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WHAT WORKS

(and what doesn't)

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John Graham

According to the Federal Government something is very wrong with school education in Australia – and it has the 'evidence' to prove it. Education Minister, Simon Birmingham, said that he was personally "embarrassed" by the "appalling" results of Australian students in the latest international TIMSS testing of Year 4 and Year 8 students. Another member of the government who seems to have a particular interest in education, Andrew Laming, put it more colourfully: "We're effectively falling out of the peloton of global education, moving to the back of the pack, and ultimately being dropped off". Similar views were expressed when the latest international PISA results for Australia came out and when the national ("stagnating") NAPLAN results were published.

Faced with this 'evidence', what should the government do? After inspecting the results Minister Birmingham declared: "Some of the things we're doing in our classrooms clearly aren't up to scratch" and: "We need to focus on evidence-based measures that will get results for our students". The federal government's favourite education 'expert', Kevin Donnelly, went even further:

> *What Australia needs is a root-and-branch renewal of our school system, based on international best practice and what is proven to work in the classroom.*

In both cases the claim being made was that Australian classroom practice, and even the school system as a whole, was failing the country's students because it was out of sync with the evidence of what works to improve achievement.

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To reverse this trend, the government, and its expert, proposed a package of evidence-based changes supposedly verified by 'research'. At the head of the queue was performance-based pay. Yet the evidence supporting a positive link between this policy and student improvement is very thin on the ground. John Hattie, whose meta-analyses and "effect size" research is often referenced by federal government papers, found that performance pay had little or no effect on student performance but did increase teachers' stress levels and decrease their enthusiasm. He also places another of the Donnelly/ Birmingham shibboleths – school choice – in the same "what doesn't work in education" category.[i]

A third initiative claimed by the government (and its expert) to be based on sound research evidence is the so-called Independent Public Schools policy. In a case study[ii] of "the ways research is (mis)used in the service of a particular ideology in the public sphere", Alan Reid explored Kevin Donnelly's use of "the imprimatur of research evidence to substantiate his claims" about Independent Public Schools. Reid found that Donnelly, in casting around for research evidence to support a view that public schools need to become more like private schools, committed a number of basic research errors including:

> *…a lack of attention to context, generalising across cultures, attributing causation to a connection between variables which has not been researched, and screening out any evidence which contradicts his established view.*

Reid believes that education research should be at the centre of public discussions about education policies and therefore an important role of education researchers is to point out when it is being used "as a front for sloganeering for particular ideologies".

The Birmingham/Donnelly use of terms like 'evidence-based', 'best practice' and 'research' to justify the changes they want to make to education practice is a recognition that education policy-making now requires this type of gloss to influence public and/or education community opinion. In many respects this is a positive development as it emphasises that the work of teachers is underpinned by a body of research-based knowledge. Alan Reid's examination of Donnelly's work however, exposes the downside of this development. Politicians and their fellow-travellers can use the respectable cloak of 'research' to sell policies which most research studies do not support. There are parallels here with the climate change debate and the Trump administration's concept of 'alternative facts' to reframe reality.

A memorable example of the misuse of research in Victoria was the 'New Directions' policy paper issued by the Coalition Government in 2012. Offering a wish-list of New Right policies aimed at "lifting the achievement of Victorian students to the global top tier" the paper

contended that all of its proposals were evidence-based and linked to the policies of the top PISA countries. The more closely you analysed the paper's "evidence" however, the more it crumbled into fabrication and ideology. Even the narrow set of reference sources used seemed to have been only half-read, or deliberately mis-read, as they often contradicted the very case being made in the paper. It was as though the Minister (or his staff) thought that no one would actually bother examining the 'evidence' by going to the reference sources.

The New Directions paper and the comments by the federal Minister for Education raise the further issue of the use of international testing data to diagnose the health of Australia's schooling systems. Evidence of a decline in the rank order and mean scores in PISA and TIMMS are interpreted as a decline in the quality of the country's education system and its teachers. The rationale for proposals to change what happens in schools, and the performance indicators to measure whether the changes have led to any improvement, then becomes achieving a higher rank order and mean score in international testing. Success for schools means concerted efforts to improve their test scores in reading, maths and science. This raises all sorts of questions about the desired purposes and outcomes of schooling.

The nature of the 'evidence' generated by international testing programs can be useful in analysing demographic and policy variables, but it does not provide a consensus pathway to improvement. The 'top tier' countries often have very different approaches to schooling. The add-on tutoring culture of Asian countries may make a substantial contribution to their success. In a similar way, the absence of a private school market in Finland may underpin the achievement of their students. In Australia, the unwillingness of the federal government to implement the full Gonski recommendations and base school funding policies on need may help to explain why the country is not in the top tier. An analysis of the performance of Australian students in PISA 2015 found that school level SES (as measured by PISA's index of economic, social and cultural status) explains just over 50 per cent of the variation between schools' average reading scores. A difference of one standard deviation increase in schools' mean SES score is associated with a score difference of 82 on the reading assessment scale – equivalent to two years of learning[iii]. Instead of addressing this reality head-on, the government has reframed the equity argument as one about 'quality'.[iv]

The theme of this edition of *Professional Voice* is an examination of the evidence about what works in schooling and early childhood education, and, as a corollary, what doesn't. The writers have been chosen because of their research expertise and the depth and quality of their work in these areas. The first two articles are in many ways complementary. Steve Higgins, Lee Elliot Major and Rob Coe were asked to write about their UK Sutton Trust review of over 200 pieces of research to identify the elements of teaching with the strongest

evidence of improving attainment. They define effective teaching in terms of its effect on student progress and identify six categories that contribute to it: content knowledge, quality of instruction, classroom climate, classroom management, teachers' beliefs and professional behaviours. They also provide advice about the use of their findings:

> *Great teaching cannot be achieved by following a recipe, but there are some clear pointers in the research to approaches that are most likely to be effective, and to others, even if quite popular, that are not.*

To complement the first article, Stephen Dinham was asked to write about the negative side of the theme - current classroom practices which, while in common use, lack a convincing research base. He is particularly critical of approaches which concentrate on learning styles, multiple intelligences and various forms of personality tests. They have the potential to create harm by "invalid labelling, categorisation and stereotyping" and can constrain future learning by giving students the impression that their abilities are fixed or limited. He refers to this as "entity thinking" (Dweck). It is important to communicate to students of all abilities that intelligence is "malleable" and their current performance is what they can do at that particular time. While the impact of workload pressures on teachers have made 'quick fixes', often advocated by various vested and/or commercial interests, more attractive, Dinham emphasises the importance of teachers becoming "critical consumers of research".

Gehan Roberts reports on his study of Cogmed, owned by the huge multinational Pearson, which is the most widely used memory training program. The randomised clinical trial compared the effects of Cogmed, an adaptive working memory intervention program, with usual classroom teaching in Year 1 classrooms in 44 schools across Melbourne. The study showed no evidence that Cogmed brain training for Grade 1 children who were identified on screening as having low working memory, made any difference to academic or behavioural outcomes in Grade 2 or Grade 3. The world-wide brain training market has been estimated to be worth over $1 billion and rapidly rising. Roberts indicates that a comprehensive review of these programs found that they improved performance on specific trained tasks but had little if any effect on distantly related tasks such as everyday cognitive or learning skills.

Stacey Fox sets out the research case for extending universal access to funded preschool programs to age 3. Australia is presently lagging behind most of its peer countries in the OECD which already provide at least two years of preschool and have done so for decades. Starting preschool at age 3 and attending for two years would reduce the number of children who start school significantly behind their peers. For disadvantaged children in particular, one year of preschool is insufficient to close achievement gaps that are already present at age 4.

The political problem is to get the federal government to translate its expressed dismay about the country's falling international testing results into a realisation that a key intervention strategy is to properly fund this foundational education sector.

Justin Bowd's research examines the complexity of one of those taken-for-granted aspects of school life – homework. He highlights the difficulties of defining 'homework' as a research construct. For example, is homework only study material assigned by teachers or should it include out-of-school tutoring, studying with a family member or working on a computer? Another key research issue is the relationship between homework practices and student background. In his analysis of PISA data Bowd found that Australia had a significantly greater gap than most other OECD countries between the top and bottom SES cohorts in the amount of reported time spent on homework. How this SES difference relates to achievement outcomes (short-term and long-term) is unclear and requires further research.

Trevor Cobbold takes issue with three aspects of the federal government's reaction to PISA 2015 Australian data – the contentions that: the existing level and distribution of school funding is appropriate and generous, that funding has little impact on student outcomes and that the achievement of Australian students is steeply declining. His analysis shows that not only has the increase in school funding been small but, despite the higher needs of students in public schools, it has unfairly favoured students in private schools. He describes a range of recent research studies which conclude that funding levels do affect student outcomes, particularly for students from a disadvantaged background. Finally, he contrasts the PISA performance of Australian 15 year-olds with ABS and OECD data about the very significant increases in Year 12 attainment since 2000-2001.

In the interview for this edition, Rachel Power talks to the Canadian educator Barbara Arrowsmith-Young. Her long struggle to address her own severe learning difficulties became the basis for the Arrowsmith Program, an approach to helping students overcome specific learning difficulties, which has been operating in Canadian schools for more than 35 years. Her program is premised upon the concept of neuroplasticity which she describes as "a capacity-based model":

> *…we can change the capacity, which will allow the student to learn the skills and the content not only more efficiently, but it will also be retained, as the structure will be there to retain it and build on it.*

While there are many strong advocates for the Arrowsmith program, it is subject to ongoing academic argument about its research base. This edition of *Professional Voice* publishes

both the interview with Barbara Arrowsmith-Young and the article by Gehan Roberts as a contribution to the debate about how best to address the learning needs of students with specific learning difficulties.

Notes

i Hattie, J. (2015), *What doesn't work in education: The politics of distraction*, Pearson

ii Reid, A. (2016), "The use and abuse of research in the public domain", *Australian Educational Researcher*, 43:75-91

iii *PISA 2015 Database*. OECD, n.d. Web. 5 Feb. 2017. **http://www.oecd.org/pisa/data/2015database/**.

iv For a general discussion of the reframing process in Australian education policy-making see Mockler, N (2014), Simple solutions to complex problems: moral panic and the fluid shift from 'equity' to 'quality' in education, *Review of Education*, Vol. 2, No 2, pp115-143.

What makes great teaching?

Steve Higgins, Lee Elliot Major and Rob Coe

The aim of our review was to set out a framework for professional learning and to address three deceptively simple questions:

- What makes 'great teaching'?
- What kinds of frameworks or tools could help us to capture it?
- How could this promote better learning in schools?

We know that the quality of teaching is by far the biggest factor within schools that can make a difference to the achievement of children and young people. Over the course of a school year students can make 18 months or even two years' progress with the best teachers, compared with the equivalent of only six months with teachers who are the least effective - half what might be expected. In other words, a great teacher can enable a whole year's extra learning (Machin & Murphy, 2011).

In the report, we review over 200 pieces of research to identify the elements of teaching with the strongest evidence of improving attainment. The report also identifies some common practices that can be harmful to learning and have no grounding in research. Specific practices which are supported by good evidence of their effectiveness are also examined and six key factors that contribute to great teaching are identified. The report also analyses different methods of evaluating teaching including: using 'value-added' results from student test scores; observing classroom teaching; and getting students to rate the quality of their teaching (Coe et al. 2014).

We define effective teaching as that which leads to improved student achievement using outcomes that matter to their future success. However, defining effective teaching is not easy. The research keeps coming back to this critical point: student progress is the yardstick

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Rob Coe is Professor of Education at Durham University and Director of the Centre for Evaluation and Monitoring (CEM), Durham University: http://www.cem.org

by which teacher quality should be assessed. For a judgement about whether teaching is effective to be trustworthy, it must be checked against the progress being made by students.

Some teaching approaches are supported by good evidence of their effectiveness (Rosenshine, 2012). Many of these are obvious and widely practised, but others are at odds with common assumptions (Dunlosky et al. 2013). Examples include: challenging students to identify the reason why an activity is taking place in the lesson; asking a large number of questions and checking the responses of all students; spacing-out study or practice on a given topic, with gaps in between for forgetting; and making students take tests or generate answers, even before they have been taught the material.

The report offers a "starter kit" for thinking about what constitutes effective teaching. This is based on behaviours, approaches and classroom practices that are well-defined, easy to implement and show good evidence of improvements in student outcomes. Six key factors that contribute to good teaching are identified.

The two factors with the strongest evidence in improving student outcomes are:

1. Content knowledge	Teachers with strong knowledge and understanding of their subject make a greater impact on students' learning. It is also important for teachers to understand how students think about content and be able to identify common misconceptions on a topic
2. Quality of instruction	This includes effective questioning and the use of assessment by teachers. Specific practices, like reviewing previous learning, providing model responses for students, giving adequate time for practice to embed skills securely and progressively introducing new learning (scaffolding) are also found to improve attainment.

Another four elements of effective teaching which have fair to moderate evidence showing a positive impact on learning are:

3. Classroom climate	This includes the quality of interaction between teachers and students as well as teacher expectations
4. Classroom management	Such as the efficient use of lesson time and managing behaviour with clear rules that are consistently enforced
5. Teachers' beliefs	For example, the reasons why they adopt particular practices and their theories about learning
6. Professional behaviours	This relates to professional development, supporting colleagues, and communicating with parents.

It may seem unduly negative to focus on things that do not work, but there are a number of reasons for doing this. One is that it provides a challenge to complacency. A potential problem with lists of 'best practice' is that they can be susceptible to confirmation bias. If the list of effective practices is long enough, and contains descriptions of practices that are open to a bit of interpretation, most teachers will be able to identify something they think they are doing well. Including some examples of 'worst practice' is likely to provoke a stronger reaction, which we hope can be challenging in a constructive way.

