal study. *Learning and individual differences, 20*(3), 220–224. doi: 10.1016/j.lindif.2009.11.005

Weinstein, C. E., & Mayer, R. E. (1986). The teaching of learning strategies. In C. M. Wittrock (Ed.), *Handbook of research in teaching* (pp. 315–327). New York: Macmillan.

Winne, P. H. (2005). A perspective on state-of-the-art research on self-regulated learning. *Instructional Science, 33,* 559–565. doi: 10.1007/s11251-005-1280-9

INDIGENOUS AND RURAL STUDENTS: DOUBLE WHAMMY OR GOLDEN OPPORTUNITY? EVIDENCE FROM SOUTH AUSTRALIA AND AROUND THE WORLD

Petra Lietz

Australian Council for Educational Research

Dr Petra Lietz is Principal Research Fellow at ACER. Petra joined ACER in February 2009 from the position of Professor of Quantitative Research Methods at Jacobs University Bremen, Germany. She is Editor in Chief of the Australian Journal of Education *(AJE). The AJE was established in 1957 and is published by SAGE for ACER.*

Research methods and designs were also a focus at Central Queensland University in Rockhampton, where she was a Senior Lecturer in Research Methods in the Faculty of Business and Associate Dean Research from 1997 to 2000. Dr Lietz has also worked outside academia, as a consultant to the Organisation for Economic Co-operation and Development (OECD) and the International Association for the Evaluation of Educational Achievement (IEA). From 2000 to 2002, she was Assistant Project Director at International Survey Research (then ISR, now Towers-Watson) in London, a firm that conducts employee satisfaction surveys for globally as well as nationally operating companies.

Her research interests include survey research methodology and methodological issues in internationally comparative research, in which she has been involved since she started to work at the International Coordinating Centre for IEA's Second International Science Study and Reading Literacy Study at Hamburg University in 1988. Her publications range from contributions to professional journals on the nature of employee satisfaction to refereed journal articles of findings from multivariate and multilevel analyses with a focus on factors related to student achievement in various subject areas. In addition, Dr Lietz has contributed chapters on descriptive and inferential statistics in methods books for the social sciences.

I Gusti Ngurah Darmawan

The University of Adelaide, South Australia

Dr I Gusti Ngurah Darmawan is a Senior Lecturer, Associate Head (International) within the School of Education at the University of Adelaide.

His research interests are wide and varied. From a strong initial interest in Information and Communication Technology and Science Education, he has extended his field of inquiry in these areas to cross-national and comparative perspectives, and consequently has developed a strong interest in educational research methodology and measurement. He has been recently involved in the South Australian hub of the National Centre of Science, Information and Communication Technology and Mathematics Education for Rural and Regional Australia (SiMERR-SA) research project.

He has also been working with educationists from Cambodia, Philippines and Indonesia to provide support for their educational reforms through research, training and consultancies funded by either AusAID or other sources. He initiated and led successfully the fellowship program for 10 fellows from the Kingdom of Cambodia in educational assessment and evaluation, working closely with its Ministry of Education, Youth and Sport in 2009. He currently collaborates with leading academics and researchers from Malaysia, Thailand and Indonesia in a program designed to investigate ways to improve the literacy and numeracy performance of students in the Asia-Pacific Region using the large body of data collected by the International Association for the Evaluation of Educational Achievement (IEA) and the Programme for International Student Assessment (PISA) through their international assessment studies.

Carol Aldous

Flinders University, South Australia

Dr Carol Aldous is Project Director of the Literacy and Numeracy Project of the South Australian hub of the National Centre of Science, Information and Communication Technology, and Mathematics Education for Rural and Regional Australia, which undertook the analyses of changes over time and grades reported in this paper. She is a Senior Lecturer in the School of Education at Flinders University. She has a strong background in education, having held a range of leadership positions within the Education Department of South Australia. As a former systems leader, she has broad experience in curriculum matters. Among other things, she managed the Science Curriculum Focus Schools Projects, the 'Science Alive: a Festival of Science for Young Australians' and the Gender Equity Project for students and teachers of highest level mathematics and physics. She is committed to the development of high-quality teachers with a passion for science and mathematics learning and teaching. Recently, Dr Aldous was made Director of the Master of Teaching Program within the School of Education. Dr Aldous is also a member of the South Australian Institute for Educational Research (SAIER) executive committee.

Discussants

Lester-Irabinna Rigney

The University of Adelaide, South Australia

John Halsey

Flinders University, South Australia

Abstract

This session presents and discusses results of analyses aimed at providing insights from large-scale assessments in literacy, numeracy and science into the differences in student- and school-level factors related to the performance of Aboriginal students and students in rural and remote areas when compared with the performance of other students. Evidence examined in the analyses includes data from international testing programs, namely the Progress in International Reading Literacy (PIRLS: Year 4, reading performance), the Programme for International Student Assessment (PISA; 15-year-old students' mathematics and science performance) and longitudinal data in literacy and numeracy from three cohorts of students from Year 3 to Year 7 in South Australian government schools (SiMERR-SA). The analyses address questions such as: What factors are related to performance in literacy and numeracy? Is the picture for Aboriginal and rural students in Australia different from that for Indigenous and rural students in other countries? How does living in a rural and remote community relate to changes in student outcomes over time? What is the situation in rural and remote (South) Australia when compared with metropolitan Australia (Adelaide)?

Professor John Halsey and Professor Lester-Irabinna Rigney will discuss and comment on the results presented by Dr I Gusti Ngurah Darmawan, Dr Carol Aldous and Dr Petra Lietz. This will be followed by a Q&A format, moderated by Petra Lietz, in which the audience has the opportunity to ask questions of presenters and discussants.

This session will be held in cooperation with the South Australian Institute for Educational Research (SAIER). The Institutes for Educational Research were formed in the late 1920s as supports for and promotion of ACER and the Institute in SA is still very active (see www.saier.org.au).

The performance of Indigenous students relative to the performance of non-Indigenous students has been a focus not only in Australia but also in countries such as Canada, New Zealand and the USA (Bishop, Berryman, Wearmouth, Peter & Clapham, 2012; Clark, 2014; Demmert, 2001; Parker, Bodkin-Andrews, Marsh, Jerrim & Schoon, 2013). Likewise, performance of students in metropolitan and non-metropolitan areas is frequently a focus for policy makers and educators (Clarke & Wildy, 2011; Hanushek, Link & Woessmann, 2013; Sullivan, Perry & McConney, 2013).

These aspects are examined in two ways. First, performance differences are explored briefly using international evidence from PISA. Second, longitudinal data in literacy and numeracy from three cohorts of Grade 3 to Grade 7 students in South Australian government schools are analysed using multilevel path modelling to examine further how Indigenous status and school location are related to performance changes across grades and over time.

