Communities Making a Difference
National Partnerships

SA Teaching for Effective Learning Pedagogy Research Project 2010–2013
FINAL REPORT

Australian Government

NATIONAL SMARTER SCHOOLS PARTNERSHIPS

Government of South Australia
Department for Education and Child Development

For the first time, a state education system had declared a holistic policy position on curriculum, quality teaching and learning, and assessment and reporting.

Acknowledgements

This report brings together research conducted by the South Australian Department for Education and Child Development, Teaching and Learning Services between 2000 and 2013.

It specifically reports on the research conducted for the *Communities Making a Difference National Partnerships: South Australian Teaching for Effective Learning Pedagogy Research Project 2010–2013*.

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Executive summary

In December 2013, a significant education policy[1] was released in South Australia. For the first time, a state education system had declared a holistic policy position on curriculum, quality teaching and learning, and assessment and reporting. This was an outcome long in the making and one responsive to the SA context.

Context

There is a recognised need in South Australia to improve student outcomes, both in terms of academic outcomes and learners' lifelong learning capability. The demands of the 21st century require learners to be equipped with the knowledge, skills, understandings and abilities to meet the challenges of a rapidly changing world. For educators, this means developing students as effective lifelong learners, who recognise their own metacognitive capacity, who have a positive disposition to and an interest in their learning, and who are equipped to engage in deeper learning with persistence and resilience.

However, from two measures of academic achievement, the National Assessment Program—Literacy and Numeracy (NAPLAN) and the Programme for International Student Assessment (PISA) tests, we see that our students in general hit a 'glass ceiling' compared to their peers in other Australian states and territories and underperform in the higher proficiency bands. We also see that in mathematics, South Australian students have the lowest disposition to learn mathematics and the lowest self-efficacy or self-confidence to transfer and apply their mathematical knowledge to real world contexts—the very skills required by 21st century learners.

In the last decade there have been rapid advances in understanding neuroplasticity, including the recognition that intelligence is not fixed at birth. Intelligence can be altered by experience and adopting a 'growth mindset', applying effort and learning to learn.[2] This ground breaking international research alters the teaching-learning contract: it means that teachers, instead of simply focusing on curriculum delivery and coverage, must embrace a pedagogical approach that unlocks in students the capacity to recognise and embrace that it is effort, persistence and employment of their own thinking that lead to deeper engagement, academic achievement and lifelong learning capacity.

The South Australian research reported in this publication demonstrates that whilst there is much excellent practice to build on, significant pedagogical change is required. Our teachers need to learn new ways of teaching to achieve these outcomes across the system.

South Australian research

For over 15 years to this end, South Australia has engaged in research into understanding a new science of learning and how this informs teaching to enhance both academic achievement and capacity as lifelong learners.

A key piece of this has been the research into pedagogy by the South Australian Department for Education and Child Development (SA DECD): Communities Making a Difference National Partnerships: SA Teaching for Effective Learning Pedagogy Research Project 2010–2013 (SA TfEL Pedagogy Research Project). This report presents a summary of the research and findings from teachers and students on the impact of elements of pedagogy on learner engagement, achievement and the development of lifelong learning capability.

Stage 1 of the research project was conducted over three years in low SES primary schools 2010–2012. Stage 2 was conducted in 2013 across a representative sample of all SA DECD schools to investigate the generalisability of the findings from Stage 1 across the state.

[1] Department for Education and Child Development (2013) *Curriculum, Pedagogy, Assessment and Reporting Policy for Reception–Year 10*, http://www.decd.sa.gov.au/teachingandlearning/files/pages/Policy/DECD_Curriculum_Pedagogy__1.pdf (accessed 17 June 2014)

[2] For example, Dweck C (2006) *Mindset: The New Psychology of Success*, Ballantine Books, New York; Langer E (1989) *Mindfulness*, Perseus Books; Blackwell LS, Trzesniewski KH & Dweck CS (2007), 'Implicit Theories of Intelligence Predict Achievement Across an Adolescent Transition: A Longitudinal Study and an Intervention', *Child Development*, Vol 78: pp 246–263

Summary of the research findings

The research findings relate to:

- observed pedagogical repertoire
- the relationship between teachers' world views and the quality of pedagogy
- baseline student characteristics and the impact of these characteristics on student engagement and achievement
- the relationship of quality of pedagogy and specific Teaching for Effective Learning (TfEL) elements on student characteristics—disposition to learn, interest, positive affect, negative affect and negative social functioning
- impact of the SA TfEL Pedagogy Research Project
- student perceptions of teachers' pedagogy.

The research is compelling and reveals the complex inter-relationships at play between teachers' pedagogy and improving learner engagement and achievement.

For example, a teacher's belief about their role was a strong determinant of their practice. Depending on the extent to which they saw their prime role as covering the curriculum, caring for students, or being responsible for whether learning occurred for each student, their practice ranged from 'content coverage and control' and 'high relationship-low challenge' to 'responsive-learning and student-centred'. Teachers' epistemic[3] awareness, their understanding of learning and knowing, and their capacity to reflect epistemically all related to their approach to learning and teaching. Teachers with lower epistemic awareness adopted a 'teaching as script approach' whilst teachers with greater epistemic awareness leant towards a 'design' approach. This latter group demonstrated a far more highly developed pedagogical repertoire compared to other groups of teachers.

This is significant. Students' disposition to learning, their resilience in learning, and their understanding of 'growth mindset' all influence their outcomes as learners. When a 'teaching as design approach' is adopted, teachers are responsive to the needs of their learners. When teachers create safe conditions for learning (TfEL Domain 2) and personalise and connect learning (Domain 4), they create conditions in which students are challenged, but supported to achieve that challenge. When students learn that intelligence is not fixed and they understand how they learn and how knowledge is constructed (TfEL Domain 3) they have the key to unlocking improved academic achievement and lifelong learning disposition.

So quality teaching means collaborating in a whole school approach to develop expert learners (TfEL Domain 3) by moving beyond curriculum coverage and protective teaching: quality teaching sees educators encouraging and supporting students to step outside their comfort zones, to be stretched intellectually. When students learn how to learn, they recognise that their intelligence is not fixed; when their learning is connected to their lives and aspirations, they see the relevance in their learning; and when they are challenged and supported in a range of authentic, but diverse, contexts, their persistence, disposition, resilience and interest in the learning increases, deepening their engagement and improving their academic achievement. Above all, their potential to apply complex reasoning and strategic approaches as lifelong learners equips them to face the challenges of the 21st century.

Through the SA TfEL Pedagogy Research Project and its work with hundreds of teachers and students, it is clear that the TfEL Framework provides the roadmap for teachers to take this new pedagogical approach.

[3] The term 'epistemic' is used here to refer to a person's assumptions and beliefs about knowledge and how it is acquired, and the influence those assumptions and beliefs and have on their approach to learning and to teaching.

Compilation of key findings

1 | Observed pedagogical repertoire

Key finding 1.1: When first introduced to the TfEL Framework, teachers demonstrated three different stages of development of their pedagogical repertoire. These stages do not correlate with the teacher's age, gender, experience or academic qualifications.

Key finding 1.2: The most highly observed domain of practice, regardless of whether primary or secondary school teacher and regardless of the Index of Disadvantage (IoD) of the school, was Domain 2: Create safe conditions for rigorous learning, with an emphasis on creating safe conditions rather than on rigorous learning.

Key finding 1.3: The three least observed elements of practice for teachers are:
2.3 Negotiate learning
3.3 Explore the construction of knowledge
4.3 Apply and assess in authentic contexts.
The degree to which the observation scores for these elements are lower differs across the three stages of pedagogical development.

Key finding 1.3a: Primary school teachers overall score more highly than secondary school teachers with regards to three TfEL elements:
2.2 Build a community of learners
3.1 Teach students how to learn
3.4 Promote dialogue as a means of learning.

Key finding 1.3b: Teachers in low SES primary schools scored more highly on observation scores than primary teachers overall with regards to two TfEL elements:
2.1 Develop democratic relationships
2.2 Build a community of learners

Key finding 1.3c: Teachers in high SES schools (IoD–7) scored more highly than teachers in low SES schools (IoD 1–4) on the majority of TfEL elements, with this difference being significantly higher on elements:
3.1 Teach students how to learn
3.4 Promote dialogue as a means of learning
4.2 Connect learning to students' lives and aspirations
4.5 Communicate learning in multiple modes.

2 | The relationship between teachers' world views and the quality of pedagogy

Key finding 2.1: Teachers' beliefs and assumptions about their role have an impact on their practice. Three orientations to practice were identified:

- content coverage and control: *the teacher's role is to cover the curriculum*
- high relationship—low challenge: *the teacher's role is to care for the students*
- responsive—learning and student-centred pedagogy: *the teacher's role is to ensure learners learn meaningfully*.

Key finding 2.2: Teachers' epistemic awareness has an impact on their approach to teaching: a 'teaching as script' approach, which places emphasis on a controlled, sequential progression and following a pre-planned approach, and a 'teaching as design' approach, which is characterised by a responsive, personalised approach to learners' needs in order to achieve desired learning outcomes.

Key finding 2.3: Teachers who have a 'teaching as design' approach demonstrated a more highly developed pedagogical repertoire.

3 | Baseline student characteristics and the impact on student engagement and achievement

Key finding 3.1: The average student in this study reports a neutral disposition to learning. Students in low SES primary schools reported a lower disposition to learning compared to primary school students generally. Secondary school students reported a lower disposition to learning compared to primary school students.

Key finding 3.2: Approximately 40% of students in this study believe that intelligence is fixed and that they have a 'fixed mindset'.

Key finding 3.3a: The average student in this study had a low score on resilience in learning compared to UK students

Key finding 3.3b: Students in this study who self-reported a higher overall score on the Effective Lifelong Learning Inventory (ELLI), recorded a higher score on all dimensions except for resilience.

Key finding 3.4a: Learning disposition strongly predicts learner interest which predicts positive affect which, in turn, predicts level of engagement.

Key finding 3.4b: Having a 'fixed mindset' increases negative affect which is a strong predictor of negative social functioning which detracts from students becoming deeply involved in learning.

Key finding 3.4c: The more strongly a student holds a 'fixed mindset', the more their future performance will be influenced by prior performance.

Key finding 3.4d: The more highly students perform on NAPLAN, the more highly they rate themselves in terms of learning power and, conversely, the more poorly students perform on NAPLAN, the more they rate themselves as having low overall learning power.

4 | The relationship of quality of pedagogy and specific TfEL elements on student characteristics

Key finding 4.1: The TfEL elements act in a complementary fashion to have a positive impact on student involvement and deep engagement in learning. Specific domains and elements have a different level of impact on specific learner attributes that determine the depth of engagement in learning. Domains that had the greatest impact on learner attributes were:

- increasing positive affect—Domain 2: Create safe conditions for rigorous learning and Domain 3: Develop expert learners
- reducing negative social functioning—Domain 2: Create safe conditions for rigorous learning
- increasing student disposition to learn—Domain 4: Personalise and connect learning.

5 | Impact of the SA TfEL Pedagogy Research Project Stage 1: 2010–2012

Key finding 5.1: The SA TfEL Pedagogy Research Project had a significant impact on:

- student learning
- the professional learning culture.

Key finding 5.1a: The most significant impacts on student learning were:

- increased learner focus
- assessment
- intentionality re learning outcomes
- lifelong learning focus
- increased student dialogue.

Key finding 5.1b: The most significant impacts on developing a professional learning culture were:

- collaborative focus
- teacher professionalism
- design, plan and organise for teaching (TfEL Element 1.6)
- structure and purpose
- challenge and support.

Key finding 5.2: The most effective strategies that contributed to the development of a professional learning culture, as reported by leaders, specialist teachers and teachers, were:

- establishing professional learning communities
- focused professional support in the form of a specialist teacher
- peer observations
- self-review.

Key finding 5.3: The leadership approaches necessary to support embedding the TfEL Framework and improving practice were identified as:

- shared leadership
- clear direction
- a focus on pedagogy
- leaders' learning.

Key finding 5.4: The most commonly occurring factors that were perceived by leaders to inhibit change were:

- site cultural issues
- multiple competing demands
- staff turnover.

6 | Student perceptions of teachers' pedagogy

Key finding 6.1: Students value the opportunity to give feedback on their teachers' practice. They consider that it is important for teachers to understand what helps them learn. They also reported that the process of giving feedback via the TfEL Compass[4] helped them reflect on their own learning.

Key finding 6.2: The qualitative difference in the learning experiences of students taught by teachers who had a highly developed or a limited pedagogical repertoire is clearly evident in the student perceptions of teacher practice and the impact of this practice on the quality of their learning.

Key finding 6.3: The difference in impact on the learners of teaching quality is not simply in the quality of the learning experience itself, but also in the impact high quality pedagogy has in developing reflective, self-directed lifelong learning capabilities.

[4] TfEL Compass: An online professional learning tool for teachers to reflect on their teaching and learning practices through self-reflection and feedback from students and trusted colleagues. For more information, contact compass@sa.gov.au

SECTION 1

INTRODUCTION

...much has been learned about the effect of deep engagement on learning, learning dispositions and the impact of student perceptions of fixed or variable intelligence on academic achievement.

Introduction

Since the late 1990s, South Australia has been exploring the latest thinking and research that offer insights into the learning process and the improvement of teaching. This work has been informed by emerging understandings in neuroscience, cognitive psychology, professional learning and school leadership. The SA pedagogical framework, Teaching for Effective Learning, was developed after ten years of research and exploration, working with teachers, leaders and leading thinkers, to produce a framework with a combined focus on progressing quality teaching to improve outcomes for learners and equip them for the demands of a rapidly changing world.

The main purpose of this report on the SA TfEL Pedagogy Research Project is to present a summary of recent findings drawn from data gathered from both students and teachers to investigate the development and impact of a whole school approach to improving learner engagement and achievement using the SA Teaching for Effective Learning (TfEL) Framework. Essentially it explores what it is that teachers do and understand to further enhance not only traditional student academic achievement that is measurable, such as through the National Assessment Program—Literacy and Numeracy (NAPLAN) and the Programme for International Student Assessment (PISA), but also how to equip students with the understandings and abilities to enhance their own deeper learning and metacognitive abilities to become effective lifelong learners.

Context

Widespread recognition of what was essential preparation for young people to face the demands of a rapidly changing world—a capacity to engage with and solve complex problems and to develop lifelong learner capabilities—are recent understandings. Before this time the focus had been on identifying what excellent teachers do to affect student academic achievement. For example, in the work of John Hattie[5], which was conducted

[5] Hattie J (2003) 'Teachers Make a Difference: What is the research evidence?', http://www.decd.sa.gov.au/limestonecoast/files/pages/new page/PLC/teachers_make_a_difference.pdf (accessed 15 July, 2014)

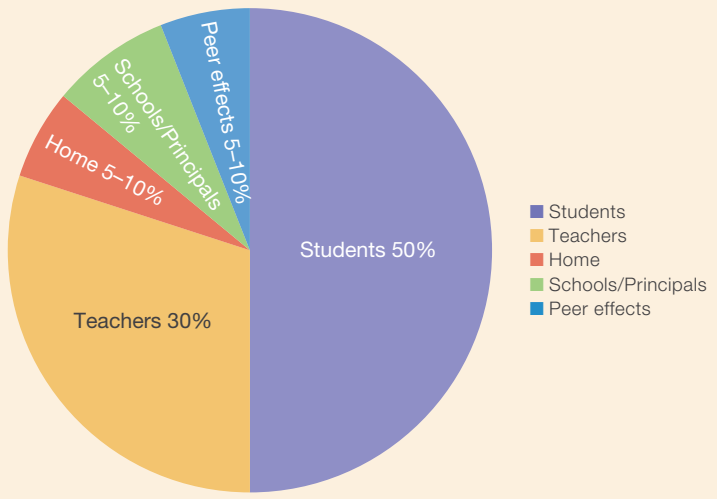
in the 1990s and synthesised over 500,000 studies, attention was paid solely to determining what affected academic achievement. No attention was paid to identifying factors that had an impact on developing lifelong learning attributes.

Another major shift in understanding that occurred at this time was that intelligence is not fixed. The neuroscience research on brain plasticity[6] that underpins the notion that intelligence is not fixed, but that one can acquire a 'growth mindset'[7], had been building for some time, as had the work on helping learners learn to learn. It took until around the turn of the century before it became generally accepted that students could learn how to learn, that developing their capacity to manage and direct their own learning was crucial to preparing them for life in the 21st century (21C), and that teaching students about learning raised academic achievement.

It is not surprising that John Hattie focused solely on the interplay between teacher quality and academic achievement, as the majority of studies on which he conducted his meta-analysis were completed prior to wide acceptance of the notion of 'growth mindset' and its implications for enhancing student learning outcomes.