A second reason is that many of these ineffective practices seem to be quite popular. By stopping doing things that are either ineffective or inefficient, we should allow more time to focus on things that will make more difference (Pashler et al. 2008). The world of schools and teachers is a busy one, if we don't identify things to stop doing, we just try to cram more in to an already hectic environment.

The following are some of the practices that the report identifies as not destructive, but not proven to be effective, and for which there is an almost total lack of evidence to support their use. The seven examples of strategies unsupported by evidence are:

1. Using praise lavishly	For low-attaining students praise that is meant to be encouraging and protective can actually convey a message of low expectations. The evidence shows children whose failure generates sympathy are more likely to attribute failure to lack of ability than those who are presented with rebuke.
2. Allowing learners to discover key ideas for themselves	Enthusiasm for 'discovery learning' is not supported by research evidence, which broadly favours direct instruction.
3. Grouping students by ability	Evidence on the effects of grouping by ability, either by allocating students to different classes, or to within-class groups, suggests that it makes very little difference to learning outcomes. It can result in teachers failing to accommodate different needs within an ability group and over-playing differences between groups, going too fast with high-ability groups and too slow with low ones.
4. Encouraging re-reading and highlighting to memorise key ideas	Testing yourself, trying to generate answers, and deliberately creating intervals between study to allow forgetting, are all more effective approaches to memorisation than re-reading or highlighting.

5. Addressing low confidence and aspirations before teaching content	Attempts to enhance motivation prior to teaching content are unlikely to succeed and even if they do, then the impact on subsequent learning is close to zero. If the poor motivation of low attaining students is a logical response to repeated failure, starting to get them to succeed through learning content will improve motivation and confidence.
6. Presenting information to students in their preferred learning style	Despite a recent survey showing over 90% of teachers believe individuals learn better when they receive information in their preferred learning style, the psychological evidence is clear that there are no benefits to this method.
7. Being active, rather than listening passively, helps you remember	This claim is commonly presented in the form of a 'learning pyramid' which shows precise percentages of material that will be retained when different levels of activity are employed. These percentages have no empirical basis and are pure fiction.

A section of the report also reviews how we make judgements about teacher quality and questions the over-reliance on lesson observation. Given the complexity of teaching, it is surprisingly difficult for anyone watching a teacher to judge how effectively students are learning (Pianta et al. 2008). We all think we can do it, but the research evidence shows that we can't. Anyone who wants to judge the quality of teaching needs to be very cautious.

Six approaches to teacher assessment are reviewed, three have moderate validity in signalling effectiveness:
1. Classroom observations by peers, principals or external evaluators
2. 'Value-added' models (assessing progress in student achievement)
3. Student ratings

Three other approaches had limited evidence:
4. Principal (or headteacher) judgement
5. Teacher self-reports
6. Analysis of classroom artefacts and teacher portfolios

The report argues for a formative approach to teacher evaluation, based on continuous assessment and feedback rather than results from high-stakes tests (Danielson, 2007). This will need to incorporate a range of measures, from different sources, using a variety of methods (Polikoff, 2014). A key to appropriately cautious and critical use of the different methods is to triangulate them against each other. A single source of evidence may suggest the way forward, but when it is confirmed by another independent source it starts to become

a credible guide. Currently available measures can give useful information, but there is a lot of noise around a weak signal, so we must be careful not to over-interpret. If we were to use the best classroom observation ratings, for example, to identify teachers as 'above' or 'below' average and compare this to their impact on student learning we would get it right only about 60% of the time, compared with the 50% we would get by just tossing a coin. These judgements therefore need to be used with considerable caution.

One of the conclusions of the report is that if that we are concerned with the learning of students, we should pay greater attention to the professional development of teachers themselves (Muijs et al. 2014). Good quality teachers are the key to an effective school and a successful education system. This aim of the research review is to challenge some prevalent teaching myths but also to identify some the core ideas for schools to help support the development of teachers.

Great teaching cannot be achieved by following a recipe, but there are some clear pointers in the research to approaches that are most likely to be effective, and to others, even if quite popular, that are not. Teachers need to understand why, when and how a particular approach is likely to enhance students' learning and be given time and support to embed it in their practice.

This article summarises the report: Coe, R., Aloisi, C., Higgins, S. and Elliot Major, L. (2014) *'What makes great teaching? Review of the underpinning research'*. Sutton Trust, October 2014 London: Sutton Trust http://www.suttontrust.com/researcharchive/great-teaching/

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The lack of an evidence base for teaching and learning:
fads, myths, legends, ideology and wishful thinking

Stephen Dinham

It is admirable and expected that teachers will want their students to learn, but a problem arises when strategies and resources are adopted that in some cases have weak, unproven, or disproved effects, on student learning. Teachers and other educators need to be what I term 'critical consumers of research' in their selection of such approaches, but this is a challenge when time and knowledge are in short supply and 'quick fixes' to student learning, often advocated by various vested and/or commercial interests, are attractive. In other cases some approaches are an ideological position on how learning and the world *should* be, in the views of some.

Discovery learning and constructivism

One such belief and approach is that of 'discovery learning' and its allied concept, 'constructivism'. It has become an article of faith for some that it is 'better' if students can discover and construct their own learning.

Writing in the *American Psychologist*, Mayer reviewed the research evidence and commented:

> *"The debate about discovery has been replayed many times in education, but each time, the research evidence has favoured a guided approach to learning. … Today's proponents of discovery methods, who claim to draw their support from constructivist philosophy, are making inroads into educational practice. Yet a dispassionate review of the relevant research literatures shows that discovery-based practice is not as effective as guided discovery."*[1]

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However, unguided discovery learning, problem based learning, inquiry and constructivism are popular with many teachers and are common strategies in many classrooms, with students receiving little or no guidance as to the content, scope or standards required for satisfactory completion of a task. A variation is social constructivism where students work in small groups trying to discover what they need to know. Hattie found that problem based learning has an effect size of only 0.15, whereas direct instruction, where the teacher is clear about his or her intentions and orchestrates the learning of the students accordingly, has an effect size of 0.59.[2] This is not to say that we don't want students to engage in problem solving or inquiry, just that such activities are most effective when students have been given a solid foundation of knowledge, skills and understanding that they can then *apply* to problems.[3]

Mayer concluded from his analysis that:

> *"As constructivism has become the dominant view of how students learn, it may seem obvious to equate active learning with active methods of instruction. Thus, educators who wish to use constructivist methods of instruction are often encouraged to focus on discovery learning – in which students are free to work in a learning environment with little or no guidance. Under the banner of social constructivism, the call for discovery learning remains, but with a modest shift in form – students are expected to work in groups in a learning environment with little or no guidance. … The research … shows that the formula constructivism = hands-on activity is a formula for educational disaster."*[4]

Ken Rowe and I noted in a review of middle schooling for the New Zealand Ministry of Education:

> *"Whereas constructivism is an established, legitimate theory of learning and knowing … it is not a theory of teaching. This has particular relevance for effective pedagogy during the middle years, especially given the strong advocacy in middle school teaching for 'hands-on', 'action-oriented', constructivist learning activities."*[5]

In highlighting the inappropriateness of constructivism as an operational theory of teaching, Wilson commented:

> *"We largely ignore generations of professional experience and knowledge in favour of a slick postmodern theoretical approach, most often characterised by the misuse of the notion of constructivism."*[6]

This is not the full extent of the fads and fashions, however. There is a raft of other approaches for which a research evidence base is either lacking or non-supportive. These include learning styles (see following), 'neuro-linguistic programming', multiple intelligences, 'thinking hats', brain exercise, emotional intelligence, the 'Mozart effect', so-called 21st century curriculum and associated skills, and 'digital natives'.[7]

Learning styles

The notion of the existence of learning styles has been around since the 1970s, with there now being more than 70 extant models ranging from early childhood to higher education. It has become a vast, lucrative industry with inventories, manuals, video resources, in-service packages, websites, publications and workshops.

However psychologists and neuroscientists agree there is little efficacy for these models, which rest on dubious evidential grounds. Of the very many publications supporting the existence and use of learning styles in teaching, most have not been subject to peer review. Hattie has noted that 'It is hard not to be sceptical about these learning preference claims'.[8]

Stahl has commented:

> *"I work with a lot of different schools and listen to a lot of teachers talk. Nowhere have I seen a greater conflict between 'craft knowledge' or what teachers know (or at least think they know) and 'academic knowledge' or what researchers know (or at least think they know) than in the area of learning styles. ... The whole notion seems fairly intuitive. People are different. Certainly different people might learn differently from each other. It makes sense."*[9]

However there is a distinct lack of empirical support for the existence of learning styles:

> *"The reason researchers roll their eyes at learning styles is the utter failure to find that assessing children's learning styles and matching to instructional methods has any effect on their learning."*[10]

The authors of an extensive review of the research evidence for learning styles concluded:

> *"Although the literature on learning styles is enormous, very few studies have even used an experimental methodology capable of testing the validity of learning styles applied to education. Moreover, of those that did use an appropriate method, several found results that flatly contradict the popular meshing hypothesis.*

> *We conclude therefore, that at present, there is no adequate evidence base to justify incorporating learning styles assessments into general educational practice."*[11]

Yet as Scott has observed:

> *"Failure to find evidence for the utility of tailoring instruction to individuals' learning styles has not prevented this term from being a perennial inclusion in discussions about and recommendations on pedagogy. It also continues to influence what teachers do in their day-to-day work. Practitioners from preschool to university level attempt to apply the theory in classrooms, administering the unreliable tests, criticised by so many, to their students, using the results as a guide to classroom practice and encouraging or requiring students to apply the results to understanding, controlling and explaining their own learning."*[12]

References to learning styles still abound in many curriculum documents at system and school level, despite the lack of evidence for their existence. When I have pointed this out to educators, the usual response is that it 'doesn't matter'. However, it *does* matter, because of the problems and harm that can be caused by the categorisation, labelling and limiting of learning experiences of students through the continued belief in and application of so-called learning styles. Would we tolerate doctors continuing to use a disproved, harmful treatment?

Multiple intelligences

Bennett exposed the lack of evidence for many of these educational fads and the harm they can do.[13] Unfortunately, these approaches are popular, particularly in primary schools, and are often thrown together in what Howard Gardner of 'multiple intelligences' (MI) fame terms 'dazzling promiscuity'. In fairness to Gardner, he is highly critical of how his work has been reified and misused in education:

> *"I learned that an entire state in Australia had adapted an education programme based in part on MI theory. The more I learned about this programme, the less comfortable I was. … much of it was a mishmash of practices, with neither scientific foundation nor clinical warrant. Left-brain and right-brain contrasts, sensory learning styles, 'neuro-linguistic programming', and MI approaches commingled with dazzling promiscuity."*[14]

Myers-Briggs, etc?

Another form of categorisation occurs through the use of various forms of personality tests sometimes administered to students. The danger lies with how the results of such tests are used and whether this use engenders 'entity thinking' or fixed mindsets in students[15] and stereotyping and fixed, inappropriate expectations for students held by teachers. Paul has commented:

> *"Millions of people worldwide take personality tests each year to direct their education, to decide on a career, to determine if they'll be hired, to join the armed forces, and to settle legal disputes. … the sheer number of tests administered obscures a simple fact: they don't work. Most personality tests are seriously flawed, and sometimes unequivocally wrong. They fail the field's own standards of validity and reliability."*[16]

'Neuromyths'

There is much information and misinformation about the brain and learning. Dekker and colleagues tested some of the 'neuromyths' held by teachers – which they define as beliefs 'loosely based on scientific facts' - and the possible effects of these on teachers and their teaching:

> *"A large observational survey design was used to assess general knowledge of the brain and neuromyths. The sample comprised 242 primary and secondary school teachers who were interested in the neuroscience of learning. … Participants completed an online survey containing 32 statements about the brain and its influence on learning, of which 15 were neuromyths. … Results showed that on average, teachers believed 49% of the neuromyths, particularly myths related to commercialized educational programs. …*
>
> *These findings suggest that teachers who are enthusiastic about the possible application of neuroscience findings in the classroom find it difficult to distinguish pseudoscience from scientific facts."*[17]

Harm can be done

As Stahl[18], Bennett[19] and others have noted, these approaches are intrinsically appealing but the fact is, learning is not so simple. Aside from wasting teachers' and students' time and schools' money, the real cost of dabbling with such unsupported strategies, is that students are not being taught what they need to know, coupled with the harm caused by arbitrary, invalid labelling, categorisation and stereotyping. Through such practices students can come

to see their abilities as fixed or limited, something Carol Dweck has termed 'entity thinking'[20] (see below). This can powerfully constrain future learning. Those convinced that they have a natural, innate talent for something will be disappointed when they come to expect success without effort, whilst those who believe they don't have a talent for something may be put off from even trying.

I have noted previously that:

> *"... one of the most damaging things we can do to people is to put them into categories and treat them accordingly."*[21]

Hattie found that *not* labelling students has a large effect size of 0.61 for student learning , yet categorisation is something approaches such as learning styles, thinking hats, multiple intelligences, personality types and so forth, are predicated on.