Performance differences from an international perspective

Initially, it was intended to compare differences in performance in PISA between Indigenous and non-Indigenous students in Australia, Canada, New Zealand and the USA. However, neither the USA nor Canada could be included in the analysis. In the USA, the reporting standards were not met for American Indian/Alaska Native and Native Hawaiian/Other Pacific Islanders (National Center for Education Statistics, 2013). In Canada, no question was administered in the PISA 2012 assessment to identify Indigenous students (P. Brochu, personal communication, 2014). Still, in

Table 1 Performance of Indigenous and non-Indigenous, Māori and non-Māori students across PISA cycles

Mathematics	Mean* 2003	SE	Mean 2012	SE	% below level 2 in 2012
Australia Indigenous	440	5.4	423	4.4	48
Australia non-Indigenous	526	2.1	510	1.6	18
Difference Indigenous–non-Indigenous	**–86**		**–86**		**30**
New Zealand Māori	477	6.6	452	6.7	38
New Zealand non-Māori	523	2.3	500	2.4	23
Difference Māori–non-Māori	**–46**		**–48**		**15**
Reading	Mean 2000	SE			
Australia Indigenous	448	5.8	434	4.3	37
Australia non-Indigenous	531	3.4	517	1.6	12
Difference Indigenous–non-Indigenous	**–83**		**–83**		**25**
New Zealand Māori	482	6.2	466	5.8	27
New Zealand non-Māori	529	2.7	512	2.4	16
Difference Māori–non-Māori	**–47**		**–46**		**11**
Science	Mean 2006	SE			
Australia Indigenous	441	7.8	526	1.8	35
Australia non-Indigenous	529	2.3	446	3.9	12
Difference Indigenous–non-Indigenous	**–88**		**80**		**23**
New Zealand Māori	480	7.2	469	6.9	25
New Zealand non-Māori	530	3.3	516	2.6	16
Difference Māori–non-Māori	**–50**		**–47**		**9**

Notes: *The 'initial' mean is taken from the year in which a domain was fully developed as a major domain for the first time in PISA.
SE= standard errror

addition to Australian data, information was available for Māori and non-Māori students in New Zealand.

Results in Table 1 show that Indigenous students perform well below non-Indigenous students in both Australia and New Zealand. Given that 33 PISA points in Australia and 39 PISA points across Organisation for Economic Co-operation and Development (OECD) countries represent about one year of schooling, results indicate that Australian Indigenous students are about two and a half years behind their non-Indigenous peers in all domains. Moreover, mean differences have remained the same over time in mathematics and reading, and decreased slightly in science. Also, Indigenous students are three times more likely to be in the lower performing band than non-Indigenous students in all domains.

In New Zealand, Māori students perform about one and half years lower than their non-Māori peers across all domains. In addition, Māori students are a bit more than one and a half times more likely to be in the lower performing bands.

Table 2 reports the average performance of 15-year-old students in mathematics, reading and science in PISA 2012 by school location for Australia, Canada, New Zealand and the USA.

In Australia, student performance in all three domains consistently and significantly increases with the size of the population base in which schools are located from village to large city. In Canada, differences in performance between students in schools in villages and small towns are not significant. However, students in schools in these locations do perform at a significantly lower level than students in schools in the highest performing locations, which are towns and cities in mathematics and science, and cities in reading. In New Zealand, similar to Australia, student performance in all three domains consistently and significantly increases from village to city. However, performance decreases again for students in schools in large cities in New Zealand. While the tendency for students in schools in villages to demonstrate the lowest performance regardless of the domain can also be observed in the

Table 2 Performance in PISA 2012 by school location

Mean mathematics performance	AUS mean	AUS SE	CAN mean	CAN SE	NZL mean	NZL SE	USA mean	USA SE
Village	468	5.57	508	4.79	458	6.13	471	13.18
Small town	478	4.78	503	3.66	483	7.88	481	10.14
Town	490	3.57	524	3.08	496	6.69	494	8.52
City	502	2.68	524	3.71	517	5.88	473	9.14
Large city	523	3.09	517	6.62	510	5.96	484	22.31
Mean reading performance	**AUS mean**	**AUS SE**	**CAN mean**	**CAN SE**	**NZL mean**	**NZL SE**	**USA mean**	**USA SE**
Village	480	6.79	505	5.21	466	10.44	480	17.20
Small town	479	5.24	510	4.26	490	7.29	491	11.09
Town	500	3.90	524	3.10	509	6.05	507	8.02
City	510	2.92	532	3.95	539	6.83	492	9.38
Large city	531	2.73	523	6.29	519	5.60	505	21.23
Mean science performance	**AUS mean**	**AUS SE**	**CAN mean**	**CAN SE**	**NZL mean**	**NZL SE**	**USA mean**	**USA SE**
Village	495	6.80	518	4.45	477	7.93	490	15.88
Small town	499	4.31	516	4.07	502	9.10	500	10.73
Town	513	4.29	529	3.05	515	6.80	510	9.44
City	521	2.99	532	3.28	539	5.98	490	8.43
Large city	535	3.07	521	6.68	517	5.80	491	20.70

Note: Results based on analysis of PISA 2012 international database; using the SPSS replicates module.

USA, the highest performance is recorded for towns, although many of the differences cannot be considered substantive due to the large standard errors associated with the estimate.

Performance differences from a South Australian perspective

In the South Australian hub of the Science, Information and Communication Technology and Mathematics Education for Rural and Regional Australia (SiMERR-SA) project, students in South Australian government schools were followed over four years of schooling to measure changes in literacy and numeracy performance. Achievement scales were constructed to enable comparisons over time and years of schooling or grade levels on a common scale. In addition, information was obtained from both the student and the school on factors that were hypothesised to be related to performance. The 90 per cent dataset was provided for secondary analyses by the Department of Education and Children's Services (DECD) in South Australia.

Achievement of non-metropolitan sub-groups on numeracy and literacy tests

Figure 1 records the profiles of performance on the numeracy and literacy tests for the metropolitan and non-metropolitan regions, as well as for four non-metropolitan subregions, namely large provincial, small provincial, remote and very remote, in the years from 2000 to 2006. Simple comparisons associated with the relative sizes of the differences are made. An effect size of 3.2 score points represents 1 year of learning in literacy while an effect size of 3.8 score points represents 1 year of learning in numeracy. The metropolitan group performs at a higher level in both numeracy and literacy that is equivalent to almost a semester of school learning. The very remote group performs about half a semester behind in literacy learning compared with the non-metropolitan group, but is not behind the non-metropolitan group in numeracy. Interestingly, no differences emerge in either numeracy or literacy performance between the other three non-metropolitan regional groups.