So, despite the fact that Hattie found that 50% of the variance in student academic achievement can be attributed to the students themselves and only 30% of the variance to teachers, he focused simply on what was commonly assumed at the time to be the only factor that could be altered—teaching quality. Since then much has been learned about the effect of deep engagement on learning, learning dispositions and the impact of student perceptions of fixed or variable intelligence[8] on academic achievement.[9]

Figure 1 | Sources of variance in student academic achievement as percentages[10]



The emerging challenge for all educators is how do we unlock the 50% of variance in achievement that is attributed to the students themselves? SA DECD Teaching and Learning Services responded to this challenge and this has been a key question contributing to the SA DECD research on pedagogy, student engagement and achievement.

It took until around the turn of the century before it became generally accepted that students could learn how to learn, that developing their capacity to manage and direct their own learning was crucial to preparing them for life in 21C, and that teaching students about learning raised academic achievement.

[6] See for example, Bach–y–Rita P (1972) *Brain Mechanisms and Sensory Substitution*, New York: Academic Press; Doidge N (2007) *The Brain that Changes Itself*, Penguin, New York;

[7] See for example, Dweck C (2006); Langer E (1989)

[8] The terms 'fixed mindset, fixed intelligence, entity view of intelligence' and 'growth mindset, variable intelligence, incremental view of intelligence' are sets of interchangeable terms used in the research literature (eg Dweck, 2006)

[9] Blackwell et al (2007)

[10] Hattie J (2003)

Early SA research into pedagogy

In the late 1990s, the South Australian Department for Education funded the Focus Schools Program. This consisted of individual schools specialising in Key Learning Areas and disseminating and sharing 'best practice'. It was clear, however, that this model would not generate new thinking, increase teacher capacity, or spawn professional practices that reflected the recent understandings that were emerging from cognitive psychology and neuroscience. The program replicated the best of the industrial model of schooling, but it did not create it anew to meet the challenges for 21C learning. New learning was needed as these areas were not addressed in teacher training conducted in the 20th century.

Resources were re-allocated to a new initiative, Learning to Learn (L2L)[11], which focused on the generation of new thinking and understandings about the learning process—knowledge generation [and] the translation of this knowledge and learning outwards to the system as a whole.[12] The key criterion was not about the 'implementation' of existing programs, but about including schools that demonstrated an intent to lead a generative learning process at the school, led and modelled by the site leaders.

The intent of the L2L initiative was to immerse teachers and leaders in rich professional learning opportunities and to work intensively with leaders in theorising the change process at the school level to inform systemic change. The program was deliberately invitational and exploratory in this first phase. The professional learning program was led by a group of international educational colleagues, many of whom were worldwide leaders in the new science of learning and leading thinkers in the application of social constructivist theories of learning.

A research strand was also developed to capture the emerging issues, insights and relationships inherent in creating schools and learning environments that focused deeply on both teaching *and* learning.

This research work was directed at understanding the effect of change on key stakeholders, particularly students. The study focused on the following questions:

- How do children experience learning differently when a student-focused approach is integrated into the school culture and a curriculum is adopted that is consistent with constructivist assumptions of learning?
- What are the collective outcomes of such change in terms of student achievement, measured according to traditional academic measures, indices of student wellbeing, and meta-learning[13] criteria?

Those schools that had already undertaken considerable cultural transformation and rigorous constructivist pedagogical change showed statistically significant differences related to the achievement outcomes for 21C learners:

- higher metacognitive/thinking skills
- higher 'on task' behaviour associated with greater interest and less boredom
- higher happiness and satisfaction
- higher social functioning and wellbeing
- higher positive disposition to learning
- higher academic achievement on state Basic Skills Tests
- stronger performance on problem solving/thinking tests.

A summary of the findings from Learning to Learn Phases 1 and 2

Over the six years and first two phases of L2L, sites from country and metropolitan locations participated in the L2L initiative. They included 74 preschools, kindergartens and primary schools, and 27 secondary and area schools, with 42 of the total working in cluster groups.[14]

[11] Learning to Learn website: http://www.learningtolearn.sa.edu.au/tfel/pages/L2Lhistory/ (accessed 17 June 2014)

[12] Foster M, Le Cornu R & Peters J (2000) 'Leadership for Learning', *Australian Association for Research in Education Conference*, Sydney, NSW, 4–7 December 2000, p.5

[13] Meta-learning refers to a student's capacity for thinking about and monitoring their own learning and thinking—their metacognitive capacity. Along with a positive sense of self as a learner and a positive disposition to learn, one's metacognitive capacity is a key aspect of being a capable and successful lifelong learner.

[14] Department of Education and Children's Services (2004) *Assessing the Impact of Phases I and II: Learning to Learn 1999–2004*, State of South Australia, Adelaide, p.1

The final report[15] of the L2L initiative showed that there had been substantial gains in learner engagement and wellbeing for learning, in teacher professionalism, and in learners' achievement in Phase 1 and 2 schools. The following figures show the impact on:

- reduced incidents of student time out (Figure 2)
- improved student engagement (Figure 3)
- increased number of learners achieving at higher band level in the state Basic Skills Tests/Literacy and Numeracy (LaN) tests[16] and in SACE achievement (Figures 4–5)
- revitalised professionalism, demonstrated by improved teacher practice (Figure 6) and increased teacher morale (Figure 7).

Figure 2 | Comparison of time out incidents

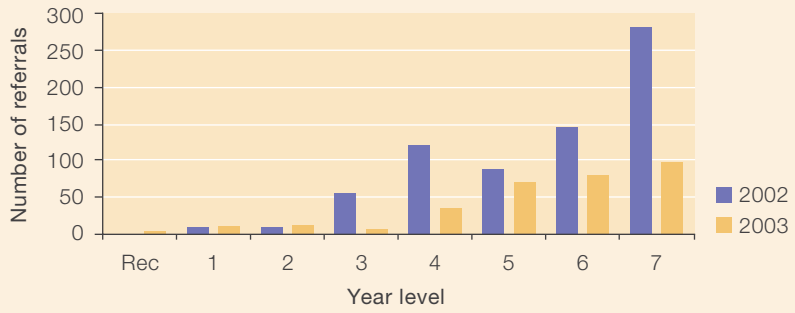
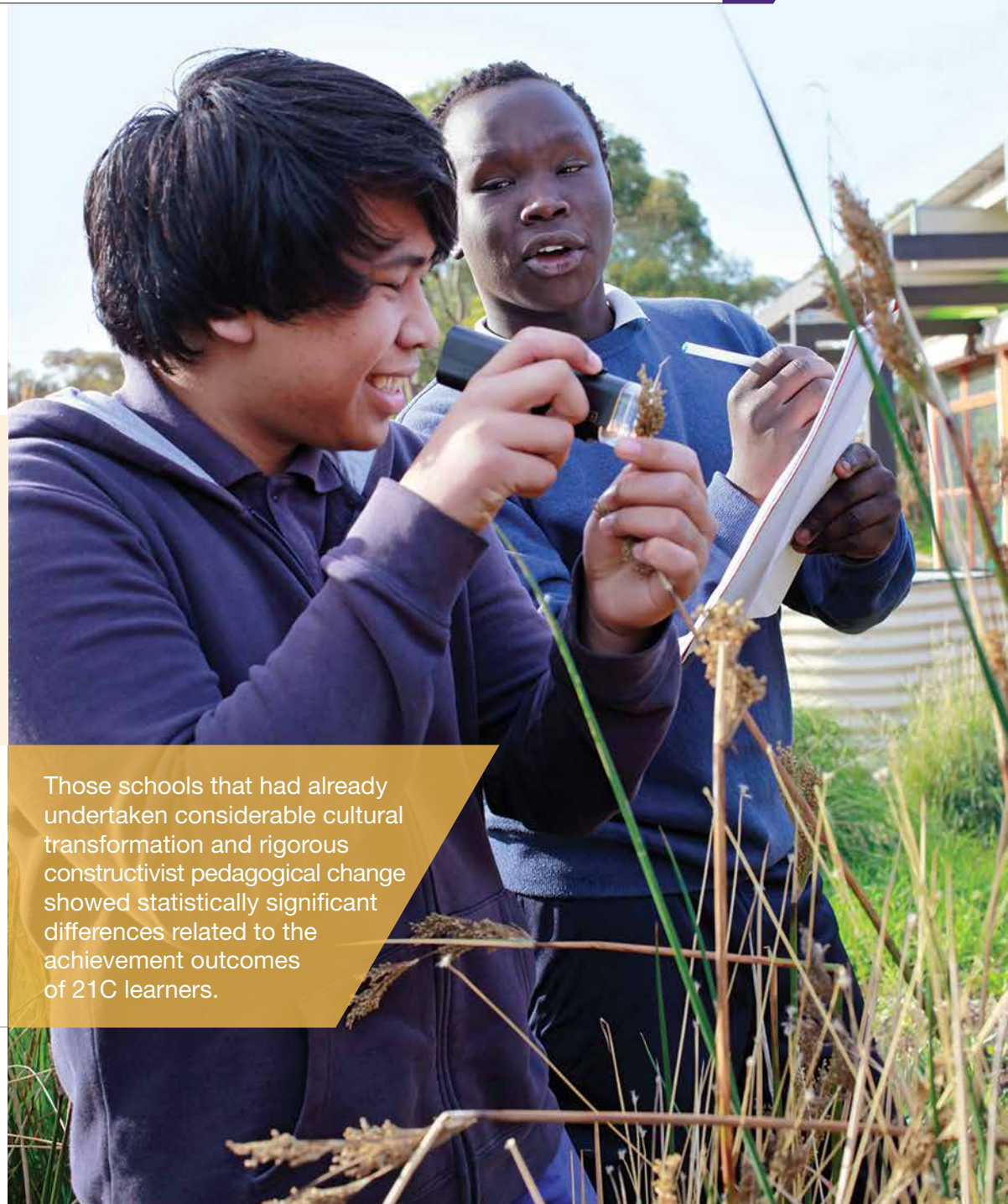


Figure 2 highlights that Phase 1 and 2 schools showed a substantial drop in school discipline incidents, as their focus on learner engagement increased through involvement in the program.



Those schools that had already undertaken considerable cultural transformation and rigorous constructivist pedagogical change showed statistically significant differences related to the achievement outcomes of 21C learners.

[15] Department of Education and Children's Services (2004)

[16] State Literacy and Numeracy (LaN) tests, which replaced the Basic Skills Test (BST) in 2003, were conducted at years 3, 5 and 7.

Figure 3 | Reported improvements in student engagement

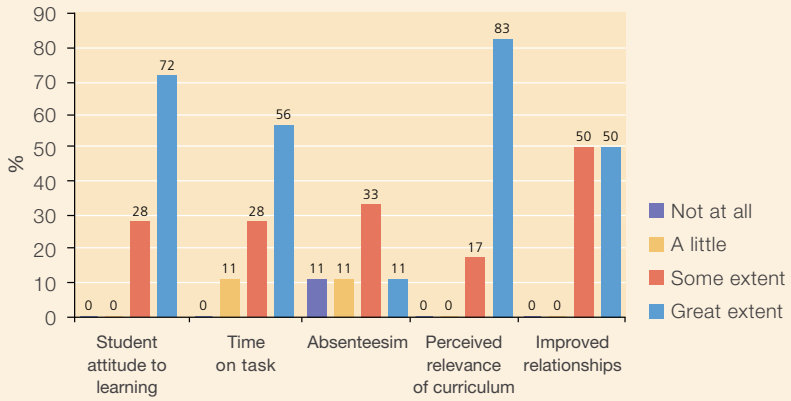
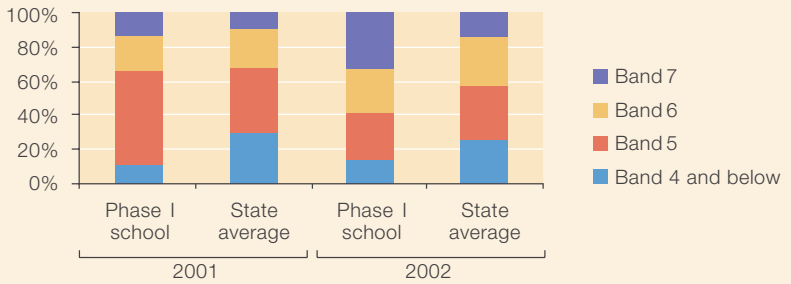


Figure 3 demonstrates how participating teachers in Phase 1 and 2 schools reported a wide range of learner impacts associated with increased engagement in learning. DECS analysis of learner absentee rates in participating L2L schools in 2006 showed an overall 11% higher attendance.

Figure 4 | Basic Skills Test [BST] – Literacy Year 7



In Figure 4 one can see how Phase 1 and 2 schools showed a substantial increase in numbers of learners achieving at higher band level in the state Basic Skills Test in a range of areas.

Figure 5 | Improvements in student achievement

Enhancing student achievement

Nearly 90% of survey respondents reported significant improvement in student outcomes

Examples in primary schools:

- Overall mean scores in literacy/ numeracy were higher than the average (by an average of 3.4%) in 2001, and increasingly higher (by an average of 5.6%) in 2002.
- 92% of Year 3 students scored in the 3–5 Skill Band in 2002 (similar in 2001) compared with 66% in the state.

Examples in secondary schools:

- SACE completion 1999–2000 from 54% to 73%
- SACE achievement 1999–2000 from 78% to 82%
- Increase in number of students receiving A's
- Increase in number of 'satisfactory' SACE Stage 1 results.

Figure 5 demonstrates the increased number of learners achieving at higher band levels in the state Basic Skills Tests and in SACE achievement.

Figure 6 | Reported improvement in methodology

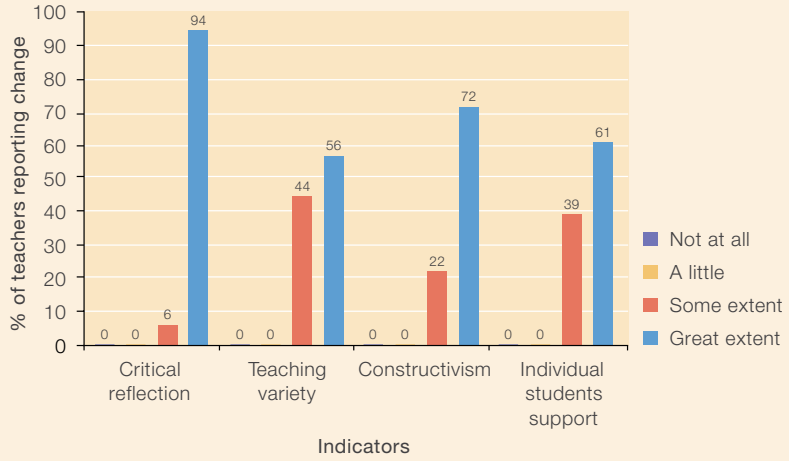


Figure 6 demonstrates that Phase 1 and 2 participating teachers from L2L schools reported substantial changes to their classroom practice—of significance was the number of teachers engaging in critical reflective practice.

Figure 7 | Increase in teacher morale

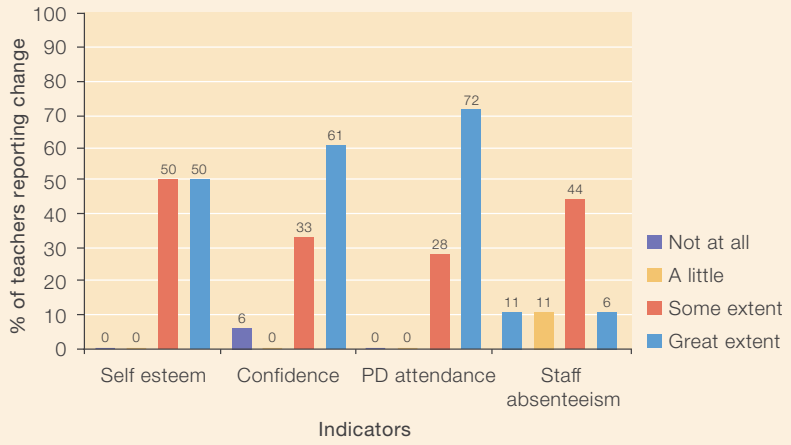


Figure 7 demonstrates how Phase 1 and 2 participating teachers reported substantial revitalisation of morale and professionalism.

What was evident was the impact that the L2L initiative was having at multiple levels on aspects of both teachers' and students' learning, coupled with the high demand from schools for subsequent involvement. By 2004–2005 schools started to self-fund their participation and re-prioritise site resources towards teacher professional learning and a focus on teaching and learning. An evaluation process showed that the initial catalytic effect of participating in the centrally-driven program of L2L reaped benefits well beyond the formal inclusion period. Increasingly evident also was the need to develop measurement methods that would capture the qualitative data and emerging relationship patterns.

What was evident was the impact that the L2L initiative was having at multiple levels on aspects of both teachers' and students' learning.