Entity versus malleable theory of intelligence

Carol Dweck identified and refuted a number of harmful, invalid beliefs about students and schooling:

1. *The belief that students with high ability are more likely to display mastery-oriented qualities ...*
2. *The belief that success in school directly fosters mastery-oriented qualities ...*
3. *The belief that praise, particularly praising a student's intelligence, encourages mastery-oriented qualities ...*
4. *The belief that students' confidence in their intelligence is the key to mastery-oriented qualities.*[23]

Dweck goes on to contrast 'two frameworks for understanding intelligence and achievement':

- The theory of fixed intelligence - Some people believe that their intelligence is a fixed trait. They have a certain amount of it and that's that. We call this an 'entity theory' of intelligence because intelligence is portrayed as an entity that dwells within us that we can't change. ...
- The theory of malleable intelligence - other people have a very different definition of intelligence. For them intelligence is not a fixed trait that they simply possess, but something they can cultivate through learning. We call this an 'incremental theory' of intelligence because intelligence is portrayed as something that can be increased through one's efforts.[24]

The concepts of entity intelligence and its counterpart, malleable intelligence, have great significance to teaching and learning. One implication is that we need to avoid giving students the view that their ability is fixed. This applies equally whether they are currently able to perform at a high level, or a low level, in any area or subject.

Telling someone they are a 'natural' at something can be equally harmful as telling someone they are 'hopeless'. I will wager that everyone reading this has at some time been given a message that they are no good at something. Whether we are talking about sport, music, mathematics, languages or any other area, such a belief can powerfully constrain future success in that area of endeavour and create a barrier to further participation and improvement.

The implication for teaching is we need to concentrate on communicating to students how their *current performance* on any task or in any subject compares to the standard expected. This must be accompanied by constructive feedback to help them understand what is required to improve their learning and performance.

Thus it is important to carefully consider how and what we communicate to students about their achievements. We need to concentrate on what they can do at a particular time and not give a message that their ability is fixed for ever.

What about self-esteem?

Research shows that student self-esteem or self-concept can have moderate or greater effects on student learning.[25]

Some educators have been convinced therefore, that if self-esteem can be boosted to higher levels, this will result in enhanced learning, a classic case of 'putting the cart before the horse' or confusing cause and effect. Conversely it is thought that any form of criticism, correction or failure will harm students' self-esteem and thus learning, and should therefore be avoided. The downside of this is that students can gain an inflated view of their capacities which can lead to the entity thinking mentioned previously.[26] I've observed schools where no one receives a 'bad' or failing mark, red pens are not used to correct work because 'red is an angry colour', and 'merit' certificates are thrown around like confetti for meeting normal expectations such as sitting quietly when eating one's lunch. In short, rampant, devalued, 'positive reinforcement' abounds.

However the best way to legitimately boost self-esteem is for students to receive regular constructive, developmental feedback, something known to have one of the most powerful

effects on learning.[27] If students can see and feel themselves achieving, even in small increments, this can then lead to an increase in self-concept/esteem that sets up a cycle for further improvement. However, empty, inauthentic, unwarranted praise ultimately hampers both learning and self-esteem.[28]

Authentic achievement, no matter how small, is thus the best way to engender self-concept and self-esteem. This can then serve as a foundation for further achievement. When students have their self-esteem boosted artificially in inauthentic ways, on the other hand, they can be confused about their actual ability and the air can quickly come out of the self-esteem balloon when they hit the wide world and meet real-life challenges.[29] Unwarranted self-esteem boosting works against building perseverance and resilience in students, qualities necessary to meet challenges in schooling and later life.[30]

Final Comment: what do students think?

A key point to consider: have students been asked what they think of all this, especially the various uses of categorisation? Their answers will be instructive. In my experience, students will put up with such methods, even when they know them to be invalid. There are many students who have been very successful in various areas out of school (music, sport, drama, for example), yet were not considered to possess such ability within school because of judgements made by teachers. Some young people are also late developers, and this development can be hindered by their negative experiences in school.

This article is drawn from Dinham, S. (2016). Leading Learning and Teaching. Melbourne: ACER Press. (Chapter 2). In the book Stephen Dinham also canvasses those strategies and approaches that have been found to have the greatest impact on student learning.

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Brain Training:
a panacea for working memory difficulties?

Gehan Roberts

'Emily' (not her real name) is in Grade 3: her teacher is worried because she daydreams, has trouble following multi-step directions and is falling behind her peers in class. Emily is a bright and caring girl who is no trouble in class, is amazing at art and loves looking after her friends. However, she is starting to feel bad about her difficulty remembering what she is taught and some of her classmates have started teasing her about this- she comes to her teacher in tears, after a spelling test, saying she feels 'dumb'. Fast forward a few months.... the educational psychologist has seen her and the report comes back with "normal IQ but very low working memory". At the next PT meeting, her parents bring out a glossy brochure about Brain Training. Could this be the answer?

As a developmental paediatrician, I frequently see children like 'Emily', who are referred via their family doctors for evaluation of learning difficulties or school refusal, often with the additional questions of whether they could have ADHD or whether they could have a mood disorder, such as Anxiety or Depression. These referrals are often driven by their parents or teachers, and a cognitive assessment has sometimes already been carried out, and has concluded that the child doesn't have an Intellectual Disability and therefore isn't eligible for PSD funding.

As a researcher, I recently had the opportunity to investigate Cogmed, one of the best known computerised 'Brain training' programs on the market.(Roberts et al., 2016) Our team used a research methodology called a Randomised Controlled Trial, and we recruited families who had children with low working memory in Grade 1 (452 children from 44 State, Catholic and Independent schools in Melbourne): these children were randomly allocated to receive either the 5 week Cogmed training program in school (the intervention), or to receive 'usual

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teaching' (the control). We checked in with the children, their parents and teachers after 6, 12 and then 24 months. At 6 months, we were cautiously optimistic: the training group, compared with the 'control' group, had improved scores on 2 out of the 4 memory measures. This replicated what Cogmed's parent company, Pearson, publishes on its website (http://www.cogmed.com.au/research). However, at 12 and 24 months, the intervention group looked no different to the control group in terms of their academic outcomes or on parent and teacher reports of behaviour, attention and daily function.

What do we conclude from this? The results are quite specific: our study shows no evidence that Cogmed brain training, for Grade 1 children who were identified on screening as having low working memory, makes any difference to academic or behavioural outcomes in Grade 2 or Grade 3. Because we designed the study to see if Cogmed could prevent problems in at-risk children, we are not able to extrapolate our results, for example, to older children or children with ADHD or learning disabilities. What if the training was provided for longer, or with the top-up session every few months or alongside a literacy or numeracy intervention? Our results do not allow us to provide an evidence-based answer to these questions.

Fortunately, many other cognitive scientists around the world are trying to pull together the current evidence to guide us. In 2016, a group of experts from the USA and UK published a comprehensive review, titled 'Do "Brain-Training" Programs Work?'(Simons et al., 2016) They carried out this work in response to 2 previous open letters published in 2014 by different groups of experts that had different conclusions. The first concluded that 'we object to the claim that brain games offer a scientifically grounded avenue to reduce or reverse cognitive decline' (http://longevity3.stanford.edu/blog/2014/10/15/the-consensus-on-the-brain-training-industry-from-the-scientific-community-2/) but the other, in response, argued back that 'certain cognitive training regimens can significantly improve cognitive function, including in ways that generalize to everyday life (http://www.cognitivetrainingdata.org/the-controversy-does-brain-training-work/response-letter/). The authors of the 2016 paper, therefore, dug deep into the available scientific literature and tried to explain how two groups of scientists could hold such diametrically opposed views.

For the interested reader, this paper is worth examining in detail. There are, however, a few important take home messages. First, that that there is good evidence that brain training interventions improve performance on trained tasks (that is, if you practice a training game over and over, you get better at playing this game). Second, there is less evidence that this training improves function on non-trained but closely related tasks (this is called 'near-transfer', and we demonstrated this with our 6 month memory tests).(Roberts et al., 2016) Finally, there is very little evidence that brain training improves function on distantly related tasks such as everyday cognitive or learning skills (this is called 'far-transfer' and matches

what we found at 12 and 24 months, when the kids in our study had moved to Grade 2 and 3).(Roberts et al., 2016). They also give some very helpful recommendations for scientists and funding bodies about designing future studies, and also very useful recommendations for consumers, including being sceptical of a 'quick-fix' if your long-term goal is to improve learning skills, and to remember to think of the opportunity costs of doing a brain-training intervention (what else you may have spent your time or money doing).(Simons et al., 2016)

So, where does this leave us when we are trying to help kids with working memory problems, especially if they are already falling behind, or are losing confidence in their own abilities? One of the authors of the review paper and a co-investigator on our trial, Professor Susan Gathercole form Cambridge University, has published very helpful information about how to modify the classroom environment to try to help these children, who frequently become overwhelmed with too much information input. This booklet can be downloaded here: https://www.mrc-cbu.cam.ac.uk/wp-content/uploads/2013/01/WM-classroom-guide.pdf , and contains helpful tips that can be written into the child's Individual Learning Plan and also discussed with his or her family for use at home.

As a paediatrician, once I have excluded contributing medical causes and associated problems such as mood or attention disorders, this is the advice that I give families: work with your teachers to develop a full understanding of your child's profile of strengths and vulnerabilities, and then develop a plan together to help the student to achieve their best despite these vulnerabilities. If working memory difficulties are the main driver for the learning problems, we have to remember that the student is likely to be lost and overwhelmed in a busy classroom environment, so we need to develop a plan to present information in a way that doesn't overwhelm their working memory capacity. There are, unfortunately, no quick fixes, but if we, as caring and nurturing mentors, can keep the student motivated and engaged and interested, they are likely to find their path in life.

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Preschool:
Two years are better than one

Stacey Fox

A child's brain develops more in their first five years than it will for the rest of their life. During this time, vital foundations are laid that will equip children to be capable and confident learners, to have good executive function and emotional regulation, build positive relationships with others, and participate in society throughout their lives. Quality early education plays a key role in supporting children's development. Australia needs well-trained and well-supported educators and quality early education services to ensure *all* children can start school with the foundations they need to thrive.

Universal access to two years of a high quality preschool (or kindergarten) program is one of the best ways to amplify children's learning and development, and to lift educational achievement in Australia. Providing two years of high quality preschool programs, delivered by skilled and well-supported early childhood educators, gives every child in Australia the opportunity to reach their potential and can be a real contributor to Australia's social and economic prosperity into the future.

High quality preschool programs improve children's early cognitive and social and emotional skills, strengthening their readiness for school. These early gains are sustained, as the impact of high quality preschool continues to be evident in primary school academic assessments, social and emotional wellbeing in adolescence, and high school graduation rates.

Since the introduction of Universal Access to preschool in 2009, Australia has made progress in the proportion of children enrolled in a preschool program in the year before school. But most of our peer countries in the OECD already provide at least two years of preschool

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and have done so for decades. Countries in our region are rapidly ramping up access to two years of preschool, framing this as a necessary investment in human capital and future productivity.

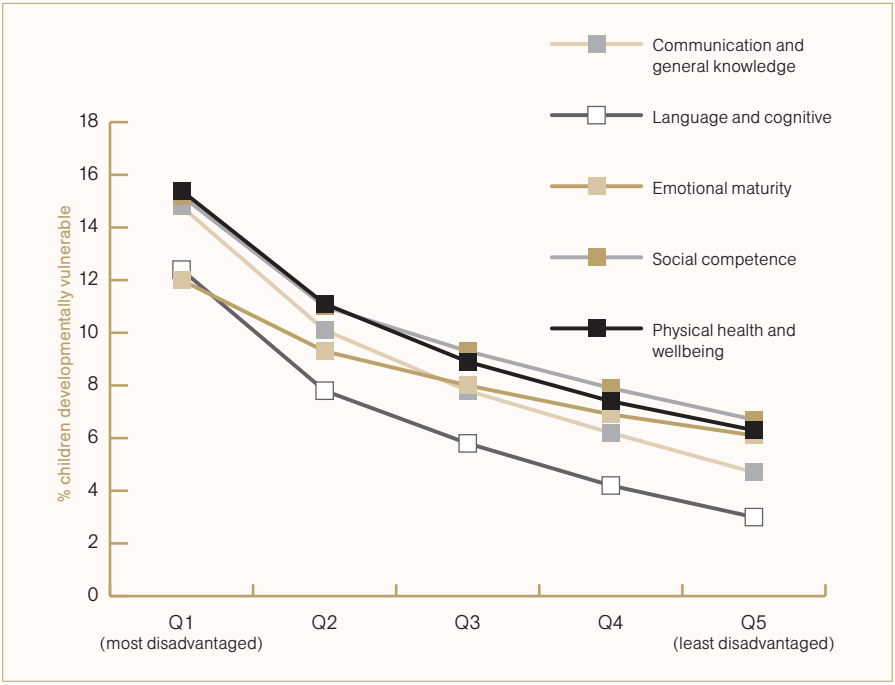
Investing in an additional year of preschool is the next big policy opportunity for Australia.

Link between early childhood development and school outcomes

Each year, at least 62,000 children start school experiencing significant vulnerabilities in key areas of development (Australian Early Development Census 2016). This is 22 per cent of all children, more than one in five. Around half of those children are vulnerable in multiple areas.

Children from low socioeconomic backgrounds are much more likely to experience developmental vulnerability (Figure 1), but there are children across the community, and in every classroom, who are struggling. Half of all children who are developmentally vulnerable are in the bottom two income quintiles (their family incomes are in the lowest 40%), and the other half are in the middle and upper quintiles.

Figure 1: Developmental vulnerability (measured by the AEDC) by community socio-economic status (measured by SEIFA) (Australian Early Development Census 2016)



Reducing the number of children who start school significantly behind their peers is a key strategy for boosting educational performance, ensuring young people are equipped with the range of skills and capabilities they will need for a lifetime of learning, and improving the wellbeing and lifetime outcomes for children.