The numeracy and literacy tests are formed from three subtests that are calibrated on the same scale as the combined test. Consequently, it is possible to compare relative performance on each of the fields of numeracy

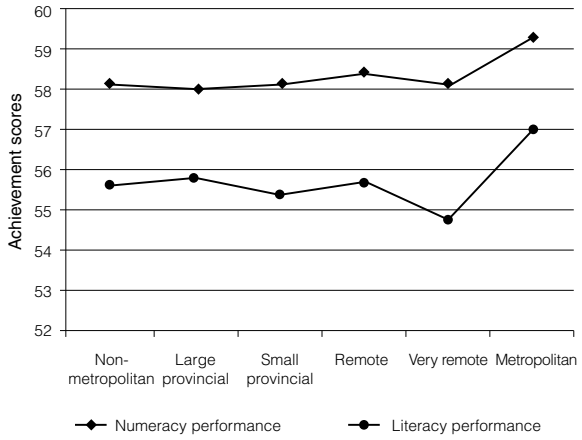


Figure 1 Profiles of achievement in numeracy and literacy for the non-metropolitan and metropolitan regions

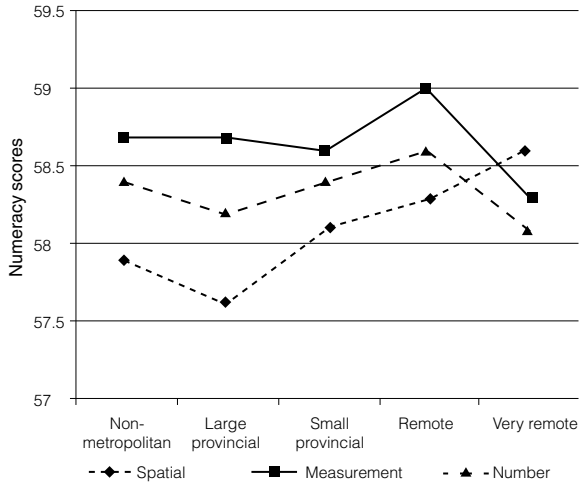


Figure 2 Performance profiles on numeracy sub-tests for the non-metropolitan region

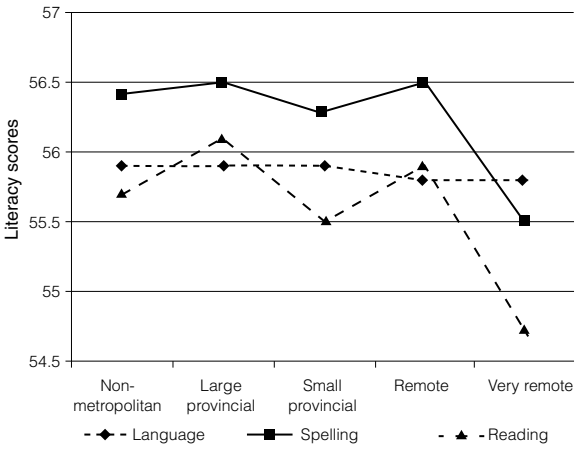


Figure 3 Profiles of achievement on literacy subtests for the non-metropolitan region

Table 3 Performance of students on numeracy and literacy tests in the non-metropolitan region and subregions

Rasch-scaled scores (Mean 50, SD 10)	Non-metro	Large provincial towns	Small provincial towns	Remote areas	Very remote areas
Numeracy					
Measurement	58.7	58.7	58.6	59.0	58.3
Space	57.9	57.6	58.1	58.3	58.6
Number	58.4	58.2	58.4	58.6	58.1
Literacy					
Reading	55.7	56.1	55.5	55.9	54.7
Spelling	56.4	56.5	56.3	56.5	55.5
Language	55.9	55.9	55.9	55.8	55.8
Number of students	10 281	3642	4836	1521	282

and literacy not only between groups but also between subtests. The subtests in numeracy comprise measurement, space and number, and the subtests in literacy comprise reading, spelling and language. Table 3 records the mean Rasch-scaled achievement scores on each of the subtests of numeracy and literacy for each non-metropolitan region. Figures 2 and 3 present the profiles of the achievement of these groups of students on the subtests on numeracy and literacy respectively.

Figure 2 clearly shows the low performance of students in large provincial towns on the spatial subtest and the high performance of students in remote areas on the measurement subtest. Figure 3 illustrates the uniformity of the language scores on the literacy tests across the subgroups and the spelling scores for all groups except the very remote group. The noticeably low scores of the very remote students on the reading subtest, together with the higher scores of students in large provincial towns on the reading subtest is noteworthy.

Information for teaching and learning in non-metropolitan schools can clearly be gained from test scores directly. However, the interrelationships between factors operating at the school and student levels and the test scores are complex, and require the use of analytical procedures that disentangle the student, school and regional effects.

Multilevel analysis of achievement test scores for the non-metropolitan subregions

Results of multilevel analyses of the effects on literacy and numeracy of school factors, between-student factors and within-student factors are given in Figures 4 and 5. The effects of specific factors are not necessarily direct but are frequently moderated by factors from inside and outside the school that influence not only performance levels but also rates of learning as students progress through primary schooling. At the school level, the proportion of

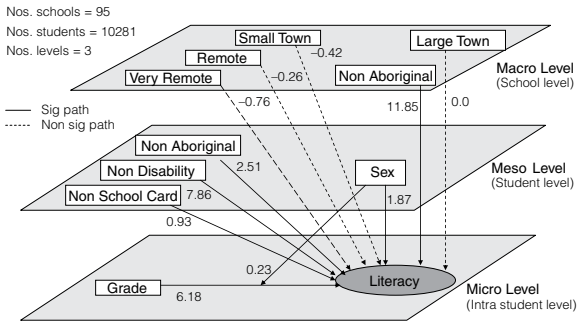


Figure 4 Path diagram of effects on literacy performance for non-metropolitan schools

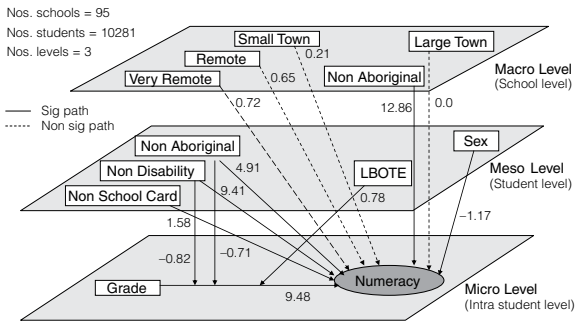


Figure 5 Path diagram of effects on numeracy performance for non-metropolitan schools

non-Aboriginal students in the school is found to be related to the performance levels in both literacy and numeracy. At the student level, girls learn at a faster rate than boys in literacy, while boys learn at a faster rate than girls in numeracy. In these figures, females are coded as one and males as zero; therefore a positive sign with respect to the variable 'sex' indicates females, while a negative sign indicates males.

Modelling for reciprocal relationship

While literacy and numeracy are separate areas of instruction in schools, evidence for a reciprocal relationship between the learning of literacy and numeracy is presented in Figure 6. These findings not only emphasise the importance of mastering the skills of literacy for the learning of numeracy during the years of primary schooling, but also indicate that the effects of the skills of numeracy on achievement in literacy cannot be ignored.

Table 4 presents the estimated reciprocal effects for the model in which the components of both literacy and numeracy are weighted to optimise the relationships between the components of reading, spelling and writing for literacy and measurement, space and number for numeracy and the combined scores.