Further research into engagement and involvement

These early evaluation and research findings led to a commitment to conduct further South Australian research into the impact of leadership on teacher learning and pedagogy, on learner engagement and on student outcomes—both academic and lifelong learner capabilities. The findings from the SA pedagogy and engagement research from L2L and the Innovative Community Action Networks (ICAN)[17] project started to reveal the relationships that exist between learner characteristics, quality of pedagogy and the achievement of both academic and lifelong learning capabilities.

In 2006, work was undertaken to develop a set of observation and self-report tools to measure student engagement, including involvement in learning. These built on work undertaken by Dr Pam Winter[18] into the relationship between pedagogy, involvement in learning and student wellbeing for the early years.[19]

[17] Innovative Community Action Networks (ICAN): A local community partnership model bringing together young people, families, schools, community groups, businesses and different levels of government to ensure young people from Year 6 up to 21 years of age have access to meaningful learning and support pathways to further education, training and employment opportunities to reach their full potential.

[18] Dr Pam Winter was the Manager, Early Learning and Curriculum, Office of Early Childhood in the Department for Education and Children's Services project at this time

[19] Department of Education and Children's Services (2008) *Assessing for Learning and Development in the Early Years using Observation Scales: Reflect, Respect, Relate*, Department of Education and Children's Services, State of South Australia, available at 'Early Years' website: http://www.earlyyears.sa.edu.au/pages/Resources/resource/ (accessed 17 June 2014)

Funding from the ICAN project supported trialling of these measurement tools with a diverse range of students in 2006.[20] Thinking skills measures were also trialled, including trial tests being developed by the Finnish Learning to Learn project.

The findings demonstrated that improving both learners' academic achievement and their lifelong learning capabilities—'results plus'—was achievable and gave further impetus to developing a pedagogical framework that embraced effective teaching for both academic achievement and development of lifelong learning capabilities.

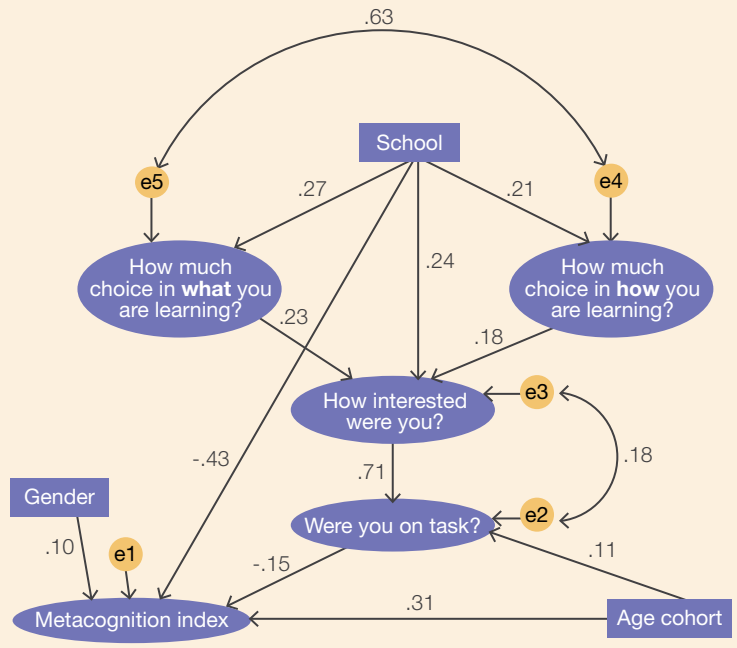
Deep engagement is characterised by a drive to understand, a readiness to seek connections with prior knowledge, and an engagement in complex relational thinking in order to make sense of experiences and new knowledge.

These findings are summarised in the following path diagrams—Figures 8a and 8b.[21] Path diagrams are visual representations of Structural Equation Models (SEM) that study complex relationships between variables by showing which variables have an impact on other variables and how large this impact is. See the text on p.17 to understand how to read an SEM path diagram.

Figure 8a demonstrates the significant increase in learner interest, on-task behaviour and, ultimately, metacognitive capacity when students are provided with a choice in *what* and *how* to learn. This shows that a constructivist approach, which engages the learner in negotiating both what and how they learn, has a significant effect on their interest, but only accounts for a total of approximately 8% of the variance in interest. The question is what accounts for the remaining 92% of variance in interest?

Figure 8b explores the relationship between interest, positive affect and involvement. When used in this context 'involvement' refers to 'deep' versus 'surface' engagement in learning. Deep engagement is characterised by a drive to understand; a readiness to seek connections with prior knowledge; and an engagement in complex relational thinking in order to make sense of experiences and new knowledge. Figure 8b demonstrates that 84.6% of the variance in deep involvement is explained by positive affect whilst 26% of the variance in positive affect can be explained by interest. This early research established that negotiating what and how they learn has a significant impact on learner interest and degree of metacognition. It also established that interest played a significant part

Figure 8a | Structural analysis of variables influencing learner metacognition



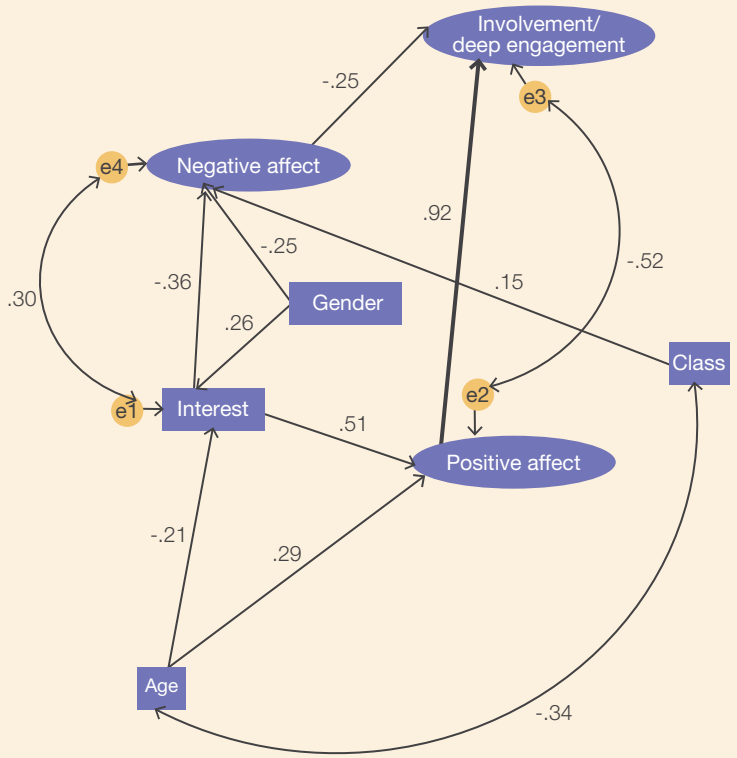
in determining learners' positive affect that in turn accounted for 84% of the variance in deep involvement in learning.

The outcomes of this small study started to reveal the nature of the complex interactions of pedagogy and student characteristics and gave direction to the future development of the South Australian position on pedagogy. It was clear that attending to learner interests was key to powerful learning outcomes for learners. Key elements of a learner-focused pedagogy emerged strongly: negotiating what and how they learn; personalising

[20] Goldspink C & Winter P (2007) 'Measuring What Matters: A series of instruments to evaluate student engagement, focusing on involvement, well-being and thinking', unpublished paper

[21] For further details, see Goldspink C (2008) 'School Reform—An exploratory case study of the impact of student-centred learning in two primary schools', DECS, Adelaide. The report used an experience sampling technique spanning one month, with data collected from three age cohorts of students (R–2, 3–5, 6–7). Eight experience samples were obtained from each student in each cohort resulting in 1266 records.

Figure 8b | Structural analysis of variables influencing positive affect and involvement/deep engagement in learning



learning by deliberately connecting learning with their interests; sparking their curiosity, interest and questioning; and explicitly teaching students about learning and how to learn. It was clear that the long-term history in South Australia of valuing learner voice and focusing on engagement needed to be central to the state's pedagogy framework. This early work also highlighted how essential it was for learners to learn how to learn, to develop self-awareness as learners, and to gain the metacognitive capacity to reflect on and direct their own learning.

One key question that remained, though, was how deep engagement in learning led to higher academic achievement. Since the introduction of the concepts 'deep' and 'surface' learning in the 1970s[22], there have been numerous studies[23] that show the correlation between 'deep' learning and academic achievement. Deep learning is an essential precursor to higher academic achievement when academic achievement is a measure of understanding, insight and complex problem solving, as distinct from the mere reproduction of information. A key indicator of a successful 21C learner is the ability to engage with complex problems and to apply one's knowledge in new situations: an ability that involves understanding and insight versus information recall.

Deep learning is an essential precursor to higher academic achievement when academic achievement is a measure of understanding, insight and complex problem solving, as distinct from the mere reproduction of information.

Reading path diagram representations of Structural Equation Models (SEM)

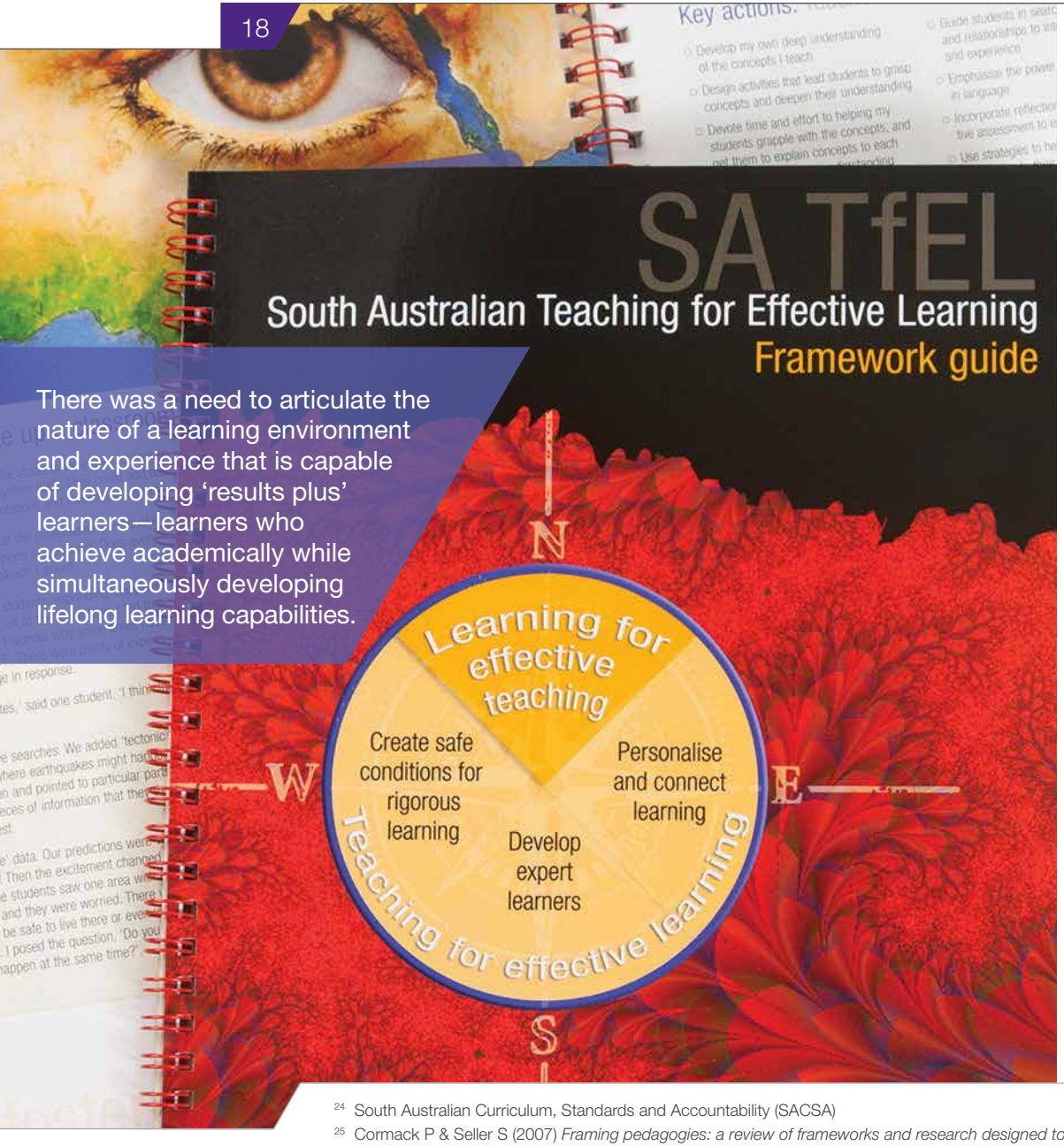
Figures 8a and 8b are path diagrams. They visually represent Structural Equation Models (SEM). They indicate the effect and the extent of variables on one another. In interpreting path diagrams, the important aspects to focus on are the direction of the arrows and the numbers attached to the arrows.

For example, in Figure 8b 'interest' has been shown to correlate with 'positive affect'. The direction of the arrow from interest to positive affect indicates the direction of the impact: interest affects positive affect but positive affect has no impact on interest. The number 0.51, called the regression co-efficient, written beside the line indicates the extent to which 'interest' has an impact on 'positive affect': if interest goes up by 1 on the scale on which interest is measured, the positive affect will go up by .51 on the scale that measures positive affect.

In addition to showing the size of the impact of one variable on another and the direction of that impact, one can extrapolate the percentage of variance: squaring the regression coefficient and multiplying by 100 provides the percentage of variance. For example, the regression coefficient between positive affect and involvement shown in Figure 8b is 0.92. The square of 0.92 is 0.846 which, when multiplied by 100, equals 84.6. This means that 84.6% of the variance in involvement is explained by positive affect. Similarly 26% of the variance in positive affect can be explained by interest (0.512 x 100 = 26%).

[22] Marton F & Säljö R (1976) 'On Qualitative Differences in Learning – 1: Outcome and Process', *British Journal of Educational Psychology*, Vol 46, pp 4–11

[23] See, for example, Gijbels D, Van de Watering G, Dochy F & Van den Bossche P (2005) 'The relationship between students' approaches to learning and the assessment of learning outcomes', *European Journal of Psychology of Education*, Vol 20, 4, pp 327–341 and Biggs J (1979) 'Individual differences in study processes and the quality of learning outcomes', *Higher Education*, Vol 8, pp 381–394



There was a need to articulate the nature of a learning environment and experience that is capable of developing 'results plus' learners—learners who achieve academically while simultaneously developing lifelong learning capabilities.

Developing the SA Teaching for Effective Learning (TfEL) Framework

Concurrent with the L2L evaluation and research, long-term participants identified the need to capture this work as a common frame of reference across the public education system as well as the need for a shared language and a reference point for collective professional reflection and learning. There was a necessity to articulate the nature and experience of a learning environment that is capable of developing 'results plus' learners—learners who achieve academically while simultaneously developing lifelong learning capabilities.

Prior to the development of the TfEL Framework (see Figure 9, p.26), there were statements to be found about pedagogy in South Australian Department for Education and Children's Services (SA DECS) documentation, such as in the South Australian Curriculum, Standards and Accountability (SACSA) documents.[24] These statements, however, were at a broad level and did not articulate a comprehensive set of specific principles to guide practice.

The University of South Australia (UniSA) was commissioned to research existing pedagogic frames: their subsequent literature searches and collections of existing frameworks demonstrated that all existing frameworks focused on teaching rather than teaching *and* learning. Rather than adopt an existing framework, it was recommended that South Australia develop and articulate a position in which there was an equal emphasis both on developing learning capability and on teaching for deep learning and genuine, lasting academic achievement.[25] Learner agency, developing growth mindset, and developing expert learners would be an integral component of the South Australian framework. From the L2L research it was very clear that a key to teachers developing their practice was their own learning about learning. In response to this finding, the SA framework would incorporate both learning for effective teaching and teaching for effective learning.

[24] South Australian Curriculum, Standards and Accountability (SACSA)

[25] Cormack P & Seller S (2007) *Framing pedagogies: a review of frameworks and research designed to promote effective approaches to teaching and learning*, Adelaide: Centre for Studies in Literacy Policy and Learning Cultures, Hawke Institute, University of South Australia

The TfEL Framework was developed over a two year period, from 2008–2009, and involved hundreds of SA DECD teachers and leaders; UniSA; and an academic reference group of international educational colleagues. The aim was to develop a framework and a set of tools and resources not only to underpin professional development, but also to support the collection of systematic data about current practice.[26]

The TfEL Framework was initially declared as South Australia's position on pedagogy and held up as SA DECS educators' professional approach. The power of having a comprehensive framework as the SA DECS position on pedagogy is that it provides potential for greater alignment of teaching practice by creating a systemic expectation for the development of quality practice and, specifically, what that looks like in terms of an agreed framework.