Young children are learning and developing an enormous range of critical foundational skills in the years before they start school. These key areas of early childhood development – physical health and wellbeing, social competence, emotional maturity, language and cognitive skills, and communication skills and general knowledge – have been shown to predict children's later outcomes in health, wellbeing and academic success.

Children who do not have the opportunity to fully develop these foundational skills can struggle significantly in their transition to school, throughout their education and with their movement into the workforce.

The case for two years of preschool

Attending the right amount of a high quality preschool program is one of the few proven strategies for lifting outcomes for all children. Its effectiveness is borne out in Australian and international research (AIHW 2015; Barnett et al. 2013; Goldfeld et al. 2016; Zaslow et al. 2010), with leading Australian child development researchers concluding that "preschool attendance was consistently associated with the lowest odds of developmental vulnerability" (Figure 2).The impact of preschool is seen across the socioeconomic spectrum (Figure 3).

Figure 2: Preschool attendance and developmental vulnerability (Goldfeld et al. 2016)

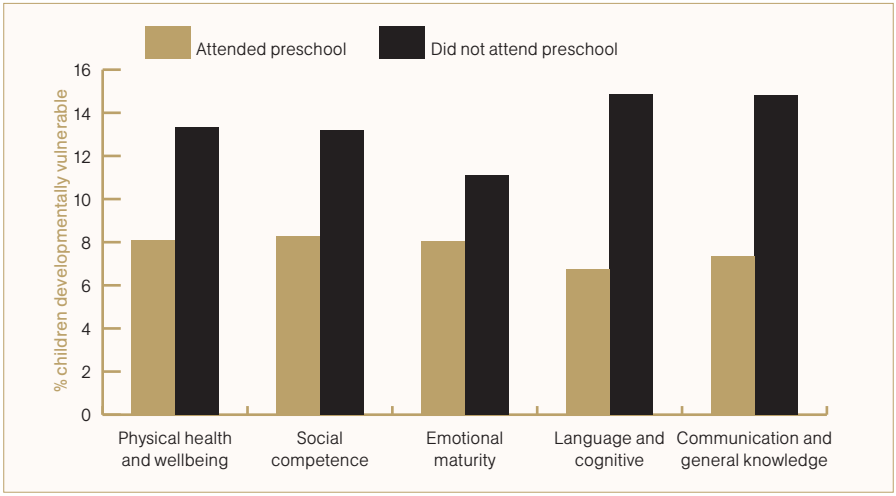
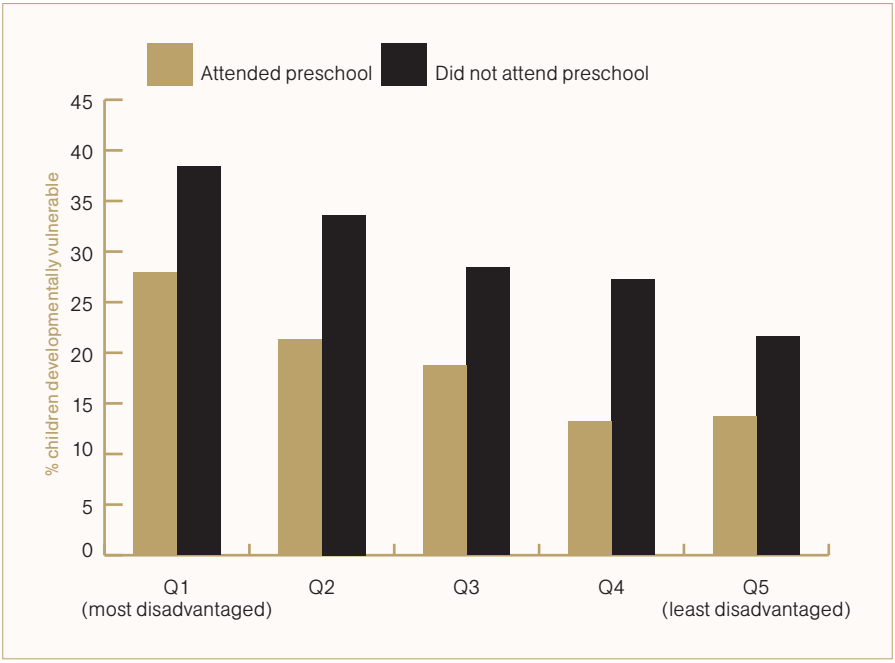


Figure 3: Impact of preschool by socioeconomic status (Goldfeld et al. 2016)



The potential impact of preschool is, however, influenced by:

- The quality of the preschool program and the learning environment children experience ; and
- The 'dose' of preschool that children have access to; how many hours, over how many years, they attend preschool programs.

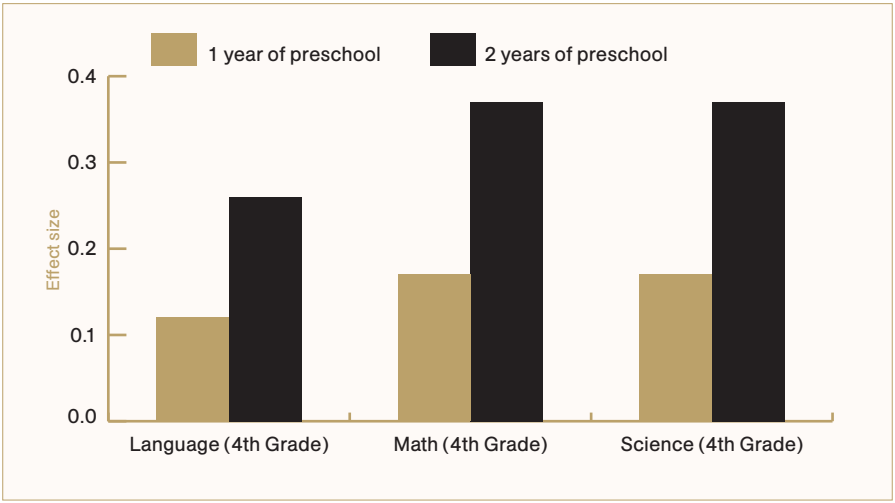
Key findings from the international research literature are that:

- Starting early and staying in for longer is beneficial for many children – studies from Europe, the US and UK show consistent benefits from two rather than one year of preschool.
- Disadvantaged children benefit the most – a range of studies highlight substantially greater impacts on cognitive and social and emotional outcomes for more disadvantaged children.
- The quality of programs matters – low and medium quality programs deliver very little short or long-term impacts, but the impact of high quality persists over time.
- Preschool programs improve cognitive as well as social and emotional outcomes – research on the long-term impacts of preschool highlights the interaction of academic and social and emotional skills on lifetime education and employment.

Starting preschool at age 3 and attending for two years appears to have the greatest impact on child outcomes. For disadvantaged children in particular, one year of preschool is not an adequate dose for closing achievement gaps that are already present at age 4. For example:

- Analysis of the impact of preschool on PISA, TIMSS and PIRLS consistently identifies that students who attended more years of preschool receive higher scores (an average of 33 points higher) in these key international benchmarking tests (Mostafa & Green 2012; Mullis et al. 2012; Mullis et al. 2016).
- The landmark Effective Provision of Pre-School Education (EPPE) study found that, at age 16, students who had spent longer in preschool (between two or three years) obtained higher total scores in secondary exams, better grades in English and in maths, and participated in more subjects/exams in secondary (Taggart et al. 2015).
- The Abbott Pre-K preschool program, a high-quality program delivered to around a quarter of children in New Jersey, also found that two years of preschool, starting at age 3, had much larger persistent effects on achievement in Grade 4 than one year (Figure 4). The strong impacts of this program are attributed to the provision of support for professional learning and continuous quality improvement mechanisms (Barnett et al. 2013, p. 19).

Figure 4: Abbott Pre-K Effects by years of attendance (Barnett et al. 2013)



Two years of preschool is good for schools too

High levels of developmental vulnerability in a classroom, or significant variation in children's underpinning skills and knowledge, make a teacher's role even more complex and places

additional pressure on schools to adequately meet the needs of all children in their community.

Children experiencing developmental vulnerability are likely to need significantly greater support in the classroom. This may range from physical challenges, like difficulty undoing buttons, managing lunch routines and sitting still, to challenges following instructions, communicating with other children and managing emotions. Teachers must utilise sophisticated teaching and learning strategies to develop and extend each child's learning, but this can be very challenging when children start school with very different capabilities.

It appears that for many students, the achievement gap evident at the start of school continues to grow as they progress through school (Goss & Sonnermann 2016; Lamb et al. 2015).

Research shows that "all children in a classroom tend to learn more during a given year if the average skill level in the classroom at the year's start is higher" (Bartik 2014, p. 56). The overall improvement in attainment in classrooms where a smaller proportion of children experience developmental vulnerabilities is likely to come both from peer effects, the influence children have on each other's learning, as well as from the enhanced capacity of the teacher to direct adequate time and resources to the students who require additional assistance (Burke & Sass 2011; Henry & Rickman 2007; Neidell & Waldfogel 2010).

Universal access to high quality preschool for all children is one of the most effective strategies to help children start school on a more equal footing.

School and community stories taken from the Australian Early Development Census show how schools are working in partnership with early education and care services to reduce developmental vulnerability in their community (AEDC 2017).

Early childhood educators change children's trajectories

There is growing community recognition and government support for the important role of teachers, and the importance of providing appropriate training and support to enable effective, high-impact teaching. However, this recognition has not been equally extended to early childhood educators, who – in spite of their pivotal influence during a fundamental stage in children's learning and development – are often still regarded as child-minders rather than educators.

The evidence is very clear that preschool programs achieve substantial and sustained impacts on children's development and wellbeing, but that they need to be high quality to do so. Highly skilled and well supported educators are essential for high quality learning environments.

The quality of a learning environment in early education settings is, to a large extent, determined by the capacity of educators to provide responsive interactions and to construct a learning program that engages and extends children in developmentally appropriate ways (Cascio & Whitmore Schanzenbach 2013; Yoshikawa et al. 2013). This requires an in-depth understanding of early cognitive and social development, and a sophisticated approach to designing learning opportunities that progressively develop and extend a broad range of complex, fundamental skills – while working with large groups of young, energetic children.

All educators need high-quality initial qualifications and effective placements in collegiate, supportive environments that allow educators to develop and test new skills. Effective leadership, access to professional learning opportunities, positive work environments and appropriate remuneration all enhance the capacity of educators to deliver high quality learning environments for children.

The early education and care system does not provide the same pay and conditions for its educators as those enjoyed by school teachers, and early childhood educators often experience isolation, high levels of churn, low pay, restrictive working conditions and limited access to professional learning.

In order to have a positive impact on children's long-term outcomes, and to change the trajectories of children experiencing developmental vulnerability, early education must be high quality – and it will be necessary for Australia to invest in its early years workforce.

Introducing an additional year of a preschool program targeted at 3 year olds will require a workforce strategy to boost the number of early childhood educators, and resources to support existing educators to deliver a high quality preschool program that engages and meets the needs of 3 year olds.

To be high quality, preschool programs for 3 year olds need to be developmentally appropriate, designed around the way 3 year olds learn best – through exploration and inquiry, free and guided play, rich engagement and conversation with educators, opportunities to practise and master new skills, and positive relationships with peers and educators.

It is important that a preschool program for 3 year olds should not be a 'pushed down' curriculum or 'sped up' learning experience, and should not simply replicate the 4 year old preschool program.

Some of the ways a preschool program can be developmentally appropriate for 3 year olds include:

- Approaches to programming that give children the opportunity for emerging skills to be practised and mastered, with the support and encouragement of educators;
- Smaller group learning experiences that don't place unfair demands on 3 year olds' listening skills and capacity to be actively engaged in the group experience;
- Reflecting 3 year olds' developing ability to wait, be patient and share with others in the design of activities, for example, by giving each child their own resource and gradually building their capacity to work collaboratively;
- Learning experiences designed around the attention span of 3 year olds, including planning fewer but richer and more engaging experiences that will capture children's interest, sustain their attention, and build their ability to focus over time;
- Supporting 3 year olds' flourishing expressive and receptive language, helping them tune into the rhythms of language, and building their confidence as communicators through responsive conversation;
- Exploring basic numeracy concepts such as counting, sorting, classifying, comparing and patterning;
- Identifying opportunities for play-based exploration of basic science concepts, supported by questioning, hypothesising and scaffolding children's everyday experiences;
- Outdoor play that helps 3 year olds to progressively develop new skills, building their strength, confidence and coordination.

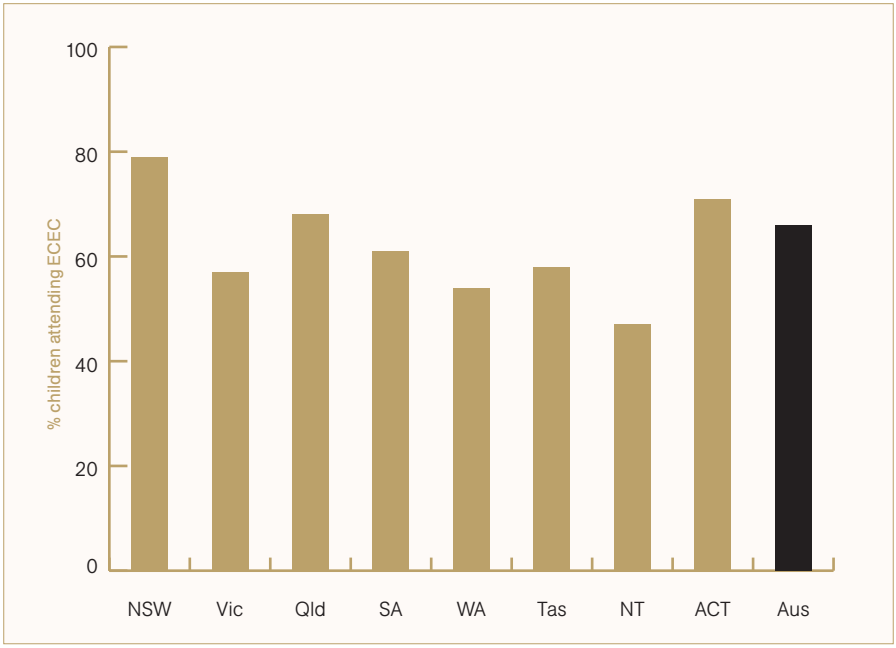
Yoshikawa et al. (2013) suggest that professional learning models that provide ongoing reflective coaching for educators, combined with assessments of child progress that are used to inform and individualise instruction, best allow educators to monitor the progress of each child in the classroom and modify their content and approach accordingly.