Multilevel path modelling approach

Recent MPlus programs can undertake a path analysis where two further analytical strategies can be

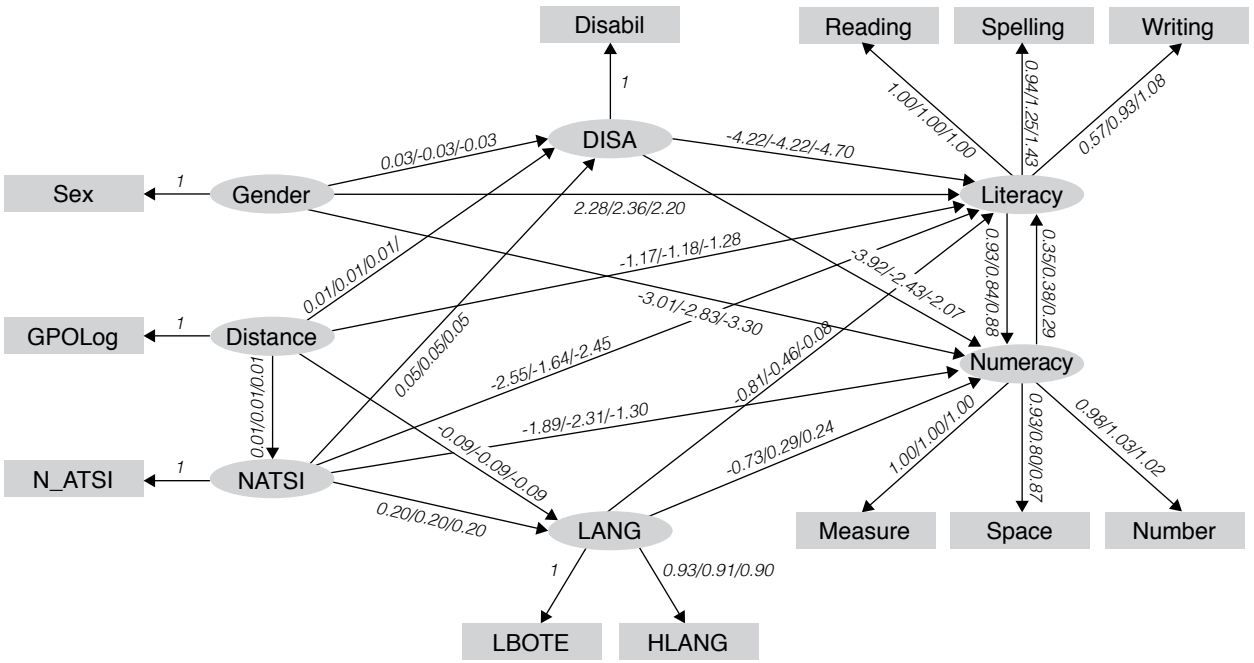


Figure 6 Path diagram for a model of the reciprocal relationships between literacy and numeracy, with metric coefficients recorded in order of year levels for Years 3, 5 and 7 analyses

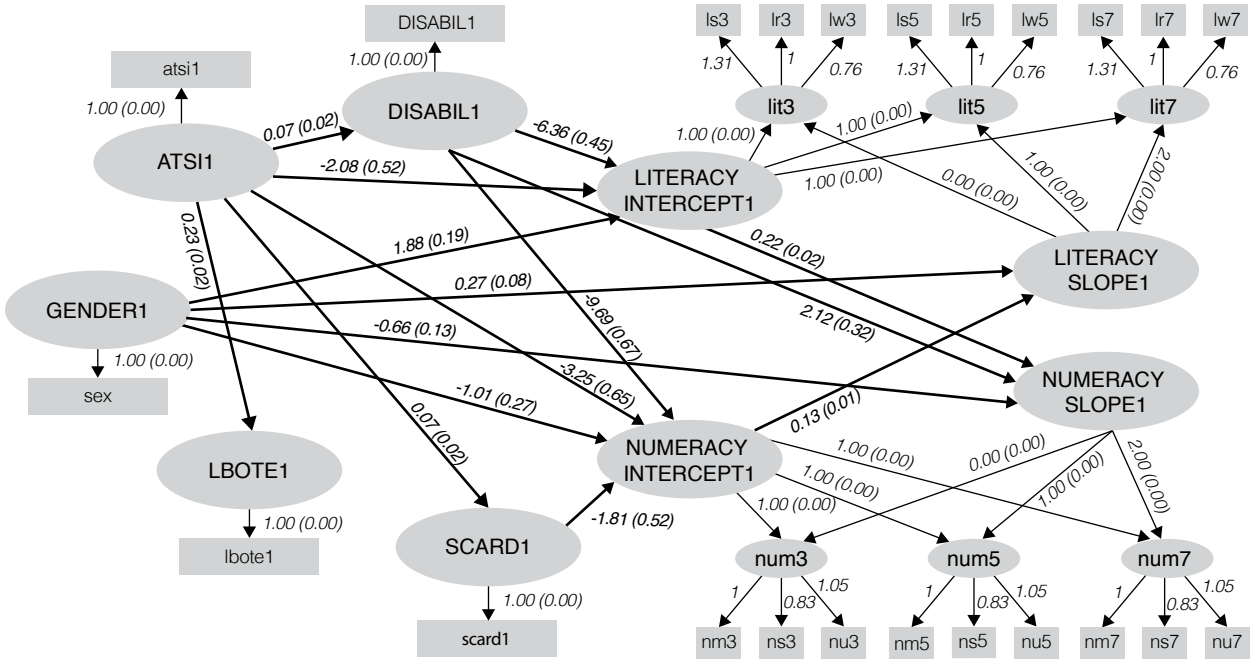
Table 4 Metric coefficients for reciprocal relationships of numeracy on literacy and literacy on numeracy, a complex path model regression analysis for Years 3, 5 and 7

Metric coefficients recorded	Regression or path coefficients		
	Year 3	Year 5	Year 7
Effects of numeracy on literacy	0.35	0.38	0.29
Effects of literacy on numeracy	0.83	0.84	0.88

employed, namely (a) for (i) between students within schools and (ii) between schools, as well as (b) for (i) initial achievement at the Year 3 level and (ii) gain in achievement across the four years from Year 3 to Year 7. These analyses consider the separated effects of characteristics of students and their homes at Year 3, as well as effects of the schools and their communities on performance gains during primary schooling. At the same time, the possibility of examining the effects of an intervention program and the magnitude of effects is explored. Below, the sample of South Australian non-metropolitan primary school students and schools is analysed to enable the estimation of the effects of the Country Areas Program (CAP) in the non-metropolitan region at the school level. Results for three models are presented.