From late 2010, it was available to schools and teachers on a voluntary basis. Engagement with the TfEL Framework in the early stages was deliberately voluntary, based on lessons learned from the L2L research: one of the powerful findings was that interest and authentic engagement in improving pedagogy was highly related to having an intrinsic, rather than extrinsic, motivation for involvement. Once the impact of the initiative was more widely known by schools, there was a growing motivation to become involved.

However, when introducing a new framework, there comes a time when in order to gain full alignment across the state, it is necessary to mandate that all schools engage with it. In November 2013, engagement with the TfEL Framework, as SA DECD's position on pedagogy, became mandated policy through the introduction of the SA DECD (2013) *Curriculum, Pedagogy, Assessment and Reporting Policy for Reception–Year 10*.[27]

Taking the Learning to Learn research further: theorising the change process

At the same time as research was being undertaken through L2L into the impact of constructivist teaching and learning approaches on student outcomes, research was also being conducted into what it took to develop this pedagogical approach. This research identified three distinct phases in the process of staff opting into change:

- establishing the local initiative
- embedding change within sites
- achieving cross-fertilisation of ideas between sites.

The key empirical findings included:

- Appealing to teacher's intrinsic motivation is key to effective site change and to transforming educational practice.
- Pursuing change with high levels of flexibility and a learning and risk tolerant approach to accountability can lead to rigorous approaches to change and a focus on results.
- Maintaining a high level of congruence to core values informing the change is vital.
- The current environment places school leaders who are pursuing change in a situation where they experience considerable paradox. This results from their being expected to act through conflicting role identities derived from an institutional value base unsupportive of the cultures they are working to support at site level.
- A non-blaming approach to change opens up possibilities for institution wide learning.[28]

The power of having a comprehensive framework as the SA DECS position on pedagogy is that it provides potential for greater alignment of teaching practice by creating a systemic expectation for the development of quality practice and, specifically, what that looks like in terms of an agreed framework.

[26] Two trials were conducted in 2009 to refine the Framework and to check for validity and reliability as a basis for systematic measurement of quality of practice: Goldspink C (2009a) 'The Compass Field Trial—Trial of instruments for measuring quality pedagogy', Department of Education and Children's Services and Goldspink C (2009b) 'TfEL Instrument Trial-results and recommendations', Department of Education and Children's Services.

[27] Department for Education and Child Development (2013)

[28] Goldspink C (2007a) 'Rethinking Educational Reform—A loosely coupled and complex systems perspective', *Educational Management Administration and Leadership*, SAGE Publications, January 2007, Vol. 35, No. 1, pp 27–50

Establishing a baseline picture of the teaching and learning patterns in SA classrooms with reference to the TfEL Framework would enable a systemic strategic response to improving learners' engagement and achievement and developing the quality of teaching.

Since 2000 SA DECD has continued to conduct research to inform policy and practice. Using the unique and diverse change initiatives fostered by the L2L project[29], the role of leaders in supporting teacher learning (and unlearning) and whole school change has been systematically investigated. When that research commenced, however, adequate methods were not available to measure the impact of pedagogy on a complete set of outcomes, including deep engagement in learning and the development of lifelong learning capabilities. With the introduction of an explicit pedagogical framework, it was considered important to continue research to inform the system of the impact of the TfEL Framework and how best to support teachers in developing their practice to align with it. Establishing a baseline picture of the teaching and learning patterns in SA classrooms with reference to the TfEL Framework would enable a systemic strategic response to improving learners' engagement and achievement and developing the quality of teaching.

In 2009, the advent of funding from the Communities Making a Difference (CMaD) National Partnerships provided the opportunity to further progress the early research. SA DECD Teaching and Learning Services commenced unique international research to identify the baseline profile of pedagogy and student characteristics in SA DECD schools at the point when TfEL was introduced, through the Communities Making a Difference National Partnerships—South Australian Teaching for Effective Learning Pedagogy Research Project 2010–2013. The findings of this research were ultimately echoed by those of the broad patterns of practice identified by the Supporting Improved Literacy Achievement (SILA) 2009–2011.

[29] Foster M, LeCornu R & Peters J (2000); Foster M, Smith R & Atkin J (2001); Le Cornu R, Peters J, Foster M & Shin AM (2002); Le Cornu R, Peters J & Collins J (2003); Le Cornu R, Peters J, Foster M, Barratt R & Mellowship D (2003); Le Cornu R (2004); Le Cornu R & Peters J (2005a and 2005b); Le Cornu R, Peters J, Foster M, Barratt R & Stratfold J (2005); Le Cornu R, Peters J, Foster M, Barratt R & Stratfold J (2006); Peters J & Le Cornu R (2004); Peters J & Le Cornu R (2005); Peters J & Le Cornu R (2006a, 2006b and 2006c)

SECTION 2

THE COMMUNITIES MAKING A DIFFERENCE NATIONAL PARTNERSHIPS: SOUTH AUSTRALIAN TEACHING FOR EFFECTIVE LEARNING PEDAGOGY RESEARCH PROJECT 2010–2013 (SA TFEL PEDAGOGY RESEARCH PROJECT)

The TfEL Framework is an aspirational model for exemplary professional engagement and practice.

The SA TfEL Pedagogy Research Project 2010–2013

Context

The TfEL Framework became available to SA DECD schools in 2010 to serve as a guide and reference point for improving the quality of teaching and for directing the ongoing professional learning of teachers. The philosophy underpinning the TfEL Framework, is captured in its four domains (see Figure 9, p.26):

- **Domain 1: Learning for Effective Teaching**, which elucidates the work of teachers as professionals, including personal professional learning, contributing to the learning of professional colleagues and interaction with the community. The elements of Domain 1 are:

  1.1 Understand how self and others learn

  1.2 Develop deep pedagogical and content knowledge

  1.3 Participate in professional learning communities and networks

  1.4 Engage with the community

  1.5 Discuss educational purpose and policy

  1.6 Design, plan and organise for teaching and learning.

- **Domains 2–4**, which describe three interdependent domains of practice. These domains are:

  Domain 2: Create safe conditions for rigorous learning

  Domain 3: Develop expert learners

  Domain 4: Personalise and connect learning.

The TfEL Framework is an aspirational model for exemplary professional engagement and practice.

Gathering baseline data at the point of introduction of the TfEL Framework was essential to enable SA DECD to monitor its impact and to engage in a continuous improvement approach to the design and implementation of strategies to improve the quality of teaching in SA DECD schools. It also gave an opportunity to include ongoing work to develop a rigorous research methodology to gain deeper insights into the nature of the relationship between the quality of pedagogy and learner engagement and achievement.

Findings from this research informed the SA DECD approach to implementing the Australian Curriculum and the SA DECD (2013) *Curriculum, Pedagogy, Assessment and Reporting Policy for Reception–Year 10*[30]. They will continue to influence the SA DECD strategic approach to improving the quality of pedagogy in our schools.

Focus of the research

The SA TfEL Pedagogy Research Project was conducted in two stages:

- Stage 1: 2010–2012 was conducted in SA DECD low Socio-Economic Status (SES) schools
- Stage 2: 2013 sought to determine if the key findings from Stage 1 could be generalised across all SA DECD schools or whether the findings were specific to low SES schools.

A methodological summary of the research for 2010–2012 and 2013 is shown in Table 1 (see p.25).

Exploring the relationship between pedagogy, learner engagement and achievement Stage 1: 2010–2012

Key questions

During 2010–2012 the research project was conducted with a sample of 20 SA DECD low SES schools with an Index of Disadvantage (IoD) of 1–4. It set out to investigate the impact of the quality of pedagogy on:

- learner engagement in the form of deep involvement in learning
- learner academic achievement with regard to literacy and numeracy (as measured by NAPLAN)
- learner lifelong learning capability.

[30] Department for Education and Child Development (2013)

The research project in Stage 1 investigated the following questions in a sample of low SES primary schools:

1. **What impact does the quality of pedagogy, referenced against the TfEL Framework, have on learner engagement and learner achievement—both academic achievement and the development of lifelong learning capability?**
2. **Do particular elements of pedagogy have an impact on specific aspects of learner engagement, achievement and lifelong learning capability?**

Research process

To answer these questions, a set of strategies and an accompanying research methodology were designed to create a whole school approach to engaging teachers with the TfEL Framework as a reference point for developing pedagogy. The key engagement strategy was using specialist teachers to:

- support the development of collaborative professional learning groups to systematically develop teachers' understanding of the TfEL principles
- model and coach teachers in how the TfEL principles can be applied in learning and teaching
- 'apprentice' teachers to the research officers and specialist teachers as observers of classroom practice.

Methodology

The first stage of the research involved 20 low SES primary schools, 253 teachers and 4511 students (see Table 1).

In summary, the research methodology involved:

- establishing baseline observational data on teachers' pedagogical repertoire, referenced against the twelve elements of the three TfEL domains of practice
- examining teachers' language to describe their practice and their epistemic[31] perspectives through structured interviews
- capturing a number of student variables, including learning disposition, lifelong learning attributes (Effective Lifelong Learning Inventory—ELLI), learners' views regarding fixed/variable intelligence, learner academic achievement (NAPLAN) and learner engagement (SA Student Engagement Questionnaire).
- interviewing leaders and specialist teachers using Most Significant Change[32] (MSC) methodology to capture qualitative changes in professional learning culture, the impact of the implementation of the TfEL Framework on students' learning, and the factors that enhanced or inhibited change.

A specialist teacher was assigned to each site to:

- work closely with the school leader to organise and administer the research processes
- support whole school engagement with the TfEL Framework
- develop a culture of professional collaboration, specifically through the instigation of Professional Learning Communities (PLCs)
- work with the research officers and site staff to conduct observations of practice
- coordinate and administer ELLI data collection
- coordinate and administer Most Significant Change (MSC) data collection
- share reflections as participant observers on their perception of the development of a learning culture.

[31] The term 'epistemic' is used here to refer to a person's assumptions and beliefs about knowledge and how it is acquired, and the influence those assumptions and beliefs have on their approach to learning and to teaching.

[32] Most Significant Change data collection involves the collection of qualitative data through personal narrative. It was developed for NGOs by Dr Rick Davies. Dr Jessica Dart adapted the methodology for the education context in partnership with the SA Learning to Learn Initiative. See Davies R & Dart J (2005) 'The 'Most Significant Change' (MSC) Technique: A Guide to Its Use'.

Schools involved in the project had priority access to professional development opportunities for staff and all schools were involved in professional learning associated with the Effective Lifelong Learning Inventory (ELLI). Leaders' days supported principals of schools in the project and provided opportunities to share emerging trends in the data. Specialist teachers attended these days with the principals of the schools to which they were assigned.

Generalisability study—Stage 2: 2013

Key question

The key question for Stage 2 was whether the findings from Stage 1 were specific only to the low SES primary schools involved, or whether, and to what extent, they could be generalised across the state.

Research process

This stage of the research project was designed purely to gather observational data about pedagogical practice and student characteristics.

Table 1 | Methodological summary

	Stage 1 2010–2012	Stage 2 2013
Schools	20 Low SES (IoD 1–4) primary schools	Random sample of SA DECD schools (IoD 1–7): Primary schools: 20 Secondary schools: 8 R–12 school: 1
Mean school population	324	266
Teachers	Primary teachers: 253	Primary teachers: 115 Secondary teachers: 101 R–12 teachers: 15
Teacher age range Mean age Gender	23–73 42 80% female, 20% male	23–67 43 67% female, 33% male
Observations of practice	253	231
Teacher interviews	240	40
Leader interviews	Site leaders interviewed twice	–
Specialist teacher interviews	Specialist teachers interviewed twice	–
Most Significant Change stories	250 coded	–
Students: Year level 3–7 Students: Year level 8–13 Gender	4511 – 52% male, 48% female	3000 1761 48% male, 52% female
Student surveys	6000 student surveys ELLI: 1922 Student engagement surveys: disposition, view of intelligence: 4067 NAPLAN data: literacy and numeracy Attendance data Biographical data	ELLI: 974 Online TfEL Compass survey: perceptions of teacher pedagogy, disposition, view of intelligence: 811 NAPLAN data: literacy and numeracy Attendance data Biographical data
Parent/caregiver	Biographical data	–

Figure 9 | South Australian Teaching for Effective Learning Framework—Domain and element overview

South Australian Teaching for Effective Learning Framework

unleashing learning potential

Leaders create learning opportunities with staff

Domain 1 Learning for effective teaching

1.1 understand how self and others learn
leaders and teachers develop their understanding of current learning theories, and themselves as learners, to inform learning and teaching design

1.2 develop deep pedagogical and content knowledge
leaders and teachers develop their expertise by strengthening their disciplinary knowledge and translating learning theory into effective teaching practice

1.3 participate in professional learning communities and networks
leaders and teachers participate in critically reflective inquiry to develop teaching and learning across the school

1.4 engage with the community
leaders and teachers interact with communities to build learning partnerships and connect student learning beyond the school

1.5 discuss educational purpose and policy
leaders and teachers contribute to educational dialogue and debate that shapes whole school policy and informs practice

1.6 design, plan and organise for teaching and learning
leaders and teachers develop systems and structures to ensure effective teaching and monitoring of learning progress

Teachers create learning opportunities with students

Domain 2 Create safe conditions for rigorous learning

2.1 develop democratic relationships
the teacher shares power with students recognising it as a fundamental condition for learning

2.2 build a community of learners
the teacher creates a culture where everyone inspires and encourages each other's learning

2.3 negotiate learning
the teacher responds to students' changing needs and involves them in deciding the direction of the curriculum

2.4 challenge students to achieve high standards with appropriate support
the teacher has high expectations and guides each student to achieve his/her personal best

Domain 3 Develop expert learners

3.1 teach students how to learn
the teacher develops student understanding of learning and expands their strategies for thinking, learning and working collaboratively

3.2 foster deep understanding and skilful action
the teacher helps students build rich conceptual knowledge and mastery of complex skills

3.3 explore the construction of knowledge
the teacher shows that knowledge is open to question, serves particular purposes and is shaped by culture and experience

3.4 promote dialogue as a means of learning
the teacher provides opportunities for students to learn through interaction and learning conversation with others

Domain 4 Personalise and connect learning

4.1 build on learners' understandings
the teacher identifies students' prior knowledge and cultural practices as a starting point for curriculum

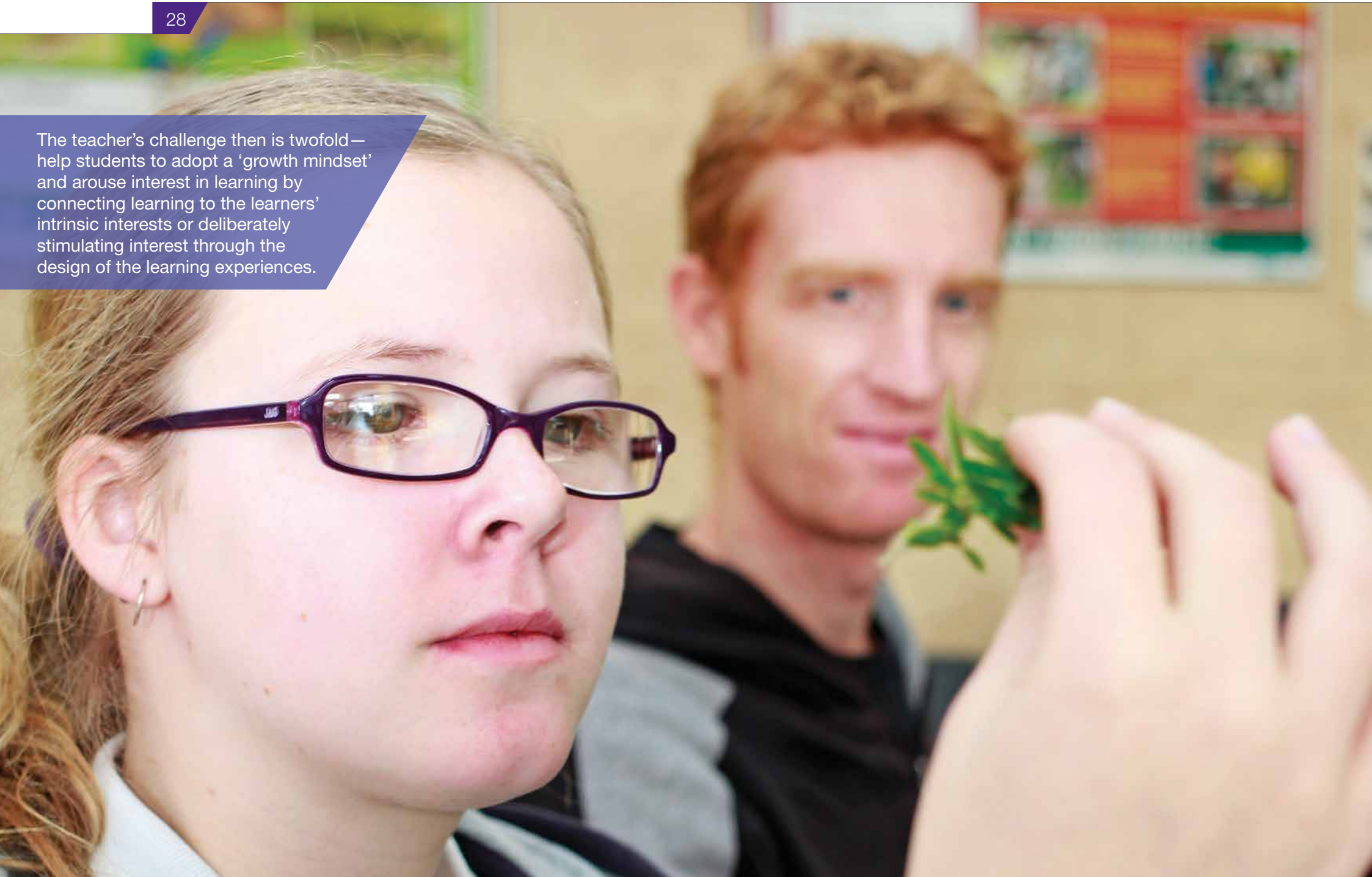
4.2 connect learning to students' lives and aspirations
the teacher ensures that learning builds on the resources, skills, knowledge and goals students develop in their homes and communities

4.3 apply and assess learning in authentic contexts
the teacher structures the curriculum so that students apply their learning in real-world/authentic contexts

4.4 communicate learning in multiple modes
the teacher ensures that the curriculum incorporates rich and varied modes of making and communicating meaning

SECTION 3

KEY FINDINGS



The teacher's challenge then is twofold—help students to adopt a 'growth mindset' and arouse interest in learning by connecting learning to the learners' intrinsic interests or deliberately stimulating interest through the design of the learning experiences.