The path to two years of preschool in Australia

For nearly two thirds of Australian 3 year olds, participation in early education and care is the norm (Figure 5). However, only a small proportion of 3 year olds are enrolled in a program led by an early childhood teacher, not all are attending for the number of hours per week they need to, and the children most likely to miss out are the ones who will benefit most. There is no national policy or funding to support access to a preschool program for all 3 year

olds (although some states support some cohorts of children experiencing disadvantage to attend preschool).

Figure 5: Proportion of 3 year olds attending any early education and care, 2015 (ABS 2016; Steering Committee for the Review of Government Service Provision 2015)



There is a clear opportunity to leverage high current participation rates by 3 year olds as the existing investment in early education and care, the ongoing roll-out and future components of the National Quality Framework, and the existing National Partnership Agreement between the Commonwealth and states and territories that provides preschool in the year before school, are up for re-negotiation this year.

It is both appropriate and feasible to build on the platform provided by the existing service system – including long day care and sessional preschools – to provide universal access to preschool in the two years before formal schooling begins.

Consideration should also be given to how to best meet the needs of the approximately 5 per cent of children experiencing multiple and complex forms of disadvantage (including children known to the child protection system) who require much more intensive provision of the highest quality early education.

To capitalise on the opportunity to lift children's academic and life outcomes through an additional year of preschool, the challenge is to:

- Ensure all 3 year olds already attending early education and care services receive an adequate 'dose' of sufficiently high-quality preschool; and
- Ensure the children currently missing out due to financial and non-financial barriers have the opportunity to participate.

At the same time, we need to continue the work already underway across the country to lift the quality and impact of early education and care in Australia, including through delivering world-class pre-service education for teachers and other educators, developing and skilling up leaders in the early childhood sector, and using evidence and data more effectively.

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The relationship between homework practices and educational outcomes

Justin Bowd

Time spent on homework, attitudes towards homework, and parental involvement in students' homework may be functions of students' socioeconomic or cultural backgrounds. The relationship between homework and motivation may also be mediated or moderated by differences in student background. Understanding these interactions has the potential to improve educational outcomes by informing policy around pedagogy, resource allocation and curriculum development.

That attitudes towards, and achievement in, formal education vary (on average) across class and cultural divides is widely known (Bourdieu & Passeron, 1977; Connell, Ashenden, Kessler, & Dowsett, 1989; Portes, 1996; Teese & Polesel, 2003). As noted by Lareau (1987), much research examining the effects of students' demographic characteristics on education has focused mainly on variation in achievement outcomes rather than variation in the processes and practices that may lead to differential outcomes. It may be that differences in homework practices contribute to this variation in outcomes, or there may be potential for effective homework practices to reduce the influence of student family background and other demographic variables on achievement. In order to reduce the degree to which structural variables such as socioeconomic status (SES), parental education, gender, cultural background, and the like influence educational outcomes, it is important to first establish which of these factors are linked with processes, like homework practices, that may produce differential outcomes on an aggregated level.

Defining homework

As one researcher has noted, 'homework is a complicated thing (and) the process of assigning and doing homework rarely works in the idealised way that laypeople—and apparently, most policymakers—envision it' (Corno, 1996, p. 27). One of the likely reasons

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for this complexity is the wide range of definitions and functions that can be applied to the concept of homework. Another possible explanation for the gap that exists between an idealised vision of homework and the reality surrounding its practices, is that homework's meanings and functions may well be subject to significant and structural, economic, social and cultural variations. The dynamic relationships between homework's content and context may be one reason for the high level of complexity.

Given this high level of complexity, defining and operationalising homework as a construct amenable to formal examination in research can be challenging. In interrogating large-scale datasets the definition of homework is necessarily constrained to that used in data collection. For example, the Program for International Student Assessment's (PISA) *2012 Student Questionnaire* asks respondents (15-year-old students) to provide an estimate of how many hours per week on average they spend on 'Homework or other material assigned by your teachers' (OECD, 2013, p. 233). Although the questions that follow in the survey ask for separate estimates of time spent with home tutors; in outside-of-school classes; on 'Practice content from school lessons by working on a computer'; and studying 'with a parent or other family member', it is not clear whether 'material assigned by your teachers' is inclusive or exclusive of these subsequent categories, highlighting the difficulties associated with defining and measuring homework and its utility.

A frequently cited definition of homework as 'tasks assigned to students by school teachers that are meant to be carried out during non-school hours (excluding) in-school guided study, home study courses, and extracurricular activities' is simple and convenient (Cooper, 1989b, p. 86). By constraining homework to mean 'tasks assigned' by teachers, this definition excludes outside-of-school study that is purely student-directed or parent-directed, allowing homework to be studied as an educational tool at the disposal of teachers. This is a useful way of operationalising the concept of homework but it is not unproblematic. For instance, there may be differences in the level of student autonomy required by different homework assignments (compare a mathematics worksheet to an exploratory research assignment, for example), and for many, one of the primary goals of homework is to promote independent learning (Bempechat, 2010). Indeed, the metaphor of homework as a 'tool' with which a teacher 'works' on students is one that a deep exploration of the concept of homework must critically examine. On a subjective level homework may have radically different meanings for different actors (Coutts, 2004).

Positive and negative effects of homework

Before examining how homework practice varies with student background characteristics it is worthwhile outlining a few of the positive and negative effects homework practices may

entail - a subject of much debate. Evidence of a positive relationship between homework time and achievement is more commonly reported for secondary school students than for primary school students (Cooper, 1989a; Daw, 2012; Hattie, 2013; Horsley & Walker, 2013). It has also been found that this relationship is often not linear, and contingent on a range of contexts including subject domain, demographic variables and learning styles (Daw, 2012; Flunger et al., 2015), and the relationship may also vary significantly across national borders (Dettmers, Trautwein, & Lüdtke, 2009).

Perhaps the most obvious benefit of homework is its potential to increase time on-task. Although the quality of this time and the amount of actual academic learning time (Berliner, 1990) experienced by the student out of the classroom is potentially less responsive to the direct intervention of a teacher, allocated time, at least, is increased.

It is the absence of a proximate teacher that actually accounts for another of homework's purported benefits by providing the space for students to move from proximal to actual developmental stages of learning (Horsley & Walker, 2013; Tharp & Gallimore, 1991). In Tharp and Gallimore's four stage adaptation of Vygotsky's zones of proximal and actual development, homework may provide space not only for the development of specific task capacities, but for human development more generally (1991). In this way homework is potentially beneficial in providing students with the opportunity to develop and practise self-directed and self-regulated learning (Bempechat, 2010; Kitsantas, Cheema, & Ware, 2011; Ramdass & Zimmerman, 2011; Zimmerman & Kitsantas, 2005).

Reported negative effects of homework include satiation (including emotional and physical fatigue), a reduction in time available for leisure and community activities, parental interference, increased opportunities for cheating, and 'increased differences between high and low achievers' (Cooper (1989b, p. 86). It has been reported that achievement benefits for extra time invested in homework are greater for students from higher SES backgrounds (Daw, 2012; Ronning, 2011). Lamkin and Saleh suggest that homework provision:

> *can elevate the Mathew's [sic] effect: Parents from low socioeconomic and educational background can provide little support to their children at home, while parents from high socioeconomic and educational background are more able to provide support to their children at home. This practice can directly contribute to increasing the gap between the poor and rich children* (2010, pp. 452-453).

Conversely, the OECD suggests that a lack of homework undertaken by low performing secondary students is an explanation of the achievement gap: 'Low performers are not

devoting enough time to homework – at least not more than their better performing peers – to close the performance gap' (2016). Confusingly, it appears that homework is both the performance gap's cause and cure.

Homework in Australia

PISA data from 2012 shows that Australian 15 year-old students reported spending around six hours per week on homework compared to the OECD average of around five hours (Figure 1).

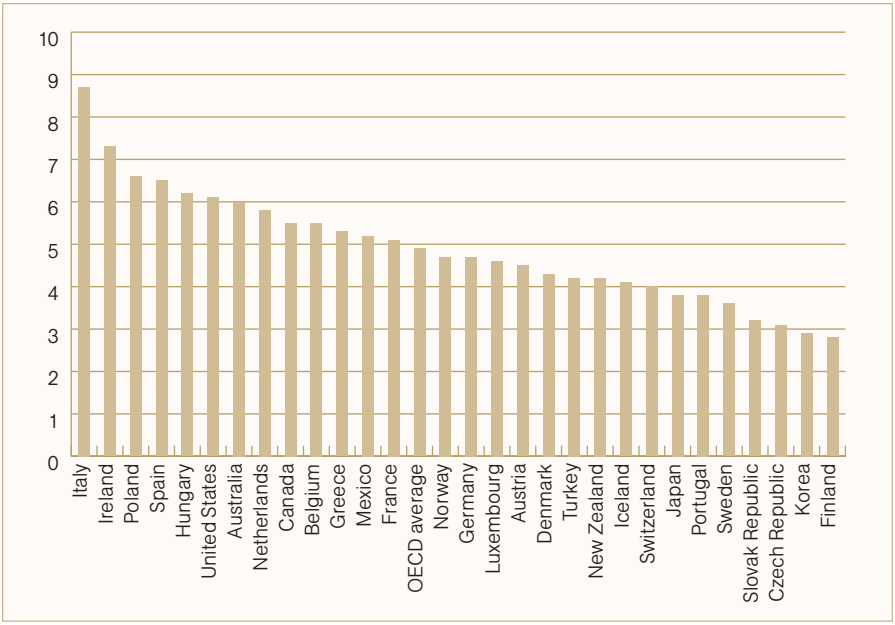

Figure 1. Hours of homework per week – PISA 2012. Source: (OECD, 2014)

The PISA data also shows that although the OECD average of reported weekly homework time reduced by about an hour between 2003 and 2012, homework time in Australia increased by 24 minutes.

Australia also stands out from the bulk of OECD countries in the degree to which the amount of reported homework time varies by SES. The SES measure used in Figure 2 is PISA's index of economic, social and cultural status (ESCS). In Australia, the difference in reported homework time between the top and bottom ESCS quartiles was 2.9 hours compared to the OECD average of just 1.7 hours (Figure 2).

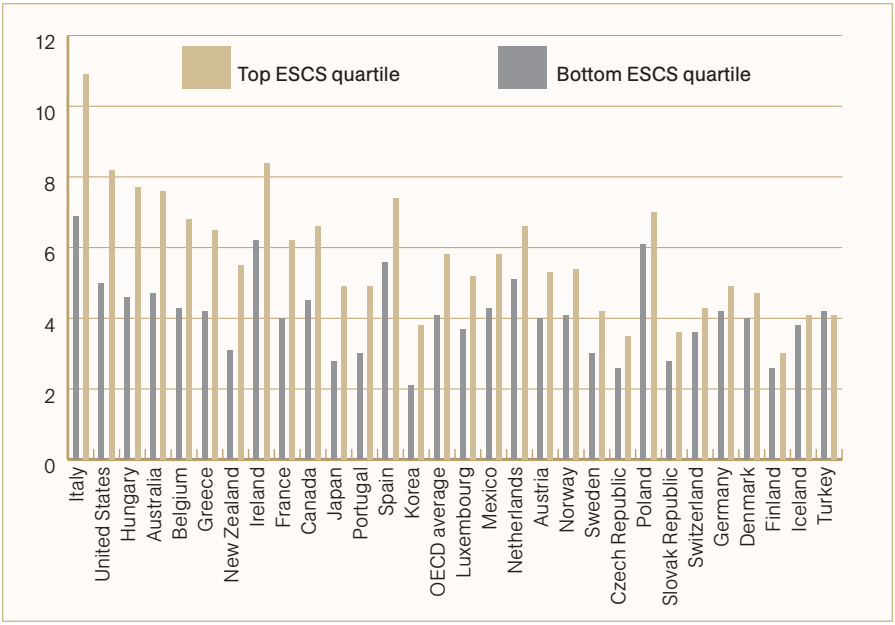

Figure 2. Weekly homework hours, bottom and top ESCS quartiles, PISA 2012. Source: (OECD, 2014)

It would seem that SES is a strong predictor of reported homework time, particularly in Australia. It is of interest here to examine whether other variables generally associated with achievement differences also account for differences in reported homework practices whilst SES is held constant. These variables include school type (government, non-government) and location (metropolitan, non-metropolitan), language background (language other than English spoken at home), previous achievement (previous grade repetition is a proxy here), and gender.