Between-students path model for non-metropolitan primary schools

Model 1 is the between-student path model depicted in Figure 7. In Model 1, at the micro-level, three latent variables are formed for literacy performance from the test scores for spelling, reading and writing at Year 3, Year 5 and Year 7 for each student. From these three measures of literacy performance, two further latent



(Inner model paths are indicated by bold lining)
Estimated path coefficients and their standard errors are recorded for N = 2702 students

Figure 7 Model 1: Between-students within schools path model for South Australian non-metropolitan schools

Table 5 Student within school effects on literacy and numeracy intercepts and slopes

Significant metric coefficients recorded	Literacy		Numeracy	
	Intercept	Slope	Intercept	Slope
Aboriginal (ATSI1)	–2.08	-	–3.25	-
Disability (DISABIL1)	–6.36	-	–9.69	2.12
Language Background (LBOTE1)	-	-	-	-
School Card (SCARD1)	-	-	–1.81	-
Gender	1.88	0.27	–1.01	–0.66
Literacy intercept	-	-	-	0.22
Numeracy intercept	-	0.13	-	-

variables are constructed with appropriate loadings to provide scores for the literacy trajectory that involve the 'intercept' of the trajectory at the Year 3 level, referred to as the 'intercept' or 'initial standard' of performance and the 'slope' of the trajectory across Year 3 to Year 7, referred to as the 'gain' in literacy performance. Likewise, for the scores for measurement, spatial, and number obtained at Year 3, Year 5, and Year 7 for each student, three latent variables are formed for numeracy performance at Year 3, Year 5, and Year 7. From these three scores of numeracy performance, two further latent variables are formed for the 'numeracy intercept' at Year 3 or 'initial standard' of performance, and the numeracy 'slope' referred to as the 'gain' in numeracy performance.

At the meso level or student level of analysis, the effects of five explanatory variables are also estimated for their influence on literacy intercept, literacy slope, numeracy intercept and numeracy slope. In addition, the effects of literacy intercept on numeracy slope and numeracy intercept on literacy slope are also estimated. Table 5 records the metric path coefficient for the effects of the five variables on the intercepts and slopes for literacy and numeracy.

Of particular interest are the significant negative effects of Aboriginality on the literacy and numeracy intercepts of (–2.08) and (–3.25) respectively but not on the slope. This means that while initial literacy and numeracy performance of Aboriginal students is lower than that of non-Aboriginal students, the effects on the rate of gain for both groups are not significant.

Effects of an intervention program in non-metropolitan schools

One major issue to be addressed through the analyses concerns the possibility of estimating the effects of an intervention program on the operation of the primary schools in the non-metropolitan region. While an appropriate program directed at overcoming learning difficulties encountered by Indigenous students in South Australian primary schools had not been developed or introduced, a program to support schools in rural areas – the Country Areas Program (CAP) – had operated for approximately 25 years at the time of data collection.

Since this CAP operated at the school level and not specifically at the student level, the findings from the analyses of the combined student and school samples, referred to as 'total sample', suffer from serious limitations. However, the multilevel path modelling approach enabled the separation of levels of analysis, with the between-student level forming the meso level and the school level forming the macro level. This enabled a single analysis involving the macro and meso levels. Furthermore, the intercept or standard relationships could be separated from the slope or

Table 6 Between-school effects with and without Country Areas Program included in the analysis of Model 2 for direct and mediating relationships on literacy and numeracy

Metric coefficients recorded	Mediating variable		Literacy		Numeracy	
	ATSI2	STR2	Intercept	Slope	Intercept	Slope
Model 2b (with CAP included)						
Country Areas Program (CAP)	–0.04	–3.28	ns	ns	1.52	ns
ATSI2	•	ns	–16.73	ns	ns	ns
Student teacher ratio (STR2)	•	•	•	•	–0.13	ns
Literacy intercept	•	•	•	•	•	0.40
Numeracy intercept	•	•	•	0.18	•	ns
Model 2a (without CAP included)						
ATSI2	•	ns	–16.00	ns	ns	ns
Student teacher ratio (STR2)	•	•	•	•	–0.13	ns
Literacy intercept	•	•	•	•	•	0.41
Numeracy intercept	•	•	•	0.23	•	•

(ns) indicates a non-significant effect, (•) indicates no relationships hypothesised.

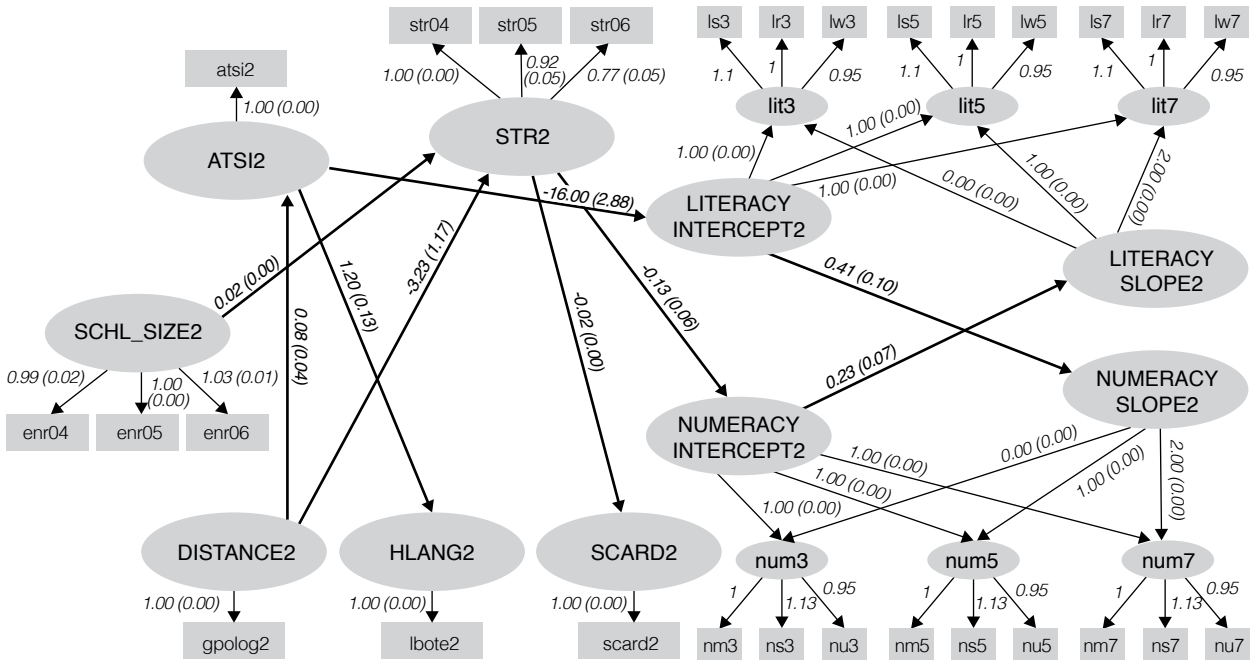


Figure 8 Model 2a: Between-schools path model without CAP for South Australian non-metropolitan primary schools