Key findings

The key findings establish a comprehensive baseline pattern of teacher practice in SA DECD schools at the point of introduction of the TfEL Framework as well as baseline data on students' learning dispositions, their view of intelligence as fixed or variable, and their lifelong learning attributes. The key findings were determined:

- from observation, interview and survey data collected from SA DECD schools between 2010–2013
- by referencing observations of teacher practice against the TfEL Framework
- through statistical analysis and interpretation of the data.

The key findings are grouped in the following categories:

1 **Observed pedagogical repertoire:**[33]
   - correlation between teacher characteristics and pedagogical repertoire
   - observation scores by total score, by TfEL domains and by TfEL elements for different stages of schooling—primary and secondary; Index of Disadvantage (IoD) 1–4 and 5–7.

2 **The relationship between teachers' world views**[34] **and the quality of pedagogy:**
   - teachers' assumptions about their role and the impact on their practice
   - teachers' epistemic[35] awareness and the impact on their approach to teaching.

3 **Baseline student characteristics and the impact on student engagement and achievement:**
   - student learning disposition—openness to learn
   - 'fixed vs growth mindset'—student views on fixed/variable intelligence
   - 'learning power'—lifelong learner capabilities
   - the impact of learning disposition, fixed/variable view of intelligence, and learning power dimensions on engagement, involvement and academic achievement.

4 **The relationship of quality of pedagogy and specific TfEL elements on student characteristics—disposition to learn, interest, positive affect, negative affect and negative social functioning.**

5 **The impact of the SA TfEL Pedagogy Research Project Stage 1: 2010–2012.**

6 **Student perceptions of teachers' pedagogy.**

NOTE | At the time of this research study, the TfEL Framework was new to both Stage 1 and Stage 2 teachers and schools in South Australia. Given this, and that it is an aspirational pedagogical model, teachers were not expected to show highly developed pedagogical repertoires in terms of the TfEL Framework. It is important to keep this in mind when reading and interpreting the key findings.

1 | Observed pedagogical repertoire

These findings were determined through single point observations of teacher practice. Individual teacher scores for pedagogical practice in terms of the TfEL Framework were determined using an observation protocol derived from the four TfEL quality tests[36] of intentionality, effectiveness, consistency and responsiveness that were applied to each of the twelve elements of the TfEL Domains 2–4. Observers rated independently and then reached a consensus rating. The reliability of the ratings was moderated consistently and the inter-rater reliability was very high.[37]

[33] Pedagogical repertoire refers to the range of TfEL elements observed and the quality of practice as determined by the four TfEL quality tests. A high pedagogical repertoire indicates that a high range of TfEL elements were observed in the teacher's practice and that they were rated highly in terms of the Quality Tests – intentionality, effectiveness, consistency and responsiveness.

[34] A world view, or '*Weltanschauung*', refers to the framework of ideas and beliefs through which an individual, a group of people or a culture interprets and interacts with their world.

[35] The term 'epistemic' is used here to refer to a person's assumptions and beliefs about knowledge and how it is acquired, and the influence those assumptions and beliefs have on their approach to learning and to teaching.

[36] The TfEL Framework identifies four quality tests that are applied to each element of practice to address the complexity of teaching practice. The quality tests are intentionality, effectiveness, consistency and responsiveness. They identify the qualitative and contextual nature of effective teaching and learning.

[37] Their independent assessments were used to calculate the inter-rater agreement (Stage 1—Inter-rater agreement = 0.81; Stage 2—Inter-rater agreement = 0.94).

Teachers for both Stage 1 and Stage 2 of the research were generally unfamiliar with the TfEL Framework. Two stages of research allowed for comparison:

- In Stage 1 in 2010–2012, observations were made of 253 teachers in a sample of 20 low SES primary schools
- In Stage 2 in 2013 observations were made of 231 teachers in a random, but representative sample of SA DECD schools—twenty primary schools, eight secondary schools and one R–12 school, across the full range of Index of Disadvantage (IoD).

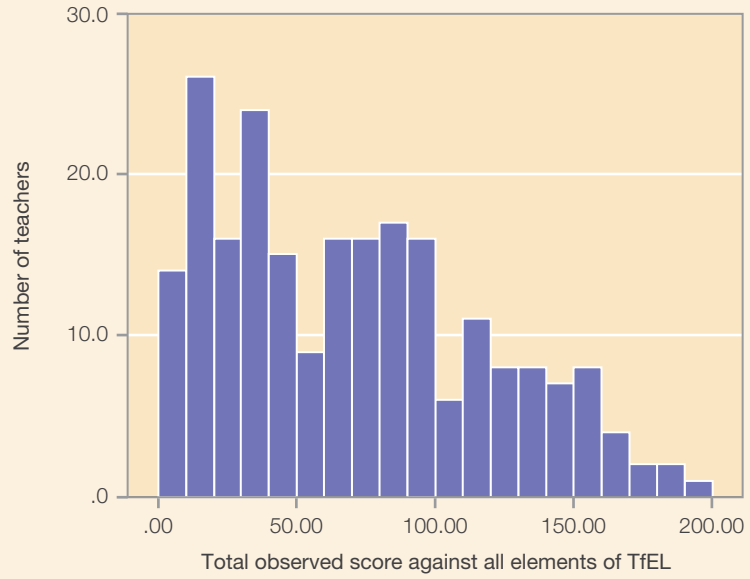
Total scores for single point observations of practice

Key finding 1.1: When first introduced to the TfEL Framework, teachers demonstrated three different stages of development of their pedagogical repertoire. These stages do not correlate with the teacher's age, gender, experience or academic qualifications.

The total score for each teacher was determined by rating the teacher on each element against each of the four quality tests on a scale of 0–4. Each element therefore has a total possible score of sixteen and there are twelve elements, giving a highest possible total score of 192.

When interpreting the total scores, keep in mind that in this study the score for a teacher's practice was determined from a single point observation of practice. Ideally, teaching and learning strategies are designed intentionally to achieve particular learning outcomes for a specific group of individual learners. Thus, in any one observation of a teacher's practice, certain TfEL elements might well feature more prominently than others and some elements might not be observed at all. This could be entirely appropriate in a specific learning context. For example, in situations when developing and clarifying learners' understanding is the main focus, Element 3.4: Promote dialogue as a means of learning and Element 4.1: Build on learners' understandings, could be the main TfEL elements that are visible. On the other hand, in situations when ensuring consolidation and transfer of understanding is the desired outcome, Element 4.3: Apply and assess learning in authentic contexts and 4.4 Communicate learning in multiple modes could well be the dominant TfEL elements observed. Thus, depending on the purpose and context for the session in which the observations were conducted, one might not expect to see evidence of all TfEL elements.

Figure 10 | Single point observation scores
SA DECD low SES primary teachers 2010–2012



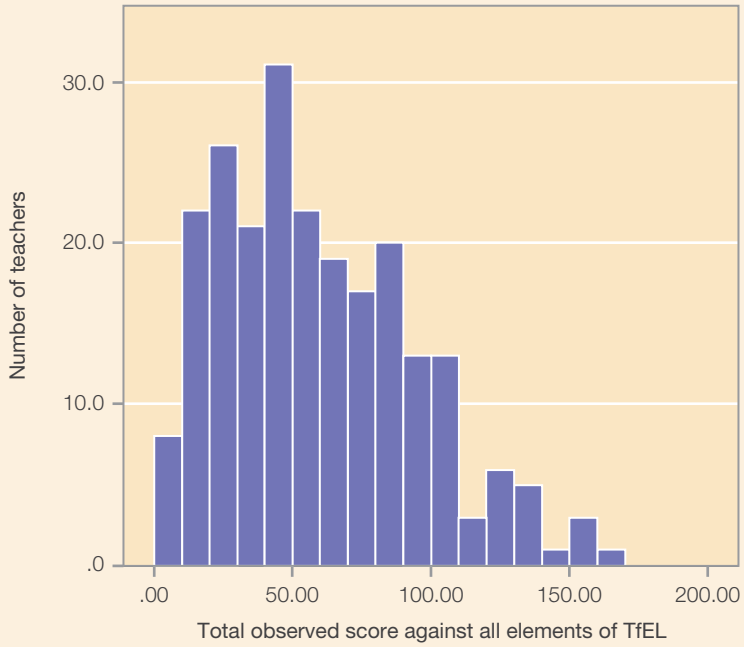
n = 226 Mean = 69.83 SD = 47.49 Median = 63.9

Figure 10 demonstrates how teachers in Stage 1 of this research were observed to have a wide range between the lowest and highest scores for a single point observation, with scores skewed towards a limited repertoire of practice.

This distribution is hardly surprising given the newness of the TfEL Framework and the single point observation. However, it did raise the question as to whether this pattern of observed practice was specific to low SES primary schools or whether it was a pattern for SA DECD teachers in general.

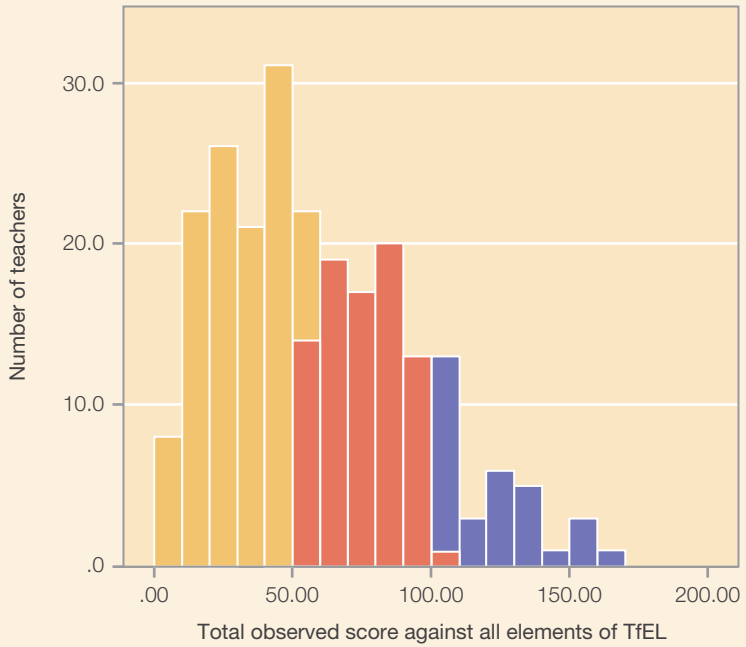
Stage 2 of the research, conducted amongst a random sample of SA DECD schools, highlighted a number of key findings concerning the baseline pedagogical repertoire of teachers in general as well as differences between primary and secondary schools and between schools with low versus high Index of Disadvantage (IoD).

Figure 11a | Single point observation scores
SA DECD primary and secondary teachers 2013



n = 231 Mean = 59.3 SD = 35.43 Median = 52

Figure 11b | Single point observation scores
3 stages of pedagogical repertoire
SA DECD primary and secondary teachers 2013



High | Highly developed pedagogical repertoire n = 31 Mean = 123.20 SD = 18.30
Medium | Moderately developed pedagogical repertoire n = 78 Mean = 76.77 SD = 12.54
Limited | Limited pedagogical repertoire n = 122 Mean = 31.95 SD = 14.34

Figure 11a demonstrates the same general pattern of the distribution of single point observation scores amongst a random sample of SA DECD schools: that is, a distribution of scores indicating a limited to moderate development of pedagogical repertoire.

Figure 11b looks more closely at this same distribution of scores, grouping them into three stages of pedagogical repertoire. For teachers scoring 50 and below, a limited pedagogical repertoire was observed; for those scoring 50–100, a moderate stage of development of pedagogical repertoire was observed and for those scoring 100 and above, a higher stage of development of pedagogical repertoire was observed. This grouping allowed for a number of useful analyses of results across the research project, especially with regard to understanding the teacher characteristics related to the stages of pedagogical repertoire.

In the first instance, results were analysed to determine if there was any correlation between these stages of pedagogical repertoire and teacher characteristics, such as teacher age, gender, academic qualification and teaching experience. No significant correlation was found to exist between the stages of pedagogical repertoire and any of these teacher characteristics. This raises the question as to what factors contribute to teachers displaying a highly developed pedagogical repertoire versus a limited pedagogical repertoire.

Domain scores for single point observations of practice

Key finding 1.2: The most highly observed domain of practice, regardless of whether primary or secondary school teacher and regardless of the Index of Disadvantage (IoD) of the school, was Domain 2: Create safe conditions for rigorous learning, with an emphasis on creating safe conditions rather than on rigorous learning.

Whereas the distribution of total scores for each teacher gives a macro view of the pedagogical repertoire of SA DECD teacher practice, an analysis of the data at the TfEL domain and element levels provides a progressively more detailed view of how the pedagogical repertoire of teachers in primary and secondary schools might be alike or different. It similarly provides a comparison between sites with different indices of disadvantage.

Whilst it is important to be cautious about jumping to conclusions when interpreting the distribution of total scores, the scores on each domain and each element are very informative. The likelihood of TfEL elements being observed increases along with the increasing number of teachers being observed and the greater the variety of contexts in which they are observed.

Table 2 shows the total observation scores by domain for both stages of the SA TfEL Pedagogy Research Project.

A key finding from Stage 1 2010–2012 (column F) was that Domain 2: Create safe conditions for rigorous learning was the most highly observed domain of practice. Stage 2 of the research asked if this finding was generalisable to all teachers in SA DECD schools.

Table 2 | Median single point observation scores by TfEL domain for SA DECD teachers 2010–2013

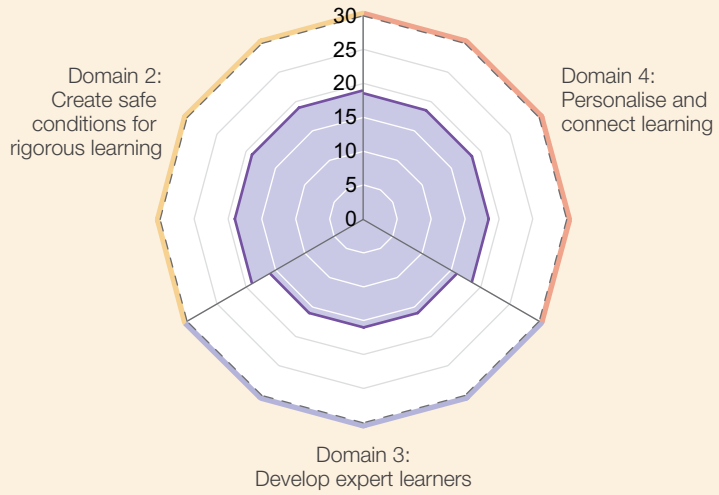
	Observation scores by TfEL domain					
	A	B	C	D	E	F
SA DECD schools	Primary, R–12, secondary n=231[38]	Primary n=115	Secondary n=101	Primary and secondary IoD 1–4 n=89	Primary and secondary IoD 5–7 n=142	Low SES primary 2010–2012 n=252
Domain 2: Create safe conditions for rigorous learning						
Mean	20.93	21.21	20.71	19.42	21.88	26.6
SD	12.76	11.96	13.98	12.04	13.14	17.06
Median	19.00	19.00	19.00	17.50	20.75	23.63
Domain 3: Develop expert learners						
Mean	18.36	20.38	16.44	15.70	20.03	21.45
SD	12.57	13.40	11.46	11.52	12.96	15.89
Median	16.00	17.50	13.00	13.00	18.00	18.25
Domain 4: Personalise and connect learning						
Mean	20.05	19.84	20.24	17.85	21.42	22.20
SD	12.53	11.89	13.55	11.02	13.24	16.57
Median	18.50	18.00	18.00	16.50	20.5	19.00

The 231 teachers[39] from a random sample of SA DECD schools that made up the 2013 study (column A) can be considered to be representative of SA DECD teachers. Domain 2: Create safe conditions for rigorous learning has the highest score and, while not significantly[40] different from Domain 4: Personalise and connect learning, it is significantly different from Domain 3: Develop expert learners. Clearly Domain 2 is consistently the domain with the highest observation score, which replicates the finding for the Stage 1 study of teachers in low SES primary schools (column F).