Statistical analysis and results

The 2015 PISA student survey was administered to 14,481 Australian 15-year-old students of which 8,995 provided estimates of how many hours they spent per week on 'Homework or other material assigned by [their] teachers' (OECD, 2013, p. 233). These students were selected randomly from within 769 schools which in turn were selected by stratified sampling methods. We ran two analyses examining the relationship between the student background variables described above and reported weekly homework time. Firstly we ran a mixed-effects binary logistic model to see if the independent variables affected the likelihood of students reporting that they undertook no homework. We found that high SES students were less likely to report undertaking no homework than low SES students. Female students,

students having a language background other than English, students from metropolitan schools, and students from non-government schools were also less likely to report that they spent no time on homework.

Next we ran a mixed-effects maximum likelihood model for students who reported undertaking at least some homework per week. The findings here were similar to those of the first model except grade-repeaters were found to report significantly less homework than students who had not repeated a grade. It is possible that this relationship was not found in the first model due to low cell counts for grade-repeaters and students reporting no homework.

Another measure of homework practice – the extent to which students agreed that they had their 'homework finished in time for mathematics classes'- was also examined against the student background variables described above. We used the same method as the first model to test whether the independent variables affected the likelihood of students agreeing or disagreeing with the statement. High SES students were more likely to agree with the statement than low SES students. Students with language backgrounds other than English and students from non-government schools were also more likely to agree that they had their mathematics homework completed on time. No significant effects were found for gender, school location or grade repetition.

Conclusion

The results obtained here largely support the conclusion that many of the variables associated with greater levels of achievement are also positively related to measures of homework practice. However, the model for reported timeliness of mathematics homework completion found that gender, location and grade repetition had no effect suggesting that this model was measuring a substantively different phenomenon with possible domain effects as reported by Trautwein, Lüdtke, Schnyder, and Niggli (2006).

Taken together, these findings do not prove that variation in homework practices cause variation in achievement; the direction of causality may flow in either direction which is not the case when considering the relationships between demography and achievement or demography and homework practices. Motivational factors may explain differences in reported homework time and may be involved with feedback relationships with both homework and achievement. It may also be the case that the material requirements necessary for homework may vary across demographic variables, as might the amount of time available or required to undertake homework tasks.

In light of these limitations, further research focusing on the relationships between demography, homework, motivation and measures of achievement outcomes (short-term and long-term) is required to provide a more complete picture of why homework practices vary according to student backgrounds. A substantial qualitative examination of how homework is perceived and practised by students from varying backgrounds is also likely to provide a richer source of data that may, at some point, be of practical use to students, teachers, schools and school systems.

This article is a synopsis of a research paper by Justin Bowd, Terry Bowles and Vicki McKenzie presented at the 2016 Australian Association for Research in Education (AARE) conference. The full paper is available at **http://www.aare.edu.au/publications-database.php/11073/an-exploratory-analysis-of-the-personal-school-and-demographic-variables-affecting-the-homework-effo**

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School funding policies and their impact on student achievement

Trevor Cobbold

Introduction

The Federal Minister for Education, Simon Birmingham was quick to pounce on the PISA 2015 results published in early December to put another knife in the Gonski funding plan. He took the opportunity to repeat his highly misleading claim that school funding increases don't improve school outcomes. His oft-repeated claim serves one purpose only – to justify his Government's refusal to fully fund Gonski.

Birmingham dismissed funding as a factor in school outcomes because he says that Federal funding has increased by 50 per cent since 2003 while the PISA results have declined (Belot 2016, Munro & Bagshaw 2016). However, he vastly exaggerated the actual increase in funding which was only very small and largely misdirected to schools least in need of additional funding; he ignored significant improvements in Year 12 outcomes that are in sharp contrast to the PISA results; and ignored several recent academic studies showing that increased funding does improve school outcomes, especially for students from disadvantaged backgrounds.

1. The funding increase was only small and largely went to private schools

Birmingham's claim of a 50 per cent increase in Federal school funding since 2003 is deceptive. It is far from the full picture:

- It is not adjusted for inflation;
- It ignores cuts in state government funding of public schools;
- It does not distinguish between funding increases for public and private schools; and
- It ignores changes in the composition of enrolments.

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The actual increase in total government funding (Commonwealth and state/territory) per student, adjusted for inflation, for the nine years from 2004-05 to 2013-14 was only 4.5 per cent, some eleven times less than the Minister's claim [Chart 1]. This increase amounts to an increase of only 0.5 per cent per year. The increase in dollar terms was a mere $472 per student for the whole period, or a miniscule $52 a year. Not surprisingly, this has had little impact on school outcomes.

State/territory governments, which account for over 80 per cent of public school funding, have cut funding of public schools while increasing funding of private schools. State/territory governments have taken the opportunity of an increase in Commonwealth Government funding for public schools of $744 per student to cut their own funding of public schools by $348 per student. In effect, they cut the Commonwealth increase by nearly half. In contrast, they increased private school funding by $135 per student to supplement the Commonwealth increase of $700 per student.

The picture is even worse because the large part of the small increase in total funding per student favoured private schools who enrol only a small proportion of disadvantaged students. Total government funding per student in private schools increased by three times more than for public schools - 9.8 per cent compared to only 3.3 per cent. In dollar terms, funding for private schools increased by $835 per student compared to $385 per public school student. That is, the most disadvantaged school sector got an increase of $43 per student per year compared to $93 per student per year for private schools.

The PISA results show that low achievement is concentrated amongst low SES, Indigenous and remote area students. The large majority of these disadvantaged students attend public schools. In 2014, 82 per cent of students from low SES families, 84 per cent of Indigenous students, 79 per cent of remote area students and 87 per cent of very remote area students were enrolled in public schools. Despite higher need in public schools, the biggest increases in funding went to private schools.

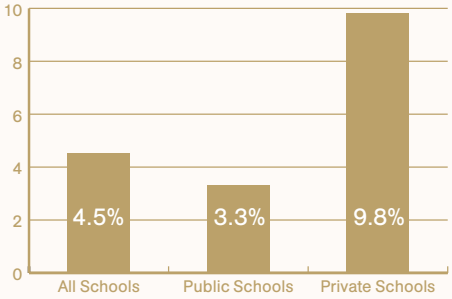


Chart 1: Percentage Increase in Government Funding of Public and Private Schools, 2004-05 to 2013-14 (per student, adjusted for inflation)

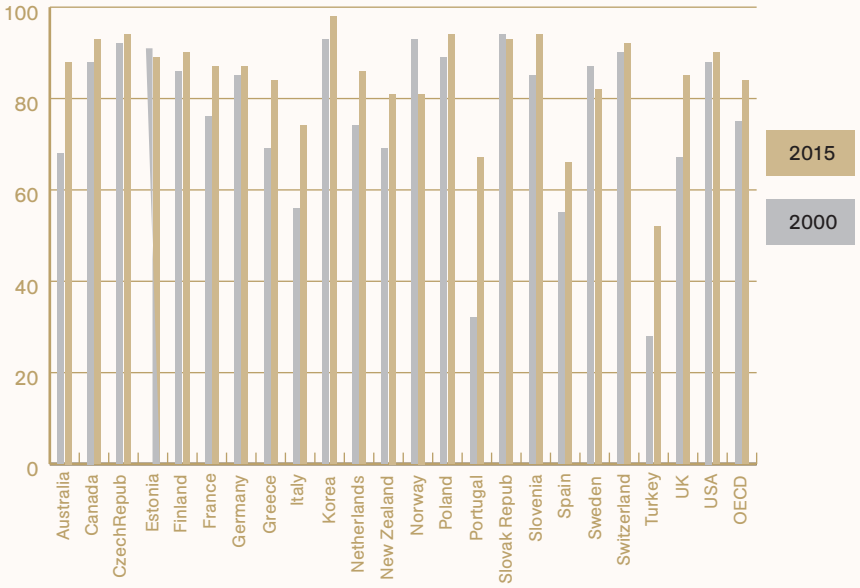
Source: Cobbold 2016.

Birmingham's claims also ignored changes in the composition of enrolments. Indigenous students, disability students and senior secondary school students attract significantly higher funding per student than average and have increased as a proportion of all students. They increased by three percentage points from 23 to 26 per cent between 2003 and 2014. The increase in public schools was 3.4 per cent compared to 2.2 per cent in private schools.[1] The increase in the percentage of these students in public schools could well have accounted for the increase in funding per student in public schools.

2. Improvement in Year 12 outcomes contrasts with the PISA decline

While the declining PISA results are a major concern, Birmingham's criticism of the lack of responsiveness of student outcomes to increased funding ignores some significant improvements in school outcomes over the period of the small funding increase. For example, there were significant improvements in Year 12 outcomes which are in sharp contrast with the declining PISA results.

Chart 2: Attainment of Upper Secondary Education, Selected OECD Countries, 2000-2015 (% of 25-34 Year Olds)



Source: OECD 2016a, Table A1.3; 2015, Table A1.4a.

There was a large increase in the proportion of young adults (20-24 year-olds) attaining a Year 12 or equivalent outcomes since 2001. In 2016, 90 per cent of young people attained Year 12 or Certificate II, up from 79 per cent in 2001, while 89 per cent attained Year 12 or Certificate III compared to 77 per cent in 2001 [ABS 2016b, Tables 31 & 32; ABS 2011].[2]

It is also notable that the proportion of 25-34 year-olds in Australia who have attained an upper secondary education increased from only 68 per cent in 2000, when it was the 5th lowest in the OECD, to 88 per cent in 2015 [Chart 2]. The increase of 20 percentage points was the largest in the OECD except for Portugal and Turkey.

The apparent retention rate to Year 12 and the Year 12 completion rate are additional ways to measure the outcomes of school education. The average retention rate from Year 7/8 to Year 12 increased from 72 per cent in 2000 to 84 per cent in 2015 [Chart 3]. The retention rate in public schools increased by 15 percentage points from 67 per cent to 82 per cent and increased for Catholic schools from 77 to 84 per cent. In Independent schools, it fell from 97 to 92 per cent. Indigenous retention rates increased from 36 to 59 per cent.

Year 12 completion rates have also increased. The rate for all students increased from 69 per cent in 2003 to 72 per cent in 2014. The completion rate for low SES students increased from 64 to 67 per cent, but fell for high SES students from 78 to 76 per cent [Productivity Commission 2005, Table 3A.40; Productivity Commission 2016a, Table 4A.124]. Despite this improvement, a large proportion of students still do not complete Year 12.

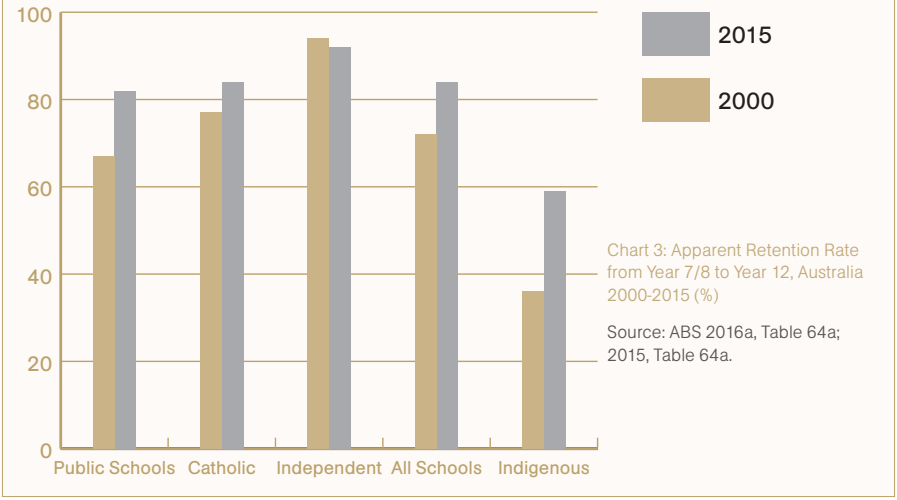


Chart 3: Apparent Retention Rate from Year 7/8 to Year 12, Australia 2000-2015 (%)

Source: ABS 2016a, Table 64a; 2015, Table 64a.

The percentage of the estimated year 12 population achieving an ATAR score of 50 or above has increased significantly in recent years from 38 per cent in 2007 to 42 per cent in 2015 [Chart 4, earlier figures are not available]. The percentage increased in all states/territories except Queensland, with a large increase in the ACT and significant increases in NSW and South Australia.

The contrast between the declining PISA results for 15 year-old students (largely Year 10 students) and the improvement in Year 12 results is a puzzle that warrants further analysis. It may partly reflect a difference in student attitudes to the PISA tests, which have no personal consequences attached to them, and the Year 12 assessments which have a major influence on the future paths that students take after leaving school.

The one thing in common between the PISA results and Year 12 outcomes is huge achievement gaps between disadvantaged and advantaged students. The PISA results show that disadvantaged 15 year-old students are three to four years of learning behind advantaged students. Year 12 retention and completion rates for disadvantaged students are well below those of advantaged students.