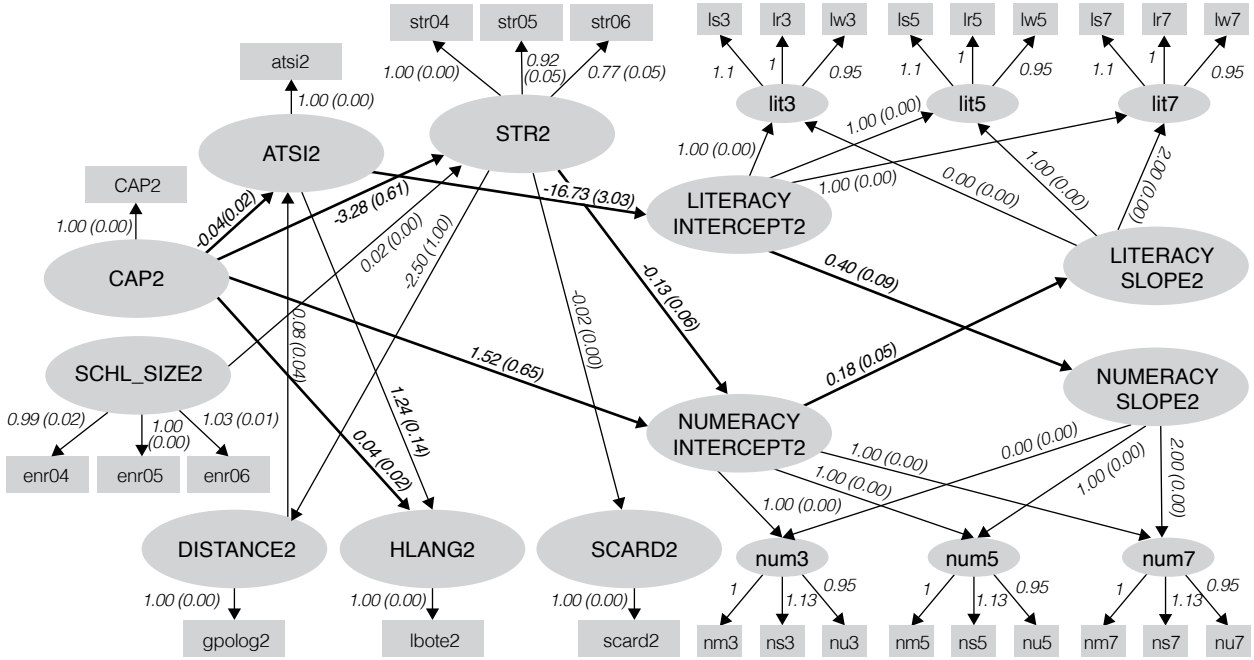


Figure 9 Model 2b: Between-schools path model with CAP for South Australian non-metropolitan primary schools

gain relationships at the micro level. This enabled the specification of Model 2 to examine further the effects of the CAP. However, two analyses at the macro level are required to estimate the path coefficients. In the first analysis, the variable CAP is excluded from the macro-level model, and in the second analysis the variable CAP is included in the macro-level model, with both analyses being undertaken with the model being exactly the same as the one for which results are recorded in Table 6 and Figure 8. Consequently,

the model of interest operating at the macro level or school level is presented as Model 2a (without the inclusion of the CAP variable) and Model 2b (with the inclusion of the CAP variable).

Table 6 records the path coefficients for the between-school analyses of Model 2 for the direct and mediating effects on literacy and numeracy intercepts and slopes with CAP (Model 2b) and without CAP (Model 2a). Importantly, in the two analyses reported in Table 6, exactly the same data are analysed for the primary schools in the non-metropolitan area of South Australia at the between-school or macro level. The results recorded for both analyses with Model 2b and Model 2a are derived from the same situation in which the CAP is operating. The differences between the two analyses merely include or exclude CAP from the analysis. Only in this way it is possible to examine whether the effects of CAP can be detected empirically.

For Model 2a (without CAP) the results of the analyses depicted in Figure 8 and presented in the lower panel of Table 6 show three direct relationships of interest.

1. ATSI2 has a direct effect (–16.00) on LITERACY INTERCEPT2.
2. LITERACY INTERCEPT2 has a direct effect (0.41) on NUMERACY SLOPE2.
3. STUDENT TEACHER RATIO (STR2) has a direct effect (–0.13) on NUMERACY INTERCEPT2.

This demonstrates a mediated effect of ATSI2 on NUMERACY SLOPE2 (–16.00 × 0.41) operating on NUMERACY SLOPE2 through LITERACY INTERCEPT2.

Two mediated influences of CAP onto LITERACY and NUMERACY INTERCEPTS emerge with mediated effects onto NUMERACY SLOPE2 and LITERACY SLOPE2 respectively.

1. CAP has a mediated or indirect effect (–0.04 × –16.73) on LITERACY INTERCEPT2 operating through ATSI2.
2. CAP has a mediated or indirect effect (–3.28 × –0.13) on NUMERACY INTERCEPT2 operating through STUDENT TEACHER RATIO (STR2).

Thus, CAP not only has recognisable effects on the component parts of Model 2 but these effects add considerably to an understanding of the learning in schools. Furthermore, the effects listed in Table 6 and depicted in Figure 9 indicate the substantial beneficial effects of the intervention.

Conclusion

The analyses reported here investigate the necessity for policies and programs to provide for the special needs of certain students with educational disadvantage and learning difficulties. Many issues arise with respect to where and why further developmental work is required not only in South Australia but across the whole of Australia and elsewhere.

Results also illustrate that while 'Indigenous' and 'non-Indigenous', as well as 'school location', are characteristics with categories required for reporting and analysis, these categories encompass many people in many unique locations and contexts.

Nevertheless, aspects of school culture and leadership proposed for high-performing schools in Indigenous contexts (Helme & Lamb, 2011, as cited in Dreise and Thomson, 2014, p. 4) resemble those that are repeatedly found to be associated with effective school environments in general (e.g. Bovell et al., 2013; Commonwealth Department of Education, Employment and Workplace Relations & Australian Council for Educational Research, 2012):

- a shared vision for the school community
- high expectations of success for both staff and students
- a learning environment that is responsive to individual needs
- a drive for continuous improvement
- involvement of the Indigenous community in planning and providing education.

Still, as the analyses have shown, the further schools and their students are away from larger centres, their facilities, services and resources, the more challenging it is for them to excel.

References

Bishop, R., Berryman, M., Wearmouth, J., Peter, M., & Clapham, S. (2012). Professional development, changes in teacher practice and improvements in Indigenous students' educational performance: A case study from New Zealand. *Teaching and Teacher Education*, *28*(5), 694–705.

Bovell, M., D'Aloia, D., O'Grady, E., Kleinhenz, E., Lietz, P., Tobin, M., & White, G. (2013). *Evaluation of data literacy and usage to improve outcomes*.

Unpublished report commissioned by the South Australian National Partnerships Council – Schooling.

Clark, J. V. (2014). The road to excellence: Promoting access and equity to close the achievement gap internationally. In J. V. Clark (Ed.), *Closing the Achievement Gap from an International Perspective* (pp. 307–315). Netherlands: Springer.