38 & 39 The total sample included one R–12 school. In creating the subsamples to compare primary and secondary teachers, the teachers in the R–12 school were not included as many teachers in R–12 schools teach across the primary and secondary years.

40 When the terms 'significantly different' or 'significant difference' are used in this report, it indicates that the likelihood of a difference in scores being simply due to chance is less than 5% ($p < 0.05$). When a difference in two scores is noted as *not* significantly different it means that the observed difference has a greater than 5% likelihood of being simply due to chance.

Figure 12 | Median single point observation scores by TfEL domain
SA DECD primary and secondary teachers 2013



Polar axis: Total possible domain score = 64 [4 elements x 16]
[Figure shows scale discontinued at 30]

Primary and secondary teachers 2013

Figure 12 provides a 'spider' diagram representing column A in Table 2. (For an explanation of 'spider' diagrams, see Figure 14 on p.35.)

Further discussion

The observation team research officers provided further insight into the nature of teacher practice associated with Domain 2: Create safe conditions for rigorous learning: they observed a greater emphasis on 'safe conditions' rather than on 'rigorous learning'. Furthermore, for Element 2.4: Support and challenge students to achieve high standards, there was a greater emphasis on 'support' rather than 'challenge'.

Research officers also reported that there was a greater focus on social and personal support than on learning support, and a lack of emphasis on setting high expectations and learning challenges.

This recognition of a general emphasis by teachers on creating 'safe conditions' for learning over 'rigorous learning', or 'support' over 'challenge', led to two major responses by SA DECD Teaching and Learning Services:

1 The original wording of Element 2.4 in the TfEL Framework was amended from 'Support and challenge students to achieve high standards' to 'Challenge students to achieve high standards with appropriate support'.

2 Professional learning events focused on raising teacher awareness of the general emphasis on support over challenge. Professional development commenced across the state to support teachers to design learning experiences that emphasised intellectual stretch and challenge, whilst paying attention to the specific, scaffolded support.

Furthermore, analysis of single point observation scores by domain revealed that Domain 3: Develop expert learners was the least commonly observed domain of practice for SA DECD teachers overall.

Element scores for single point observations of practice

Key finding 1.3: The three least observed elements of practice for teachers are:
2.3 Negotiate learning
3.3 Explore the construction of knowledge
4.3 Apply and assess in authentic contexts.
The degree to which the observation scores for these elements are lower differs across the three stages of pedagogical development.

Having established that there were differences in the extent to which each of the three TfEL domains of practice were observed in teacher repertoires, further analysis explored any difference in scores for each of the TfEL elements in each domain.

Figure 13 shows the median of the range of observation scores for each element amongst the Stage 1 sample of low SES schools. (Figure 14 explains how a 'spider diagram' of median observation scores relates to the full distribution of observed scores.)

Figure 13 highlights a finding from Stage 1 of the research project that became known as 'point three-ness'. One element in each domain showed a significantly lower level of development (based on observations of practice) than the other elements in that domain. The lowest scoring element in each domain was:

- 2.3: Negotiate learning
- 3.3: Explore the construction of knowledge
- 4.3: Apply and assess learning in authentic contexts.

One could question whether it is reasonable to assume that each of the TfEL elements would be equally evident in teacher practice: are each of the TfEL elements likely to be employed with equal regularity? Even if, by virtue of their nature, it is appropriate to assume that some elements are engaged with different regularity, the extremely low observation scores for the three elements in question indicate that they were very rarely observed. The Stage 2 research sought to investigate whether this pattern was generalisable to all SA DECD schools.

Figure 13 | Median single point observation scores by element
SA DECD low SES primary teachers 2010–2012

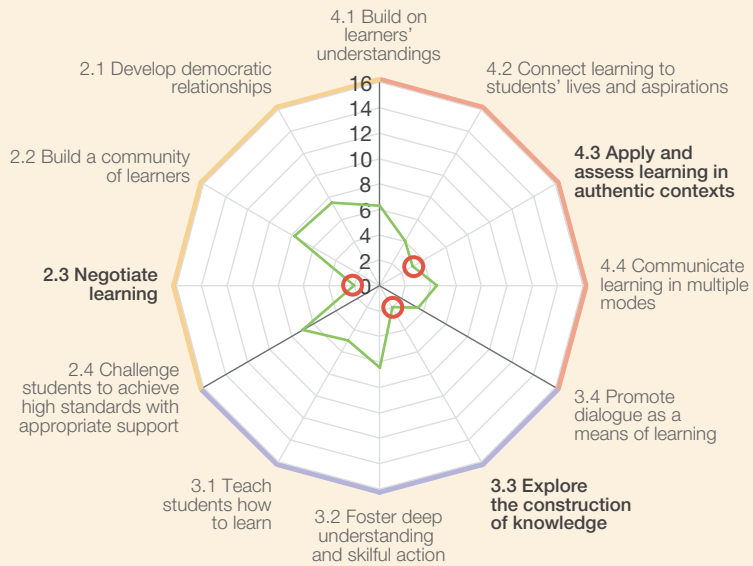
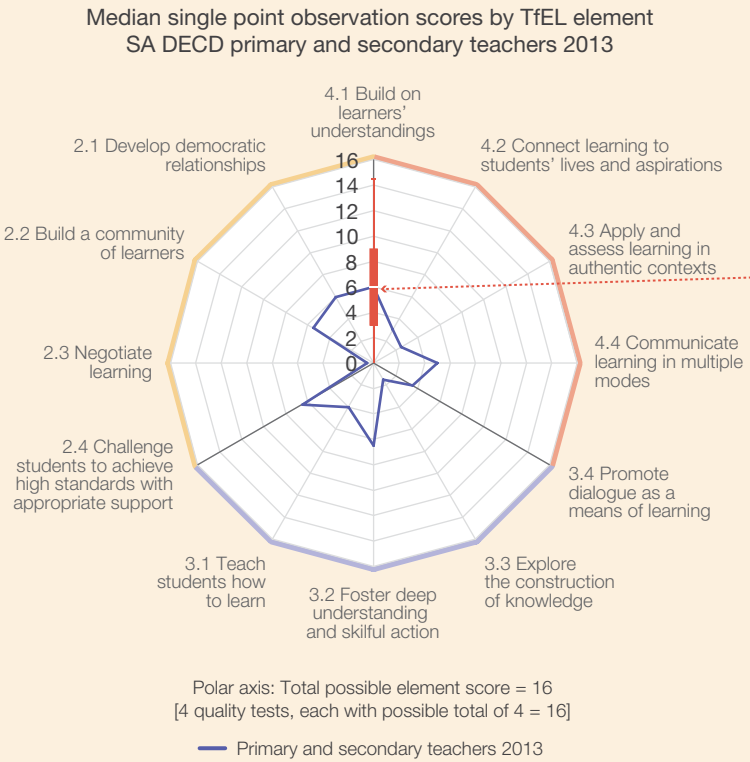


Figure 14 | How to interpret 'spider' diagrams

'Spider' diagrams only show the **median** score for each TfEL element. The red 'box and whisker' graphic overlaying the 'spider' diagram below, shows that whilst 6 was the median single point observation score recorded for TfEL Element 4.1, it should be noted that 50% of scores were greater than 6 and 50% of scores were less than 6.

'Box and whisker' diagrams show the full **range** of scores from highest to lowest, the **median** score [middle white line] and the **distribution** of scores by percentile—the highest 25% of scores, the middle 50% of scores and the lowest 25% of scores. The distribution of scores by percentile for TfEL Element 4.1 is highlighted in red below as an example.



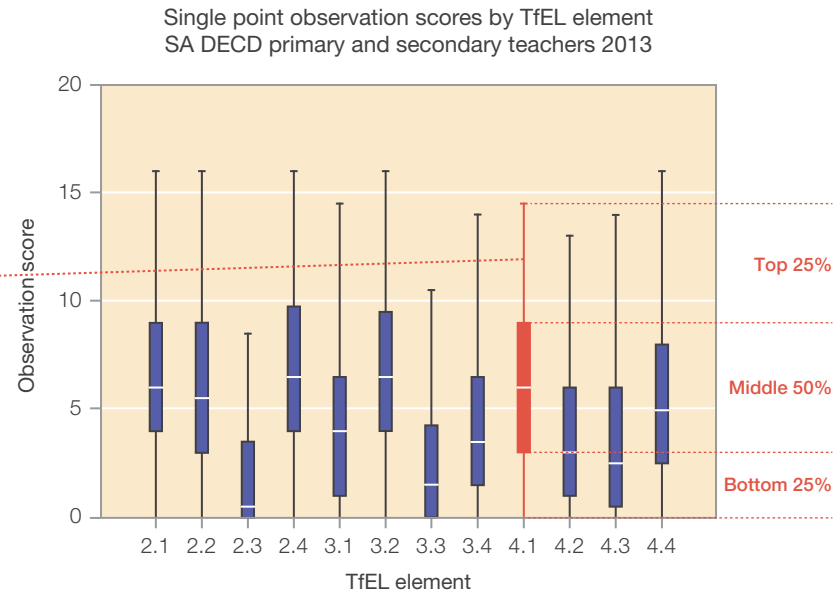


Figure 15 | Median single point observation scores by element
SA DECD primary and secondary teachers 2013

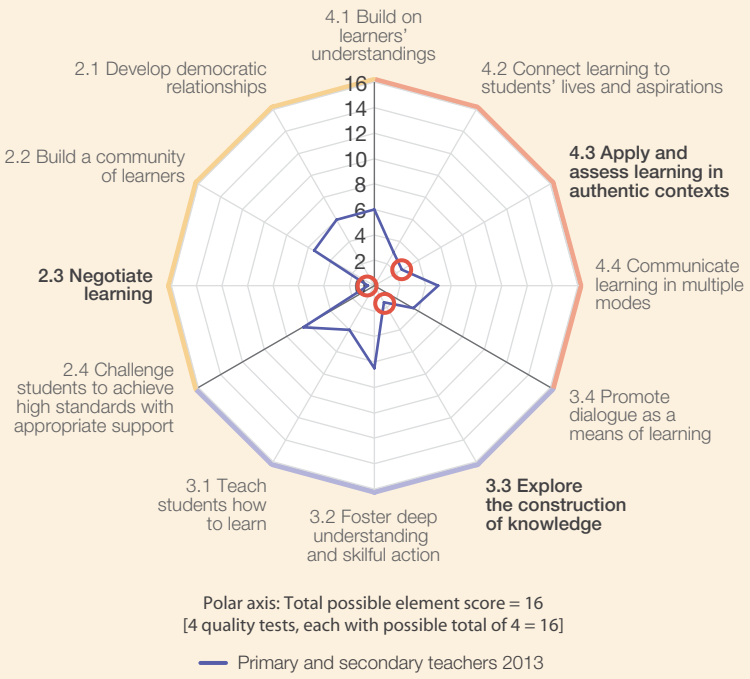


Figure 15 shows the median observation scores by element for SA DECD teachers generally in 2013. Although not strictly identical to those displayed by low SES primary teachers in Figure 13, it can be seen that the same general pattern of relative strength of elements was observed for SA DECD primary and secondary teachers in general.

Figure 16 | Median single point observation scores by element
3 stages of pedagogical repertoire
SA DECD low SES primary teachers 2010–2012;
primary and secondary teachers 2013

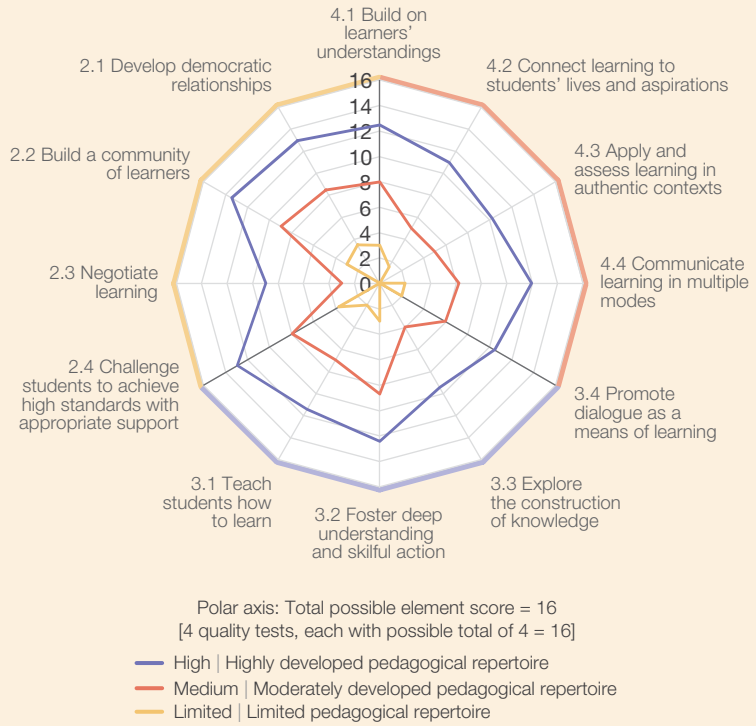


Figure 16 plots the observation scores by element against the three stages of pedagogical repertoire for the combined 2010–2012 and 2013 samples. This creates a robust sample[41] of observation scores from which one can analyse the element scores by the three stages of development of pedagogical repertoire. It is clear from this 'spider' diagram that the degree to which 'point three-ness' exists is different across the three stages of pedagogical repertoire.

[41] Although the combined sample cannot be claimed to be a random sample of schools, it is quite appropriate to combine the two groups for the purposes of examining the characteristics of the teachers with different stages of pedagogical repertoire. The distinction between the stages of pedagogical repertoire is determined by breakdown of the distribution of the total single point observation scores: high pedagogical repertoire > 100, moderate pedagogical repertoire 50–100, and limited pedagogical repertoire < 50 (see Figure 11b).

All three stages of pedagogical repertoire show a pronounced dip in scores on Element 2.3: Negotiate learning. The teachers with a more highly developed repertoire show less of a dip in scores on Element 3.3: Explore the construction of knowledge. Those teachers with a moderate repertoire and those teachers with a highly developed repertoire show less of a dip on Element 4.3: Apply and assess in authentic contexts. Elements 2.3: Negotiate learning, 3.3: Explore the construction of knowledge and 4.3: Apply and assess in authentic contexts were rarely observed in the practice of teachers with the least well-developed pedagogical repertoire.

Further discussion

This finding is particularly significant in the SA context, given that these three TfEL elements are part of the key to raising SA students' academic achievement. Neuroscience research shows that learning is essentially the formation of new or stronger neural connections and that learning is aided by tapping into already existing pathways. By integrating school learning into contexts that are relevant to students' lives (Element 4.3: Apply and assess in authentic contexts), teachers are tapping into and extending students' existing neural networks.

Neuroscience also shows that rehearsal and practice builds stronger, more hard-wired connections in the brain. But rote memorisation (memorising information that has no meaning), rehearsal and repetition of disconnected information, is not the solution. Rather, the solution lies in putting information and new learning in context and applying and practising the use of newly learned ideas and skills in authentic, meaningful contexts.

> *Whenever new material is presented in such a way that students see relationships between concepts they generate greater brain cell activity and achieve more successful long-term memory storage and retrieval.*[42]

Another relevant finding from cognitive psychology research is that students are supported and encouraged to use their brains when they are explicitly taught how to explore the construction of knowledge (Element 3.3), how to learn (Element 3.1) and that intelligence is not fixed.

In their 2007 study of the impact of notions of intelligence on academic achievement, Blackwell, Trzesniewski and Dweck[43] reported the outcomes of a series of workshops they designed for 91 junior high school students whose math grades were declining. Approximately half of the students, the control group, received instruction in skills only, whereas the others attended a combination of skills and learning about growth mind-set and how to apply it to schoolwork.

The students who were taught that, like a muscle, the brain can get stronger with use and that learning prompts neurons to grow new connections, began to see themselves as responsible for their own brain development and their maths grades stopped declining and began to climb back to their previous levels. In contrast the maths grades of the students who learned only skills continued to decline.