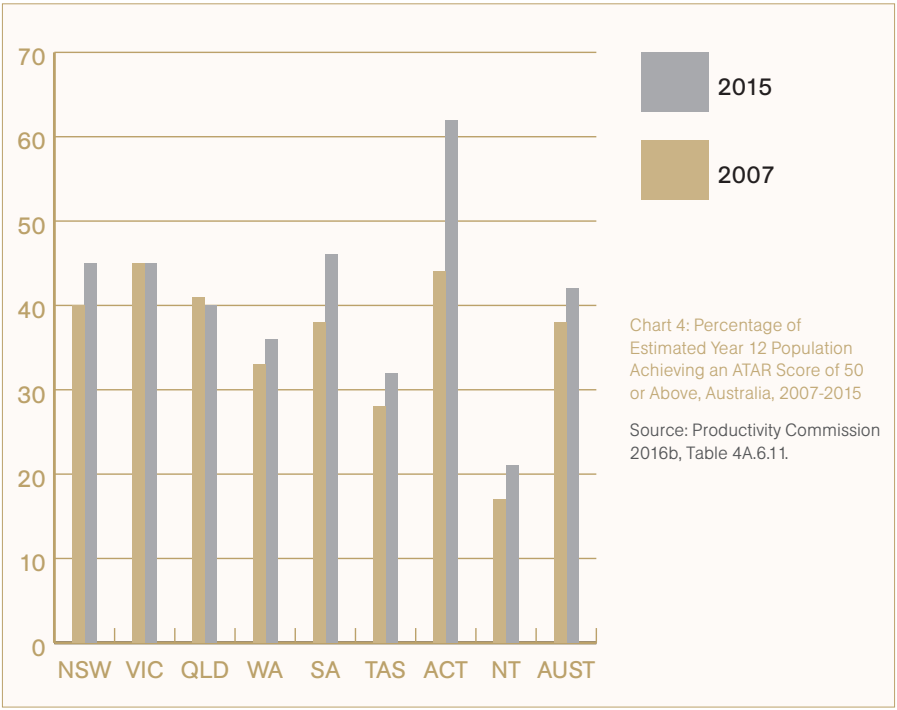


Chart 4: Percentage of Estimated Year 12 Population Achieving an ATAR Score of 50 or Above, Australia, 2007-2015

Source: Productivity Commission 2016b, Table 4A.6.11.

3. Many studies show that increased funding improves school results

Improving the results of disadvantaged students is the major challenge facing Australian education.

Yet, Birmingham continues to wilfully ignore the extensive research evidence demonstrating that increasing funding for disadvantaged students is critical to improving outcomes. Five major studies published in the last year alone show that increased funding improves results, especially for disadvantaged students.[3] For example, an extensive review of studies by an academic expert on education finance at Rutgers University in New Jersey shows strong evidence of a positive relationship between school funding and student achievement and that particular school resources that cost money have a positive influence on student results [Baker 2016]. It concludes:

> *The growing political consensus that money doesn't matter stands in sharp contrast to the substantial body of empirical research that has accumulated over time... [p. 2]*
>
> *The available evidence leaves little doubt: Sufficient financial resources are a necessary underlying condition for providing quality education.* [p. 20]

A study published in the *Quarterly Journal of Economics* found that a ten per cent increase in per-student spending each year for all 12 years of public school for low income students extends their schooling by nearly half a year, increases their adult earnings by nearly ten per cent and family income by 16 per cent, and reduces their annual incidence of adult poverty by six percentage points [Jackson et.al. 2016]. The study found that the positive effects are driven, at least in part, by some combination of reductions in class size, having more adults per student in schools, increases in instructional time, and increases in teacher salary that may have helped attract and retain a more highly qualified teaching workforce. The authors concluded that their results:

> *.... highlight how improved access to school resources can profoundly shape the life outcomes of economically disadvantaged children, and thereby significantly reduce the intergenerational transmission of poverty.* [p. 212]

A study published by the US National Bureau of Economic Research found that school finance reforms in the United States that increased funding for low income school districts improved the results of students in those districts [Lafortune et. al. 2016]. It also found that the increased funding reduced achievement gaps between high and low income school

districts. The authors concluded that "marginal increases in school resources in low-income, poorly resourced school districts are cost effective from a social perspective..." [p. 7]. Further, "Our results thus show that money can and does matter in education..." [p. 35]

Another study found that increased spending following court-ordered school finance reforms in the United States increased high school graduation rates in high-poverty districts [Candelaria & Shores 2016]. High poverty school districts in states that had their finance regimes overthrown by court order experienced an increase in school spending by four to 12 per cent and an increase in high school graduation rates by five to eight percentage points seven years following reform.

In addition, a study soon to published in the academic journal, *Economic Policy*, on the long-run effects of school spending on educational attainment following school finance reform in Michigan found that increases in school expenditure improve the later life outcomes of students [Hyman 2017]. Students who gained a ten per cent increase in school funding were seven per cent more likely to enrol in college and eleven per cent more likely to receive a post-secondary degree.

An OECD report on how to improve results for low performing students found that the incidence of low performance in mathematics is lower in countries where educational resources are distributed more equitably between socio-economically disadvantaged and advantaged schools. It concluded:

> *The evidence presented in this report suggests that all countries and economies can reduce their share of low-performing students, and that a reduction can be accomplished in a relatively short time. The first step for policy makers is to prioritise tackling low performance in their education policy agendas, and translate this priority into additional resources.* [OECD 2016b, p.190]

The OECD has also highlighted a key message from PISA 2015:

> *In countries and economies where more resources are allocated to disadvantaged schools than advantaged schools, overall student performance in science is somewhat higher...* [OECD 2016c, p. 189]

These studies show that targeting funding increases to disadvantaged schools and students is fundamental to improving student achievement and reducing achievement gaps between the advantaged and disadvantaged. Inadequate funding is likely to be a factor behind the

failure to improve the results of disadvantaged students and reduce the large achievement gaps between them and high SES students. Past funding increases have been very small and were not directed primarily to disadvantaged students. Needs-based funding in Australia, especially for low SES students, has only ever been a very small proportion of total school funding as demonstrated by a research report prepared for the Gonski review [Rorris et.al. 2011]. As David Gonski said in response to criticism of his plan that increased funding has failed to improve outcomes:

> *...the essence of what we contended, and still do, was that the way monies are applied is the important driver. Increasing money where it counts is vital. The monies distributed over the 12-year period to which the commission refers were not applied on a needs based aspirational system.* [Gonski 2014]

If there is any credibility to Birmingham's criticism of past funding increases failing to improve results, it is in relation to private schools. As shown above, funding per private school student, adjusted for inflation, increased by ten per cent between 2004-05 and 2013-14 but student performance fell in both Catholic and Independent schools. It suggests that private schools did not use their larger funding increases efficiently.

Federal and state education ministers are due to meet in coming months to decide future school funding arrangements. State education ministers should not be misled by Birmingham's false claims about school funding and outcomes. All the evidence shows that increased funding for disadvantaged students is critical to improving school outcomes.

The national education ministers' council should support the full implementation of the Gonski plan. It should resist the Federal Government's proposal to cut education funding further by reducing funding indexation rates.

This article was first published as a Policy Brief – "Birmingham is Wrong Again on School Funding and Outcomes" (Jan. 2017) – written by Trevor Cobbold and published by Save Our Schools.

Notes

1 These figures are derived from ABS 2016a, Tables 43a, 46a; Productivity Commission 2005, Tables 3A.17, 3A.18; Productivity Commission 2016a, Table 4A.31.

2 The Council of Australian Governments has designated Certificate II as the vocational equivalent to Year 12, but this will change to Certificate III by 2020. See COAG 2009.

3 Many studies prior to these have come to the same conclusion. See Cobbold 2014.

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Interview: Barbara Arrowsmith-Young

The Arrowsmith Program: neuroplasticity in the classroom

Rachel Power

As a child, Barbara Arrowsmith-Young read and wrote backward, struggled to understand basic concepts, continually got lost, and was physically uncoordinated. Her long struggle to address her own severe learning difficulties led her to recognise the benefits of exercising the brain. This became the basis for the Arrowsmith Program, her approach to helping students overcome specific learning difficulties, which has been operating in Canadian schools for more than 35 years and increasingly taken up around the world. A revised edition of Arrowsmith-Young's bestselling memoir, *The Woman Who Changed Her Brain*, was released in early 2017.

RP *Considering the extent of your own learning difficulties as a child, which were profound, it's extraordinary that you had the tenacity to overcome them. What was it about you that gave you that determination?*

BA-Y I think it was the unique combination of my cognitive strengths and weaknesses. I had an exceptional pre-frontal cortex, which controls executive functioning – thinking, problem-solving, planning. That critical part that drives for a solution was in really good shape. So I was incredibly driven; I just couldn't make sense of most of my experiences and my world. Whereas somebody who possibly had the same problems I had, but didn't have really strong problem-solving capacity, might just have given up.

Very early on, I tried to come up with solutions or compensations for my difficulties and, for me, it was relying on my memory, which was pretty exceptional. I had a whole ritual, where I would line all my books up on my bed when I was studying, I would kneel down in front of my bed and basically cry until there was nothing left in

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my system. I think actually I was draining my amygdala of all that fear and anxiety, till I was just empty, almost in a Zen state. But, as an 11 or 12-year-old, I had no idea that that's what I was doing. And then I would start this memory process – I would look at my book, I would read the first sentence, say it to myself, close my eyes, visualise it; then I'd read the next sentence, do the same process, then match it to the first sentence… and I'd just keep going until I could close my eyes and go through all of my notebooks.

Then, when it came to an exam, I'd go through that library in my head and try to match the question to an answer. Sometimes I'd do a really good job, and sometimes not such a good job, it would depend on the match I made, because I didn't really understand the question, and I was always hypothesising, always thinking maybe this is what it means but never being certain.

Secondly, I think it was my parents. My mother was an educator, and passionate about education, so that got instilled in me very early. When I was identified in Grade 1 as having "a mental block", she just decided, "Well, my daughter's going to learn how to read and write, and learn numbers", so she started using flashcards and teaching me those skills, which didn't address the learning difficulty, but gave me the skills to read and write, and some basic numeracy.

My father was a physicist and mathematician, who became an engineer, and was always very creative – he had 30 or 40 patents over the course of his career. He would come home with all his blueprints and designs and lay them out on the living room floor and try to explain them to me. I had no idea what he was trying to explain, but I caught his excitement about creating something. Also, he had this belief, which he instilled in all of us, that if you had a problem and no solution, you go out and find one. He said, "Don't be limited by conventional wisdom. If the rest of the world tells you that you can't do it, don't let it stop you, this is part of the process in creating something that didn't exist before."

So my cognitive strengths and having those two models – that, I think, is what drove me.

RP *Later, at university, you came across two very important pieces of research that transformed your approach to your own situation.*

BA-Y Very early on, I was hunting for a solution to my difficulties – initially compensation, and using strengths to support the weaknesses. Then, in graduate school, coming

across [neuropsychologist Aleksander] Luria's work out of Russia, looking at the impairment of brain function, and really starting to see: "Oh my gosh, that's what my problem is, it's parts of my brain that aren't working as they're designed to" – because if you're solving a problem, you have to understand its nature.

And then, this concept of neuroplasticity with [American research psychologist Mark] Rosenzweig's work looking at rats – and figuring that if rats, through experience, can actually improve brain physiology and function, which led to better learning, probably humans had that same capacity, even though people weren't really looking at it at that time.

That was my breakthrough – that hunt, and then coming across those two pieces of information – which led me to create the first cognitive exercise, which was "symbol relations" [then a series of 100 handmade flashcards featuring analogue clocks]. It wasn't that I wanted to tell time; I couldn't at that point. But it was trying to find an activity that would work that part of the brain as much as possible without the supports and compensations that people use.

Luria talked about the fact that someone with that particular difficulty couldn't tell time because they couldn't see the relationship between the hour hand and the minute hand, and I thought maybe this was a way to force my brain to start seeing relationships, making connections. Again, I had no idea if it would work, but I thought I had to try something, because I was pretty desperate. I was in graduate school at that point and I just truly didn't see a future. At that point I was thinking, for the second time in my life, that I was going to end my life, and this time I knew how to do it, more than I could at 13.

RP *I suppose that you were always going to hit a point where those compensatory methods weren't going to work for you anymore.*

BA-Y Well, there just aren't enough hours in the day! By the time I got into graduate school, where clearly you're expected to *understand* information, I was working seven days a week, 20 hours a day, just to tread water. There was no future. I compromised my immune system – I have an immune disorder even now, due to all that adrenaline and all that stress. Then I'd get pneumonia, and I'd just work through…

RP *So, it all started with Luria's discovery with the rats in 1977, which destabilised that common wisdom that the brain is fixed. Then, 40 years later, brain plasticity is*

discovered, and suddenly all that work that you've done is in the spotlight. The timing is quite extraordinary.

BA-Y Again, I do thank my father, because it was his message of not being limited by conventional wisdom [that drove me]. Certainly, when I first developed this work, I thought the world would be excited. When I had my first breakthrough, at the four-hand level [of the clock exercise], I was ecstatic! I could sit and watch *60 Minutes* on TV and I could understand it as the people were talking. Before, I used to have a friend who would interpret for me, and even with his interpretation I didn't always get it. I would read a page in a book – not something simple like *Nancy Drew*, but anything conceptual – and I might have to read it 20 times before I thought I knew what it was saying.

You live in this constant state of uncertainty, and Luria was the first person I read who described it so beautifully: he said you can never verify meaning, so you're walking in this cloud of the unknowing all the time, and just feel incredibly threatened because you don't understand. I was always terrified that one of my professors would get on the elevator with me and ask me a question. I'd think: "I'm not going to understand what he's saying and I don't have time to play it over for the next hour in my head before I answer him."

It was like all of a sudden the fog was gone and I could listen to conversations and understand what the person was asking me and be part of the conversation. Before – it was so profound – I was not part of human discourse; I was not a part of human relations, because I couldn't follow things. I used to feel like my face was pressed up against a plate glass window and there was this banquet on the other side, which I wanted so much to be part of. It was incredibly isolating, and then all of a sudden I could do it. I was walking on air!

But the world was not at all excited, because it was still in the paradigm of seeing the brain as fixed; back then, in 1977–78 (and I like the term in Australia 'specific learning difficulties' versus 'disability'), there was the belief that these difficulties didn't have anything to do with the brain. I don't know where they thought learning resided. The idea that the issue was cognitive – there's something not working properly in the brain, and then that we can change the brain – those were two very controversial statements at the time.