Clarke, S., & Wildy, H. (2011). Improving the small rural or remote school: The role of the district. *Australian Journal of Education*, *55*(1), 24–36.

Commonwealth Department of Education, Employment and Workplace Relations & Australian Council for Educational Research (2012). *National school improvement tool.* Retrieved from http://www.aph.gov.au/~/media/Estimates/Live/eet_ctte/estimates/sup_1213/answers/EW0743_13_Attachment_A.ashx

Demmert Jr, W. G. (2001). *Improving academic performance among Native American students: A review of the research literature.* Retrieved from http://files.eric.ed.gov/fulltext/ED463917.pdf

Dreise, T., & Thomson, S. (2014). *Unfinished business: PISA shows Indigenous youth are being left behind.* ACER Occasional Essays. Retrieved from http://www.acer.edu.au/media/unfinished-business-pisa-shows-indigenous-youth-are-being-left-behind

Hanushek, E. A., Link, S., & Woessmann, L. (2013). Does school autonomy make sense everywhere? Panel estimates from PISA. *Journal of Development Economics, 104,* 212–232. Retrieved from http://www.econstor.eu/bitstream/10419/58689/1/696793946.pdf

National Center for Education Statistics (2013). Trends in U.S. performance by student race/ethnicity. Retrieved from http://nces.ed.gov/surveys/pisa/pisa2012/pisa2012highlights_6b.asp

Parker, P. D., Bodkin-Andrews, G., Marsh, H. W., Jerrim, J., & Schoon, I. (2013). Will closing the achievement gap solve the problem? An analysis of primary and secondary effects for indigenous university entry. *Journal of Sociology*, 1440783313498946.

Sullivan, K., Perry, L. B., & McConney, A. (2013). How do school resources and academic performance differ across Australia's rural, regional and metropolitan communities? *The Australian Educational Researcher*, *40*(3), 353–372.

CONFERENCE PROGRAM

SUNDAY 3 AUGUST PRE-CONFERENCE
Adelaide Convention Centre

1.30–2.30 **Registration**

2.30–4.15 **Concurrent sessions**

SESSION A

Quality and equity in vocational education and training (VET)

Dr Sheldon Rothman, ACER; Assoc. Prof. David Curtis, Flinders University, SA; Lori Hocking, VETnetwork Australia; and Dave Tout, ACER

SESSION B

Negotiating competing education values: Equality, equity, quality and Indigenous rights

Prof. Peter Buckskin, The University of South Australia; Assoc. Prof. Gary Thomas, Queensland University of Technology; and Dr Zane Ma Rhea, Monash University, VIC

SESSION C

Learning before the school years: Benefits for life

Prof. Joseph Sparling, The University of Melbourne; Assoc. Prof. Susan Krieg, Flinders University, SA; and Mrs Marion Meiers, ACER

4.30–5.30 **Conversation with Prof. Geoff Masters AO, CEO, ACER and the Hon. Julia Gillard, former Prime Minister of Australia**

5.30–7.00 **Networking drinks**, Adelaide Convention Centre

MONDAY 4 AUGUST

8.00–9.00 **Registration**

9.00–9.30 **Welcome to Country with Frank Wanganeen**

Conference opening with the Hon. Christopher Pyne

9.30–10.45 **Plenary 1**

Quality and equity through evidence-based practice

Prof. Geoff Masters AO, CEO, ACER

10.45–11.15 *Morning tea*

11.15–12.30 **Concurrent session Block 1**

SESSION D

Achieving quality and equity for Māori Secondary school students in New Zealand

Assoc. Prof. Mere Berryman, The University of Waikato, NZ

SESSION E

Perspectives on quality and equity from large-Scale assessment studies

Dr John Ainley, ACER

SESSION F

School attendance: Equities and inequities in growth trajectories of academic performance

Prof. Stephen Zubrick, The University of Western Australia and Telethon Kids Institute

SESSION G

Cooperative learning: The behavioural and neurological markers that help to explain its success

Prof. Robyn Gillies and Assoc. Prof. Ross Cunnington, The University of Queensland and Science of Learning Research Centre

12.30 – 1.30 *Lunch*

1.30 – 2.45 **Plenary 2**

The predictive validity of the AEDI: Predicting later cognitive and behavioural outcomes

Dr Sally Brinkman, Fraser Mustard Centre and Telethon Kids Institute, SA

2.45–4.00 **Concurrent session Block 2**

SESSION H	SESSION I	SESSION J	SESSION K
Bubalamai Bawa Gumada (Healing the Wounds of the Heart): The search for resilience against racism for Aboriginal Australian students Dr Gawaian Bodkin-Andrews, Macquarie University, NSW	*Gender and mathematics: Quality and equity* Dr Sue Thomson, ACER and Science of Learning Research Centre	*Early bird catches the worm: The causal impact of preschool participation and teacher qualifications on Year 3 NAPLAN cognitive tests* Dr Diana Warren, Australian Institute of Family Studies	*Educational disadvantage and regional and rural schools* Dr Sara Glover, Mitchell Institute for Health and Education Policy, VIC

4.15–4.45 Four-Minute Forum

Invited Research Conference 2014 presenters will be asked to provide a compelling response, in less than four minutes, to a topic given to them only hours earlier. Join us in the Exhibition Hall for this light-hearted pre-Conference Dinner activity and a glass of champagne.

Conference dinner 6.30pm (7pm start) Adelaide Convention Centre

Speaker: Dr Lynn Arnold AO (Personal perspectives on quality and equity)

TUESDAY 5 AUGUST

9.00–10.15 **Plenary 3**

Quality and equity issues related to the integration of immigrant students in education

Prof. Petra Stanat, Humboldt University of Berlin, Germany

10.15–10.45 *Morning tea*

10.45–12.00 **Concurrent session Block 3**

SESSION L	SESSION M	SESSION N	SESSION O
Learning, earning and yearning: Disruption, innovation and expansion in Indigenous education Tony Dreise, ACER	**Towards quality and equity: The case for Quality Teaching Rounds** Prof. Jennifer Gore, The University of Newcastle, NSW	**Unpacking educational inequality in the Northern Territory** Prof. Sven Silburn, Menzies School of Health Research, NT and Science of Learning Research Centre	**Students' use of good quality learning strategies: A multilevel model of change over five years of secondary school** Assoc. Prof. Helen Askell-Williams, Flinders University, SA

12.00–1.00 *Lunch*

1.00–3.00 **Plenary 4**

Indigenous and rural students: Double whammy or golden opportunity?