Furthermore, teachers reported noticing significant motivational changes in 27 percent of the children in the growth mind-set workshop as compared with only 9 percent of students in the control group.

The significance of Element 2.3: Negotiate learning is that negotiating how and what they learn increases ownership, enhancing their sense of agency resulting in higher motivation to achieve. The early SA research (Figure 8a on p.16) showed that negotiating learning resulted in greater persistence and time on task and, ultimately, greater metacognitive processing.

The TfEL elements 2.3: Negotiate learning, 3.1: Teach students how to learn, 3.3: Explore the construction of knowledge, and 4.3: Apply and assess in authentic contexts, are not only contributing to developing lifelong learner capabilities, but have been shown to have a significant impact on academic achievement.

The significance of Element 2.3: Negotiate learning is that negotiating how and what [students] learn increases ownership, enhancing their sense of agency resulting in higher motivation to achieve.

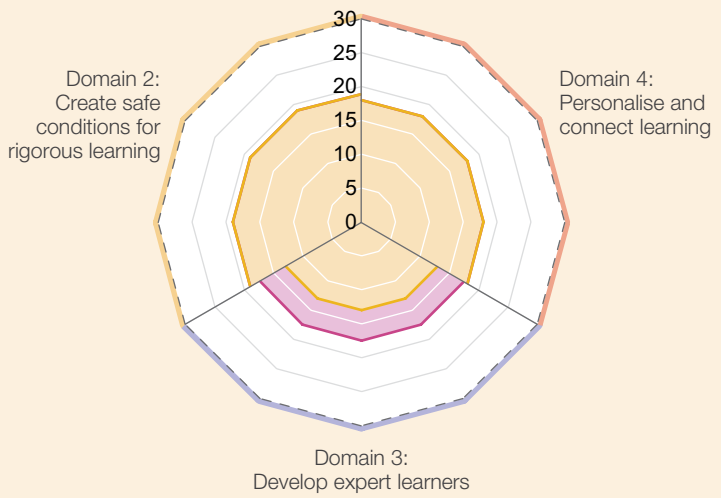
[42] Willis J (2007) *Research-Based Strategies to Ignite Student Learning*, ASCD
[43] Blackwell et al (2007)

Domain and element scores for single point observations of practice—primary versus secondary teachers

Key finding 1.3a: Primary school teachers overall score more highly than secondary school teachers with regards to three TfEL elements:
2.2 Build a community of learners
3.1 Teach students how to learn
3.4 Promote dialogue as a means of learning.

Having established that three important TfEL elements, all of which play an important role in unlocking students' potential to make a difference to their own learning, are consistently the least observed in all settings, the question remains as to whether there are further differences in observed pedagogical repertoire. Figures 17 and 18 compare and analyse domain and element scores for primary and secondary teachers.

Figure 17 | Median single point observation scores by TfEL domain
Comparison of primary and secondary teachers
SA DECD primary and secondary teachers 2013



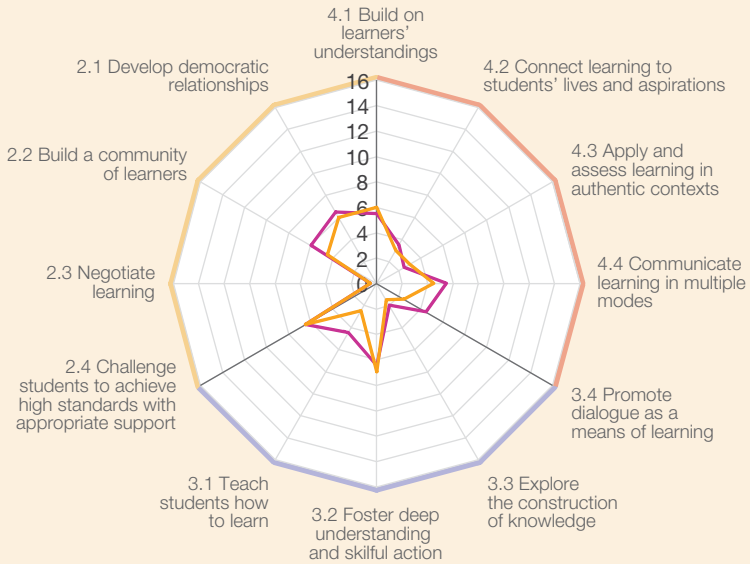
Polar axis: Total possible domain score = 64 [4 elements x 16]
[Figure shows scale discontinued at 30]

Primary teachers 2013
Secondary teachers 2013

Figure 17 shows the observation scores by domain for primary and secondary schools. This is a diagrammatic representation of columns B and C in Table 2 on p.32. The comparison between primary and secondary teachers shows identical median observation scores for Domain 2: Create safe conditions for rigorous learning and for Domain 4: Personalise and connect learning. However, secondary teachers show a significantly lower score for Domain 3: Develop expert learners.

Figure 18 shows this more detailed comparison of primary and secondary teachers' observation scores by element. By examining the differences between primary and secondary teachers' observation scores at the element level, it is possible to determine which elements in particular need to be the focus for professional learning.

Figure 18 | Median single point observation scores by element
Comparison of primary and secondary teachers
SA DECD primary and secondary teachers 2013



Polar axis: Total possible element score = 16
[4 quality tests, each with possible total of 4 = 16]

Primary teachers 2013
Secondary teachers 2013

Further discussion

With the advent of the Australian Curriculum and its emphasis on the integration of general capabilities and cross-curricular priorities in all of the Learning Areas, the role of teachers in secondary schools is transformed from 'teachers of a subject' to teachers of the whole person. This represents a significant shift for many secondary teachers. Current understandings about learning and intelligence and how to develop these understandings and associated metacognitive capabilities in students requires further development.

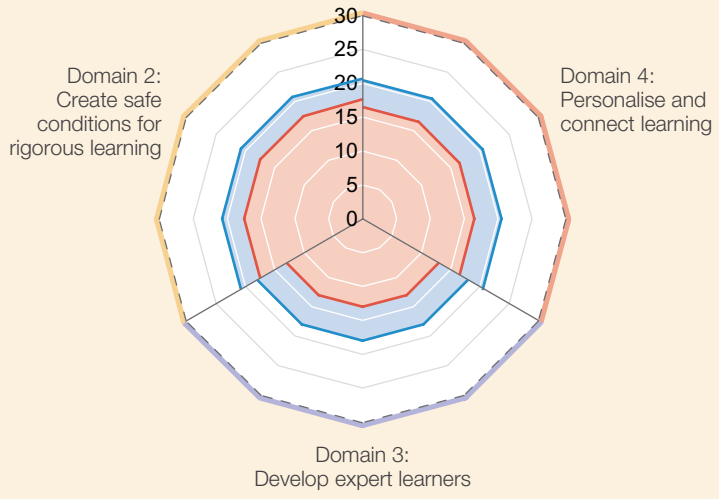
In addition to the need for development of Elements 2.3: Negotiate learning, 3.3: Explore the construction of knowledge and 4.3: Apply and assess in authentic contexts, there is additional need for secondary teachers in particular to develop an understanding of why and how to build a community of learners, to teach students how to learn, and to promote dialogue as a means of learning.

Domain and element scores for single point observations of practice—Index of disadvantage

Key finding 1.3b: Teachers in low SES primary schools scored more highly on observation scores than primary teachers overall with regards to two TfEL elements:
2.1 Develop democratic relationships
2.2 Build a community of learners.

Key finding 1.3c: Teachers in high SES schools (IoD–7) scored more highly than teachers in low SES schools (IoD 1–4) on the majority of TfEL elements, with this difference being significantly higher on elements:
3.1 Teach students how to learn
3.4 Promote dialogue as a means of learning
4.2 Connect learning to students' lives and aspirations
4.4 Communicate learning in multiple modes.

Figure 19 | Median single point observation scores by TfEL domain
Comparison of IoD 1–4 schools with IoD 5–7 schools
SA DECD primary and secondary teachers 2013



Polar axis: Total possible domain score = 64 [4 elements x 16]
[Figure shows scale discontinued at 30]

IoD 1–4 schools 2013
IoD 5–7 schools 2013

A further question remains as to whether there are further differences in observed pedagogical repertoire across sites with different indices of disadvantage.

Figure 19 compares and analyses domain and element scores for teachers in schools with different socioeconomic status. It reveals that for teachers in schools with IoD 1–4, all three domains are observed less frequently than in schools with IoD 5–7. The domain score for IoD 1–4 for Domain 2: Create safe conditions for rigorous learning, while appearing visually to be lower than IoD 5–7, is not actually significantly lower—the difference could simply be due to chance (see footnote 40 on p.32 for an explanation of 'chance' when interpreting data).

There is a significant difference, however, for Domain 3: Develop expert learners and Domain 4: Personalise and connect learning, with the schools of higher socioeconomic status showing higher observation scores. The fact that the observation scores by domain for IoD 1–4 schools are significantly lower than for IoD 5–7 schools for these two domains raises considerable concern. It appears that the very students who stand to gain the most benefit from high quality pedagogy to develop their capacity as learners (Domain 3: Develop expert learners) and to make learning relevant and personally significant (Domain 4: Personalise and connect learning) are those who are experiencing more limited pedagogical practice in these two domains.

Figure 20 | Median single point observation scores by element
Comparison of low SES primary teachers with primary teachers overall
SA DECD low SES primary teachers 2010–2012 and primary teachers 2013

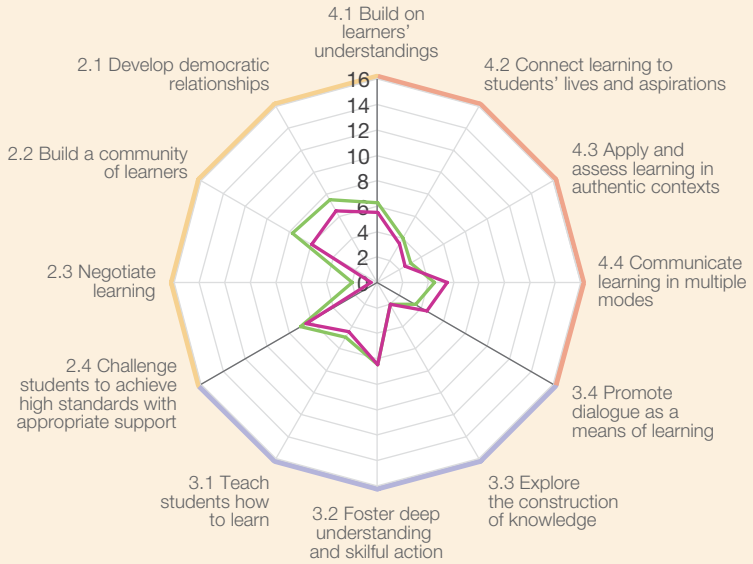


Figure 20 analyses observation scores at the element level, comparing low SES primary teachers (Stage 1) with primary teachers overall, to explore whether the observation scores were lower for all elements in the two domains—Domain 3: Develop expert learners and Domain 4: Personalise and connect learning. Both settings show the same general pattern. However, there are significant differences on two elements—2.1: Develop democratic relationships and 2.2: Build a community of learners—with teachers in low SES primary demonstrating these two elements more highly.

Further discussion

It is not surprising that primary teachers in low SES schools, as compared to primary teachers in general, show higher observation scores on Element 2.1: Develop democratic relationships and Element 2.2: Build a community of learners, as they no doubt consider the wellbeing of the students and creating safe conditions as paramount.

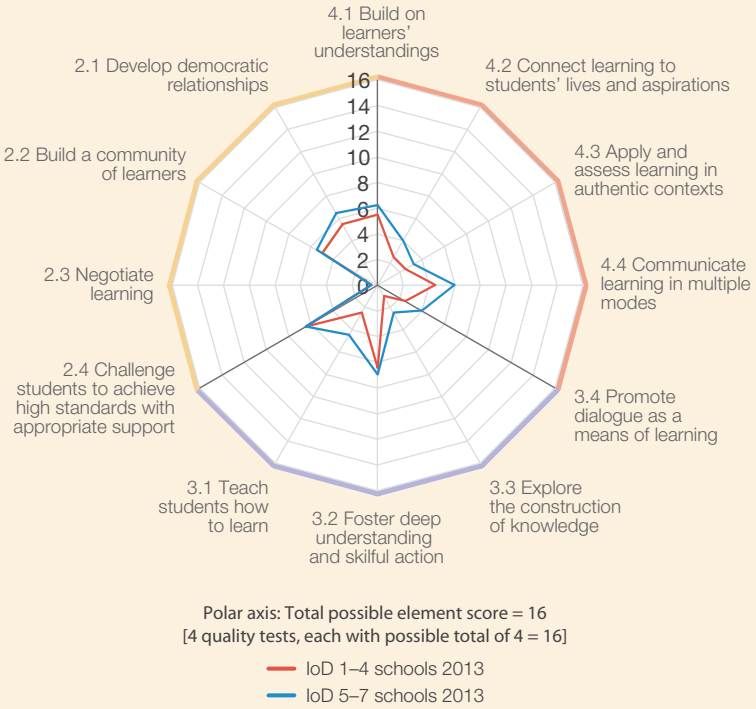
The challenge for all primary teachers in SA DECD schools is how to improve pedagogical practice for the domains and elements that are most powerful at increasing the level of personal significance in learning and raising each learner's sense of agency—Domain 3: Develop expert learners and Domain 4: Personalise and connect learning.

Figure 21 reports on the differences between teachers' observation scores in sites with IoD 1–4 and sites with IoD 5–7 at the element level. This makes it possible to determine which elements in particular need to be the focus for professional learning for teachers in low SES schools in general. The analysis revealed that for teachers in schools with IoD 1–4, four elements were observed significantly less frequently than in schools with IoD 5–7. Those elements are:
3.1 Teach students how to learn
3.4 Promote dialogue as a means of learning
4.2 Connect learning to students' lives and aspirations
4.4 Communicate learning in multiple modes.

The analysis of the comparison of observation scores by domain for primary teachers with those of secondary teachers, as well as the comparison of observation scores by domain between teachers in IoD 1–4 and IoD 5–7 schools, highlighted the domains of TfEL that need to be targeted for different sectors and school sites in professional learning, both at the system

level as well as in professional learning communities within schools. Although the analysis highlighted patterns of general differences, it is important to remember that there are always exceptions to any generalisation. It should not be assumed that all teachers and all sites fit the general pattern.

Figure 21 | Median single point observation scores by element
Comparison of IoD 1–4 schools with IoD 5–7 schools
SA DECD primary and secondary teachers 2013



2 | The relationship between teachers' world views and the quality of pedagogy

Key finding 1.1 for this report stated that the three identifiable stages of pedagogical repertoire for SA DECD teachers do not correlate with the teacher's age, gender, experience or academic qualifications. So what are the characteristics that separate the pedagogical practice of these three groups of teachers?

Having gathered observation data that showed the baseline level of pedagogy against TfEL, qualitative methods[44] were used to identify teachers' ability to articulate their ideas about learning and teaching and explore if these influenced their pedagogical repertoire.

The process of analysis of qualitative data is complex. To make sense of the data, both bottom up and top down coding methods were used. Bottom up coding looks for emerging concepts that help categorise the data. This involves a complex action of moving back and forth between emerging concepts and the data. Both inductive and deductive reasoning processes are used to sort emerging concepts and categories to identify those that express the essence of recurring themes, and those that are unique, exhaustive and mutually exclusive. The top down approach, on the other hand, involved using coding categories from the TfEL Framework. In both cases the data is coded based on the frequency of the categories being mentioned.

The analysis of qualitative interview data from the SA TfEL Pedagogy Research Project Stage 1 provided early signals that teachers' world views were strong determinants of the nature and quality of their practice. The Stage 2 research gave the opportunity to deepen and consolidate these early indications.

Two clear findings emerged, both related, but which tell slightly different stories:

- teachers' perceptions of their role and the impact on their practice
- teachers' epistemic awareness and the impact on their approach to teaching—their view of the nature of knowledge and how it is acquired, combined with an awareness that their assumptions affect their approach.

A total of 160 teacher interviews from the Stage 1 2010–2012 study and the Stage 2013 study focused on the different teacher world views, with regard to their role and their epistemic assumptions and awareness, as reliable, broad categorisations[45] of what distinguishes their practice and their approach to teaching and learning.

Teachers' perceptions of their role and the impact on their practice

Key finding 2.1: Teachers' beliefs and assumptions about their role have an impact on their practice. Three orientations to practice were identified:

- content coverage and control: *the teacher's role is to cover the curriculum*
- high relationship—low challenge: *the teacher's role is to care for the students*
- responsive—learning and student-centred pedagogy: *the teacher's role is to ensure learners learn meaningfully*.