So I decided I had two possible paths. One was to spend a lot of time arguing the point; or to spend time working with people developing more and more programs.

And I felt that if there was validity and truth to what I was seeing, over time the field would come to that recognition or understanding, which is what's happened.

RP *And yet you still face the argument that your work is not scientifically proven.*

BA-Y What is scientific proof? There are different levels of proof. We have a number of very reputable outcome studies – from University of Calgary, University of Toronto, the Toronto Catholic District School Board – some looking at academic measures, some looking at cognitive measures, showing significant change. Now are they randomised control studies? No. But most social science does not use randomised control studies; it's too hard to split classes into those kids who can and those kids who can't participate – we don't want to run it like that.

There are lots of other experimental designs, one called an N1, where you take, say, 40 Grade 5 students, all with learning difficulties, and you have them as their own baseline, based on their progression since Grade 2. Then you have an intervention, and if they've improved by two year levels, whereas before they were achieving at half a level per year, you can infer that it's probably the outcome of that intervention.

So we have a number of research designs used in social sciences. The piece that we didn't have, which we're getting now, is the imaging work, and that's what is being done at Southern Illinois University. We're seeing now the changes in the brain that I've postulated all these years; we're seeing the pre-frontal cortex activated in the brain in students where it wasn't active; we're seeing reorganisation in their brain structures; and we're looking at cognitive and academic changes as well.

In the study that's being done at the University of British Columbia, we have students in the Arrowsmith program; we have a group of normally developing individuals – because we know that in normal development the brain changes through childhood, so we want to control for that; and then we have a group of students who are in traditional special education programs. What we're working on now is to increase those sample sizes. And we're seeing really positive change, both cognitive and academic, and in neurophysiology. So it will be there in the next year. It takes time to get all this research done and then it's a process to get publication.

RP *Do you still confront the attitude that the brain is fixed?*

BA-Y I think it'd be very hard to find anyone who still believes in that pre-neuroplastic paradigm where the brain is fixed. But there are those who still say: "Yes,

neuroplasticity is a phenomenon, but it has no place in education." Those individuals – I don't know whether they're ever going to be convinced by the research. Then there are those who will want this [scientific] research in order to feel more comfortable about implementing the program. And then there are schools around the world that say: "We're dealing with students whose needs we're not meeting through traditional programs, so we going to try this."

When a school signs on with us, it's just a one-year commitment; I'm never going to lock anybody in beyond that. But I don't think there's been one school that hasn't continued beyond a year, because parents, teachers and students see the results. So I think over time there'll be a groundswell, where we'll have enough on-the-ground evidence. I like research – I think it's useful and important – but, to me, it's much more important to see what these individuals can do in the world that they couldn't do before.

For me, it was [a case of] one day I couldn't do this, and then one day, getting to a critical point in the exercise, I could. Before, with all the compensation in the world, it didn't matter how hard I tried, I could not listen or read and understand simultaneously.

RP *The implications are enormous, particularly for early intervention, and I imagine it could seem like a big leap for many education systems, which can be very constrained for various reasons, including a lack of resources.*

BA-Y The vision that I ended my book with is one where every child starting in Grade 1 would do a cognitive program, and we have two schools that are doing that now – one taking the Grade 1 class and one taking the Grade 2 class. For Grade 1, we've picked the exercises related to Motor Planning; every child can benefit from that, not just students who've been identified as having difficulties. And what they're already seeing is that after ten weeks [of the program] not one of the students identified as needing Reading Recovery still needs it.

There are a number of different models. One is you take a cognitive exercise per year and progressively work through the critical ones in those early years. Or a school can have a full-service model, where those students who get to the end of the first year and clearly need more, could filter in and out of a cognitive classroom for any number of activities. It's very fluid, and that's why it's a real vision of personalised education. Everyone can benefit from cognitive stimulation, and the

ones who are more at risk can have access to a more intensive program. It's based on their needs.

RP *So what do you see as the main barriers to schools picking up the program?*

BA-Y I think lack of awareness. There's still a lack of understanding about neuroplasticity and a lack of awareness that brain functioning is a problem. And there's still this divide. Most of education is still content and skills-based: the idea that education is pouring content into a black box. A lot of educators are committed to supporting the learner in learning *how* to learn, but they have a mandate whereby they've got to teach a lot of basic content throughout the school years. And then there's the capacity-based model, which is saying that we can change the *capacity*, which will allow the student to learn the skills and the content not only more efficiently, but it will also be retained, as the structure will be there to retain it and build on it.

The University of British Columbia is looking at creating a Department of Education Neuroplasticity, which I'm really excited about, and that has partly grown out of the work that we're doing on my program there. It will be the first in Canada, bringing all of this knowledge into education so that students can benefit from this. I'm very optimistic; I think that in the next 10 or 15 years we'll see this much more accepted: that you go to school to learn, and that we learn with our brains, so if we can do things to enhance cognitive functioning, that's going to make us better lifelong learners.

RP *As you say, there are those standard subjects, such as Maths, which require cognitive development but also impart the building blocks of knowledge. Given that Arrowsmith students are working outside the curriculum, or parts of it, while doing the program, what would you say to those with concerns about students potentially missing out on those building blocks?*

BA-Y When Arrowsmith is implemented in a school, we request four periods a day, so there's another half day that students can be undertaking academic subjects, and we will recommend literacy and numeracy for the reasons you're suggesting, because there are critical experiences and building blocks that are necessary, and what we see are the cognitive functions start to improve, so they start to be able to benefit from that learning.

But we know that once a child can think, reason, problem-solve, retain information and express themselves, they can pick up subjects like History and Geography in

Grades 3, 4, 5 or 6, whereas before they could have sat in those classes not being able to comprehend what they were meant to be learning. We learn the content more efficiently and effectively, and retain it, when we have the capacity to do so. They go hand in hand.

That's what we have to foster out there in the world: that understanding that we *can* change capacity, which then will allow content to be learned, but also all the effective ways of *how* to learn. We know that many graduates can move between quite different disciplines because they've got the capacity and wherewithal to pick up the content. I think some of the criticisms that get levelled at this work are by people who aren't informed: they just want to put up a barrier.

RP *And of course students who are struggling in class are not only failing to learn, they are also likely to be having a very negative experience of schooling.*

BA-Y That's right. Learning becomes negative and aversive, and students get into all sorts of behaviours we wish they wouldn't, from avoidance to self-harm to addiction. We're currently putting the Arrowsmith program into an American school for troubled youth, because we know a number of these individuals go down that path because of learning difficulties.

If you can't reason, you can't see cause and effect, and you can't benefit from therapy. I could have been in therapy for years and my eyes would have glazed over, because I just couldn't see the consequences of my behaviour. So it's not just critical for education, it's critical for learning in life, and being able to benefit from insight. Our brains are fundamental to the core of our beings; it's what mediates our relationship to the world. When something's not working there, it means our relationship to the world is distorted.

When I started this work, the belief that was promoted by organisations dealing with people with learning disabilities, as we define it here, was that we have to accept that "some people are squirrels, some people are rabbits, some people are ducks… and you're not going to be able to make that rabbit swim". That's essentially what I was told in Grade 1: "You've got a mental block; just accept that there are certain things that are going to be impossible for you."

What makes me really sad is that when I go out there and give talks, there are still pockets of people operating with that world view. It's not that I'm suggesting that you don't accept that beautiful being and love your child as they are – however, it's

recognised that we can change those capacities, so that they *can* swim or fly or run or hop, and then the world is open to them and there are all these possibilities.

Many of the adults I work with say their curve was chosen for them, because they got to a certain point when almost every door was closing. This work opens so many doors and possibilities for them – and maybe they will still decide: "Actually, I do want to go through that door", but then it's a real choice; it's not a forced choice. I think that's the power of this work: it allows people a different trajectory for their life.

RP *Teachers always say that their most heartbreaking experiences are not being able to help a child they know could be helped, if they only had the time and resources; and their most satisfying moments are when they see a child finally 'get' something. So how do teachers describe their experience of implementing the Arrowsmith program?*

BA-Y Most teachers get into education because they want to make a difference, and it's not very rewarding if they keep hitting roadblocks. One teacher told me that before, when her students with special needs left Grade 8, she wasn't thinking, "Are they going to pass their Maths exam?", she was thinking, "How are they going to find their locker?" But after doing this work, she didn't have to worry anymore; she could watch them go out the door knowing they were going to be successful. So it's really satisfying for teachers, because this is what they got into education to do.

RP *Has developing and running your program given you insights into the role of equity in education?*

BA-Y If we talk about equity, this program needs to be in the public system, because these are the kids who really get marginalised. If they can't access private tuition, they are doubly disadvantaged. I'm thrilled that it's in independent and Catholic schools, because people make that choice as well, but the program needs to be accessible, so that anyone who needs it doesn't get turned away.

That's my vision: that every child walking into school, irrespective of where it is, has access to a cognitive program to address any problems. Whether it's my program or another quality program, they need access to this kind of work to allow them to be productive, engaged members of society who are contributing down the road.

Several of the students in the schools where we run the program here in Toronto, their parents would never be able to afford private tuition. My commitment – and I'm

working as hard as I can – is to get this into more publically funded systems, and I believe all it takes is an administration with vision. The funds are out there, and how costly is it if we don't do this!

In our society, we're very short-sighted. A brilliant study done here in Canada looking at the cost – physical, emotional but also economic – to society [found it costs on average] half a million dollars per individual with learning difficulties, in terms of additional supports, some of it worn by society, some of it worn by families. Another recent study showed that people with learning difficulties are twice as likely to be unemployed or marginally employed; a significant number of them end up in the prison system; and they suffer triple the rate of mental health disorders, so they're in that system, too.

A small intervention, perhaps only for the first four or five years of a person's schooling, and we're not going to have that societal cost. In one of the follow-up studies we did with the Toronto Catholic Schools Board, in 2007, we found the reduction of welfare services and resource support for students was dramatic, because most didn't need it any longer. So, even within the education system, there's a saving, but these people also go on to contribute to society.

RP *You're working on a revised edition of your memoir. Can you tell us about that?*

BA-Y It's going to be an update for the past four years. The book was published in 2012. It'll talk about the research that's happening and some of the preliminary results. It'll talk about one of the things I've become really passionate about, which is looking at behaviour through a cognitive lens. We look at somebody's behaviour and think: "Oh my gosh, that person really is obstreperous or obnoxious or difficult or rude", and possibly they are – but sometimes it's a cognitive problem that's affected the way they experience the world, and if we at least step back and look at that, maybe we'll have more compassion for that individual and their experience. Maybe that individual will have more compassion for themselves, too. And then there's the possibility that something can be done.

Also, I talked about my vision, and now we have two schools here starting what I call the 'whole-cohort model', so a whole class working on a cognitive exercise. We look at the demands of each grade, in terms of what the learner needs to learn, and pick the exercise that would most suit that class. So I'll be talking a bit about that and some of the results those two schools are seeing.

We're also in discussion with the University of Madrid, where they are looking at introducing the 'Symbol Relations' exercises. Imagine – if we could create a laboratory at the university that the students could filter in and out of throughout the day, in between their classes. Over a year they only need four hours per week. That would be really exciting.

Professional Voice

Back issues

The following back issues are still available, free to AEU members. Contact Marlene McLean marlene.mclean@aeuvic.asn.au indicating the volume, number, and title of the edition and your postal address.

Others can order copies for $10 each by contacting Marlene McLean marlene.mclean@aeuvic.asn.au indicating the volume, number, and title of the edition and your postal address. These and other issues can be found online at www.aeuvic.asn.au/pv.

PV 11.2: Teaching in context

This edition is about the conditions and context of teaching. The authors challenge some of the current "truths" about education such as the need for greater school autonomy and choice, the unimportance of class size, the unalloyed benefits for teachers of the new digital environment, the negligible need for mainstream gender diversity education and the quality of private schooling.

PV 11.1: School choice

The theme of the Autumn 2016 edition of Professional Voice is school choice. There are four articles directly related to the theme. Two of them describe and analyse research studies of school choice in Melbourne. The other two have an international flavour and investigate charter schools in America and academies in the UK.

PV 10.3: Teaching "teaching"

This edition's focus is initial teacher education. Three authors comment on the national (TEMAG) report into teacher education and give their views about how to improve the quality of pre-service education. There is also new evidence about the decline in equity in Australian schools and an article about diagnosing and accommodating in schools the increasingly common Autism Spectrum Disorder.

PV 10.2 Public, Private and Edu-business

This edition looks at the relationship between the public and private education sectors and busts the myth that education offered in private schools is superior to that offered in public schools. We also examine the alarming rise of edu-business in Australia.

PV 10.1: Testing Times

From NAPLAN to PISA, tests have become a defining feature of global education systems. But how much do testing regimes really tell us about education systems and how much do they distort the very thing they report on?

PV 9.3: Global Education Reform Movement

With an editorial overview of the GERM agenda, stories include a look at NAPLAN and assessment, collaborative teaching, class sizes and the models of reform being pursued in America and the UK.

PV 9.2: School Improvement

This edition of Professional Voice moves away from the thematic approach we have used in the past and instead highlights quality writing that questions taken-for-granted ideas surrounding contemporary educational discourse.

PV 9.1: Equity and Disadvantage

The autumn 2012 edition takes a broad look at equity issues. Alan Reid argues that governments have fallen in love with quick fixes and easy answers. Alan Smithers notes that choice and standards policies in England failed to increase equity because they were not part of a well-designed system. Tony Vinson says that investment in early years is not only the best investment we can make in society, it is a moral imperative.

What works (and what doesn't)