Evidence from South Australia and around the world

Dr Petra Lietz, ACER; Dr I Gusti Ngurah Darmawan, The University of Adelaide, SA; Dr Carol Aldous, Flinders University, SA; Prof. Lester-Irabinna Rigney, The University of Adelaide, SA; Prof. John Halsey, Flinders University, SA

Conference summary and next steps

Prof. Geoff Masters AO, CEO, ACER

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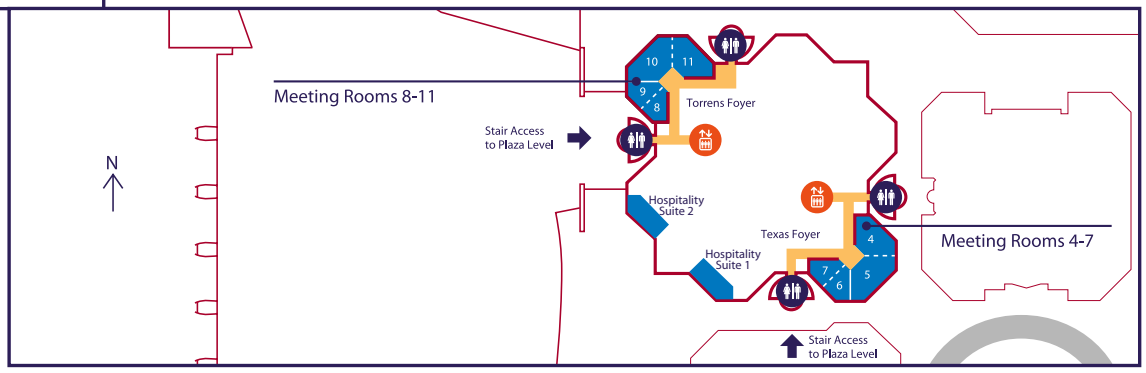
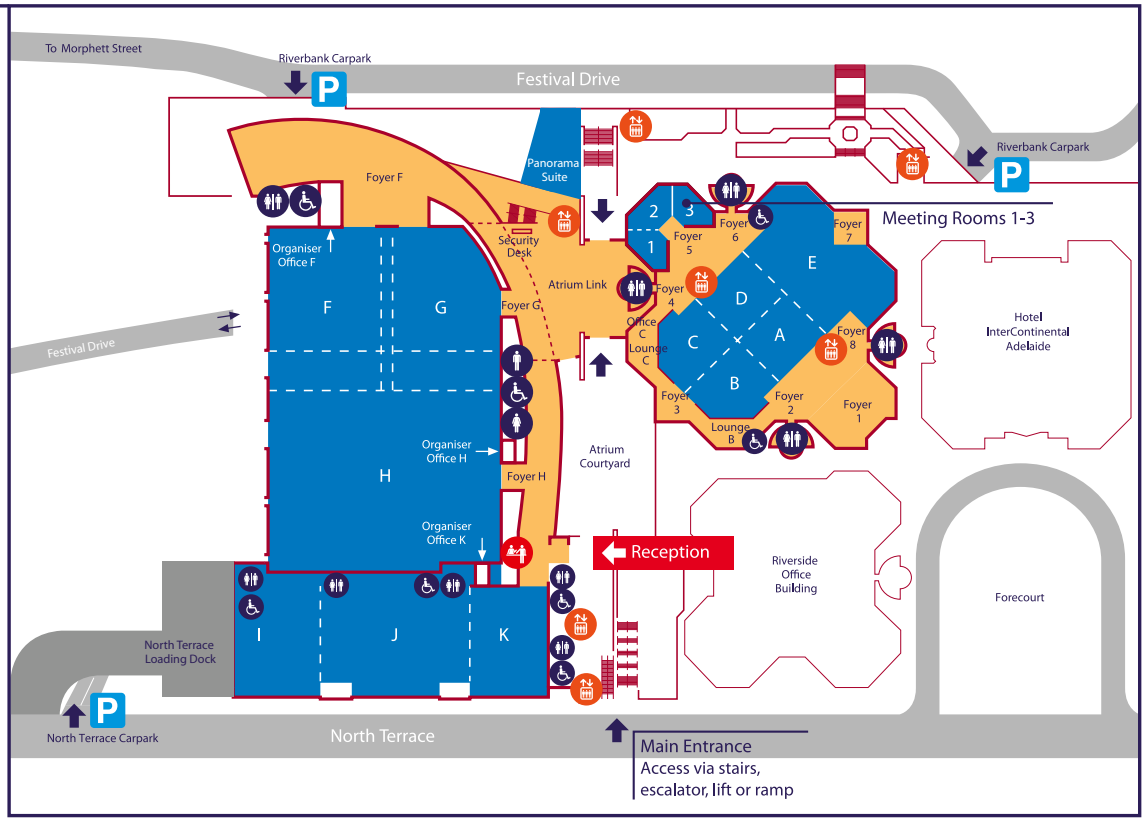
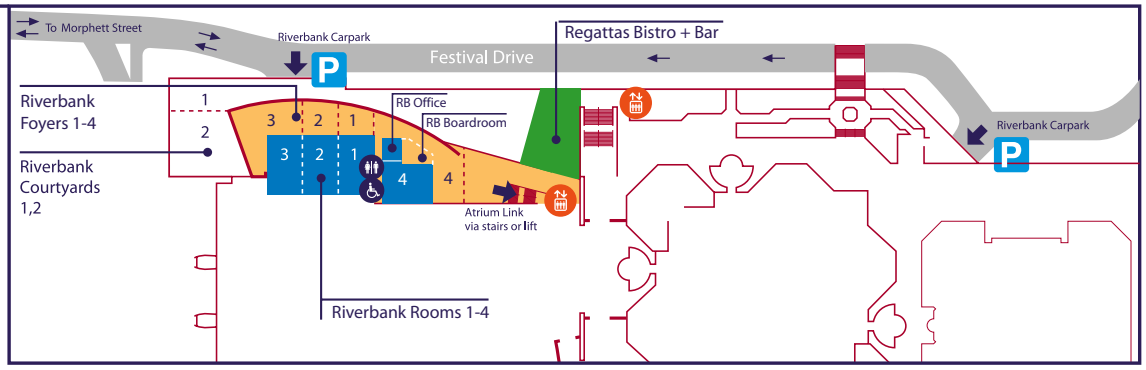


Plaza Level



Riverbank Level



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ACER's higher education registration supports professional learning

The Australian Council *for* Educational Research (ACER) will offer Graduate Certificate professional learning programs, following its registration in April as a higher education provider by the Australian Government's Tertiary Education Quality and Standards Agency (TEQSA).

Announcing the news, ACER Chief Executive, Professor Geoff Masters AO said registration as a higher education provider is a milestone in ACER's 84-year history.

Registration means that ACER will offer its Graduate Certificate of Education (Assessment of Student Learning), a four-unit course designed particularly for current teachers, coaches and school leaders, from October 2014. Courses offered through the ACER Institute will provide graduates with advanced skills in evidence-based teaching.

Advanced professional learning programs in the Teaching of Reading, Teaching of Writing and Teaching of Mathematics draw on international research into the most effective ways to teach these subjects and complement ACER's range of published resources for schools.

As a result of demand from across Australia, ACER Institute professional learning is available online, as well as through a blended approach that includes face-to-face sessions and opportunities for participants to conduct action research and reflect on the content in their own settings.

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