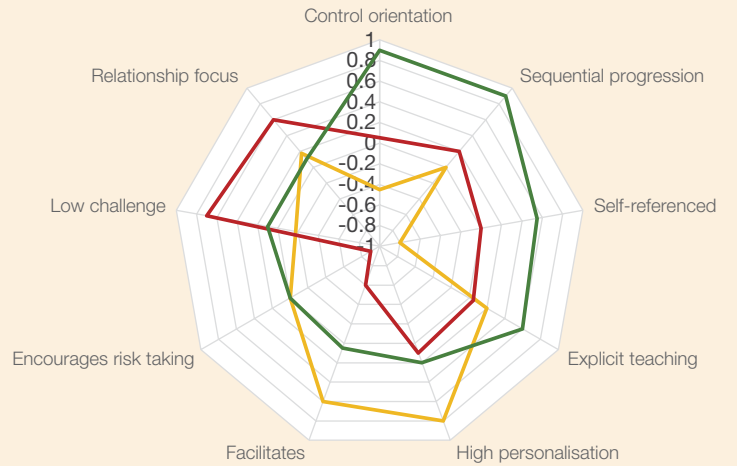
The qualitative data related to teacher practice was coded according to nine codes that emerged over a number of iterations of analysing the data. A standardised scale[46] was used to enable direct comparison between the ratings against each of the codes. The interviews from teachers' talk about their practice were coded and a clustering technique applied which revealed three distinctly different groups.

[44] Two qualitative methods were used—Most Significant Change (MSC) stories and narrative interview.

[45] Classifying teachers as falling into one or other of the broad categories carries a risk of over simplification. Each of the categories related to how they see their role and to how they approach teaching and learning are defined by a number of codes (dimensions). Whilst very distinct clustering was found in the statistical analysis, it is critical to keep in mind that teachers are scattered across a range of positions against these codes. Each individual represents a variation on a broad theme but shows a leaning towards the various categories identified.

[46] A standardised scale indicates where scores fall in relation to the mean (average) score. The mean score is assigned zero. A score of +1 indicates the score falls one standard deviation above the mean score. One standard deviation above the mean corresponds approximately to the top 16% of ratings. A score of -1 corresponds to approximately the bottom 16% of ratings.

Figure 22 | Teachers' assumptions about their role and effect on practice
Interviewed subsample
SA DECD primary and secondary teachers 2013



Polar axis: Standardised z scores scale -1 – 0 – +1
[0 = mean score, -1 and +1 indicate one standard deviation below or above the mean score]

- Content coverage and control: *the teacher's role is to cover the curriculum*
- High relationship–low challenge: *the teacher's role is to care for the students*
- Responsive–learning and student-centred pedagogy: *the teacher's role is to ensure learners learn meaningfully*

Figure 22 plots the three distinctly different groups in terms of the characteristic language and focus when talking about teaching and learning. Taking each group in turn, it is possible to see how these groupings emerged.

The group labelled as **'Content coverage and control'** in Figure 22 articulated a view of the teacher's role as covering the curriculum and placed far more emphasis than the average teacher on the following codes:

- Control orientation
- Sequential progression
- Self-referenced
- Explicit teaching.

These codes can be understood as follows:

Control orientation: teachers who scored well above average on this code strongly emphasised keeping control and that they find it difficult, if not impossible, to hand over control or choice to students. Their language implied a lack of trust that students would achieve the necessary outcomes if they were given choice. They indicated that they had worked out what they would do to cover the curriculum and what that means students will do.

Sequential progression: teachers who rated highly on this code spoke of the need to operate within a carefully planned environment because there is a logical progression through a subject which dictates what has to be learned first and what follows. The content is the reference for what and when students do something, not what the students know and might need to know in order that they can engage with the content. Their language is characterised by 'students can't learn this without first learning that': there is a 'right way' to encounter the content and it builds sequentially. Some teachers expressed discomfort at not having a good grasp of curriculum to aid their planning.

Self-referenced: this code was used to capture a strongly teacher-directed stance, with the teacher as centre-stage, directing the learning with little or no reference to the learners' needs and interests.

Explicit teaching: a high rating on this code indicated a dominant, if not exclusive, focus on a highly structured, scripted teaching environment in which each aspect of the teaching is made explicit. Their talk about their practice placed emphasis on meeting the curriculum requirements through direct instruction and information-giving, rather than exploration. This is in contrast to teachers whose score on this code was average. They spoke of engaging in explicit teaching more in response to individual learners' needs rather than as the default mode of practice.

The strong message that came through from the combination of these four codes was that the teachers perceived that there was a prescribed curriculum: it was their responsibility to teach the curriculum, and the best way to do this was through teacher direction and control. The scores for this group on the remaining five codes of high personalisation, facilitates, encourages risk taking, low challenge and relationship focus were average.

The interviews from teachers' talk ...[revealed]...three distinctly different groups in terms of the characteristic language and focus when talking about teaching and learning.

Three orientations to practice were identified:

- content coverage and control: *the teacher's role is to cover the curriculum*
- high relationship—low challenge: *the teacher's role is to care for the students*
- responsive—learning and student-centred pedagogy: *the teacher's role is to ensure learners learn meaningfully*.

The group labelled as **'High relationship—low challenge'** in Figure 22 articulated a view of the teacher's role as being to care for students and they placed far more emphasis than the average teacher on the following codes:

- Relationship focus
- Low challenge.

These codes can be understood as follows:

Relationship focus: language used by teachers who rated very highly in this code included *'being there for the child'*, *'establish bonds'* and *'protect my children'*. The focus of their perception of their important role as teachers was akin to a parenting relationship of nurture and protection.

Low challenge: a high rating on this code related to a teacher seeing their role as protecting students from failure. It included seeing their role as providing extensive scaffolding to keep the learner feeling *'safe'*. They avoided approaches and strategies that challenged students with regard to learning and they also avoided strategies that encouraged students to think for themselves. The fact that this code also included teacher comments about low challenge with regard to themselves suggested that the teacher's own discomfort in being challenged flowed over such that they avoided challenging students.

Further to having above average scores on those two codes, the teachers who were clustered together as high relationship—low challenge scored well below average on two codes:

- Risk taking
- Facilitates.

They actively discouraged risk taking and did not engage in giving students choice. Their scores on the remaining codes of high personalisation, explicit teaching, self-referenced, sequential progression and control orientation were average.

The strong message that came through from the combination of the two codes of relationship and low challenge, combined with the active discouragement of risk taking and their low score on facilitates was that these teachers perceived that it was their responsibility to relate to and protect students. Their degree of control of what and how students learned was more to do with making sure students felt 'safe' than it was to do with any need to 'cover the curriculum'.

The group labelled as **'Responsive—learning and student–centred'** pedagogy, Figure 22, articulated a view of the teacher's role as one of ensuring learners learn meaningfully and they placed far more emphasis than the average teacher on the following two codes:

- Facilitates
- High personalisation.

These codes can be understood as follows:

Facilitates: teachers who rated highly on this code spoke strongly about giving students choice in what and how they learn and in taking an 'arm's length approach' once the students are engaged in the learning. They emphasised that their approach was to see which processes were working well for which students, and to intervene as needed to guide or 'nudge' the students' thinking by involving them in identifying what they needed to achieve and which strategies might work well. They were clear about the learning intentions, but the strategies they used to help learners achieve the desired outcomes were driven by a responsiveness to the learners' needs.

High personalisation: teachers who rated very highly on this code placed value on personalising learning. They spoke of *'encouraging interest'*, *'fit the learner's way of learning'* and *'challenging individuals to do better'*.

This group of teachers were not self-referenced. Their reference point was the learner and how successfully the individual learner was responding to the task. They were lower than average on control orientation and leant towards, rather than away from, challenge. Their score on the remaining codes of explicit teaching, sequential progression, relationship focus and encouraging risk taking were average, with their explanation being that the strategies they used were in direct response to identified need. An explicit, highly scaffolded approach was used when they perceived that was what the learners, individually or collectively, needed to achieve success with regard to the learning intentions.

Teachers' epistemic[47] awareness and the impact on their approach to teaching

Key finding 2.2: Teachers' epistemic awareness has an impact on their approach to teaching: a 'teaching as script' approach, which places emphasis on a controlled, sequential progression and following a pre-planned approach, and a 'teaching as design' approach, which is characterised by a responsive, personalised approach to learners' needs in order to achieve desired learning outcomes.

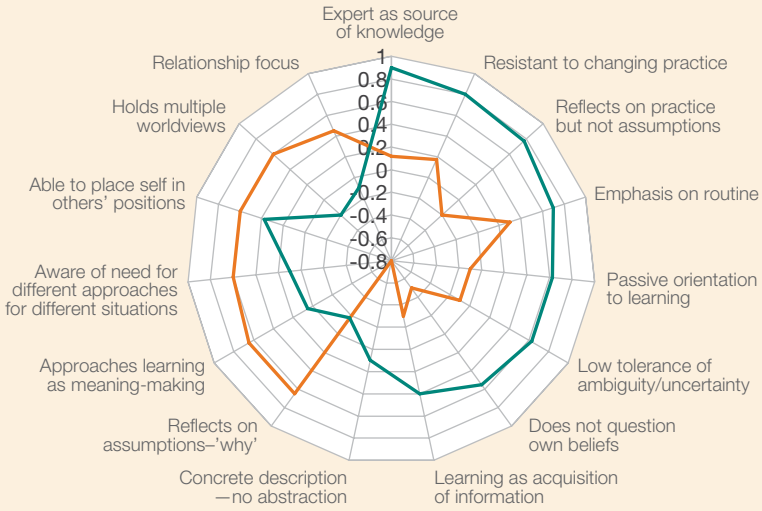
Key finding 2.3: Teachers who have a 'teaching as design' approach demonstrated a more highly developed pedagogical repertoire.

In addition to the codes discussed above and shown in Figure 22, which relate strongly to teachers' talk about their practice, other codes emerged through the interviews and MSC stories that reflected more about what the teachers believed about the nature of knowledge and how we learn, which in turn influenced the way they approached their teaching.

The qualitative data, related to teachers' epistemic assumptions and awareness, was coded according to fifteen codes that emerged over a number of iterations of analysing the data. A standardised scale[48] was used to enable direct comparison between the ratings against each of the codes and a clustering technique was applied to reveal any distinctly different groups.

Figure 23 shows the two distinct clusters that emerged from an analysis of the teachers' epistemic assumptions and their epistemic awareness. An examination of the codes leads to an intuitive connection between the 'script approach to teaching and learning' and 'content coverage and control' (as seen in Figure 22) as well as the connection between the 'design approach to teaching and learning' and 'responsive—learning and student-centred' pedagogy (as seen in Figure 22). Statistical analysis showed these are in fact highly correlated.[49]

Figure 23 | Teachers' epistemic awareness and impact on pedagogical approach
Interviewed subsample
SA DECD primary and secondary teachers 2013



Polar axis: Standardised z scores scale -0.8 – 0 – +1
[0 = mean score, -1 and +1 indicate one standard deviation below or above the mean score]

Script approach to teaching and learning
Design approach to teaching and learning

The cluster that took a 'script approach to teaching and learning' rated highly on codes that reflected that they believe that learning involves a lot of repetition (emphasis on routine), that teaching involves transmitting what the experts know (expert as source of knowledge), and that learning is about going through a set process to gain what the experts know (learning as acquisition of information). In terms of reflection on their own practice, this group thought about what they had done and what they might have done differently, but they did not question their own assumptions about how learning might best occur.

[47] The term 'epistemic' is used here to refer to a person's assumptions and beliefs about knowledge and how it is acquired, and the influence those beliefs and assumptions have on their approach to learning and to teaching.

[48] A standardised scale indicates where scores fall in relation to the mean (average) score. The mean score is assigned zero. A score of +1 indicates the score falls one standard deviation above the mean score. One standard deviation above the mean corresponds approximately to the top 16% of ratings. A score of -1 corresponds to approximately the bottom 16% of ratings.

[49] A Pearson correlation test was performed to determine the size of the correlation between these categories. The 'script' approach and 'content coverage and control' are highly correlated ($r=0.75$, $p = 0.000$) and similarly the 'design' approach and 'responsive—learning and student-centred' pedagogy are also highly correlated ($r = 0.75$, $p = 0.000$)

In contrast, the 'design approach to teaching and learning' cluster showed much higher than average scores on codes that indicated they perceived learning to be about meaning-making (approaches learning as meaning-making) and that individuals construct their own meaning with teacher guidance (able to place self in others' positions; aware of the need for different approaches in different situations). Another key factor that set this group apart was the fact that they did question their own assumptions about knowledge and learning and asked 'why' (reflects on assumptions–'why').

Why, then, are there two sets of codes and two sets of descriptors for teachers? An outcome of the qualitative analysis by top down and bottom-up coding is that slightly different concepts can emerge. None of the groupings are hard and fast groupings that the teachers fall into neatly and cleanly. The 'high relationship–low challenge' grouping only emerged after coding the way teachers talked about their practice rather than their approach to teaching. For example, the power of identifying these themes is that they can help interpret the influences that shape teachers' pedagogical repertoire and guide the nature of professional learning that will be most effective at helping teachers develop their practice.

Those teachers with a 'design approach to teaching and learning' demonstrated higher than average observed scores on all TfEL elements.

These patterns in the data are only useful if they are shown to predict quality of teacher practice. How do these broad differences in teachers' world views relate to their observed pedagogical repertoires?

Figure 24 returns to the Stage 1 study to illustrate the relationship between observation scores by element and the teacher's approach to teaching and learning. Those teachers with a 'design approach to teaching and learning' demonstrated higher than average observed scores on all TfEL elements, with the strongest differences being in relation to:

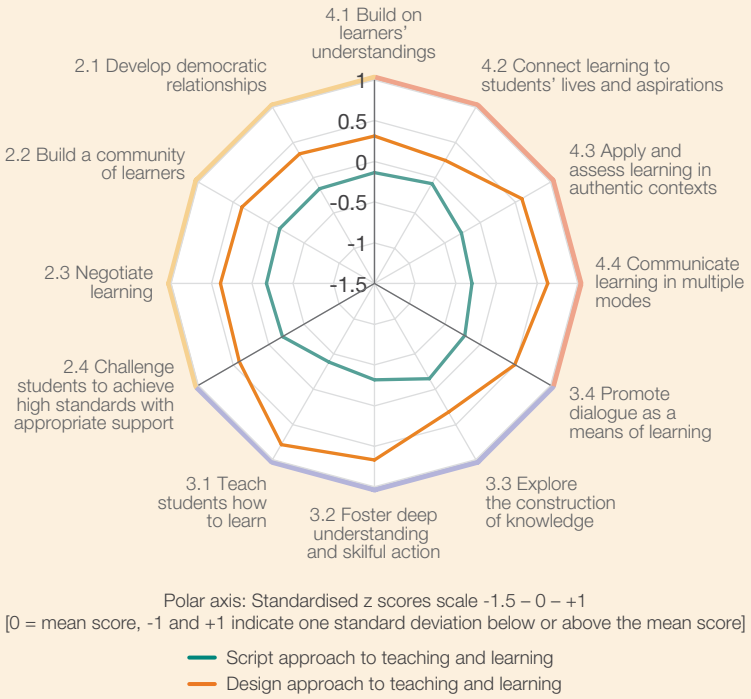
3.1 Teach students how to learn

3.2 Foster deep understanding and skilful action

4.3 Apply and assess in authentic contexts

4.4 Communicate learning in multiple modes.

Figure 24 | The relationship between observed pedagogical repertoire and epistemic awareness—Interviewed subsample SA DECD low SES primary teachers 2010–2012



Further discussion

The analysis of teacher interviews led to some very powerful insights. Both how teachers see their role and their epistemic awareness and understanding have an influence on their practice and on their pedagogical approach. These findings support the earlier findings from the L2L initiative that a key to developing teacher practice lies in developing greater epistemic understanding and reflection—helping teachers understand learning more deeply and reflecting on the impact of specific strategies on learning.

The finding that emerged from the L2L initiative led to the inclusion of Domain 1: Learning for Effective Teaching in the TfEL Framework, specifically Element 1.1: Understand how self and others learn. It is clear that increasing the epistemic awareness of all teachers is required. This can be done in part by developing Domain 1: Learning for effective teaching, Element 1.1: Understand how self and others learn, but needs to be complemented by other elements of Domain 1, including Element 1.2: Develop deep pedagogical and content knowledge and Element 1.6: Design, plan and organise for teaching and learning.

The additional insight that emerged from the pedagogy research between 2010–2013 is that the teacher's view of their role also contributed to their pedagogical practice and approach. In general, teachers who viewed their role as ensuring learners learnt meaningfully generally adopted a design approach to teaching and learning. These teachers were highly aware that their grasp of content knowledge was an important factor in enabling a design approach to their work. This highlights the critical importance of Element 1.2: Develop deep pedagogical and content knowledge.

These findings from the SA research reflect the findings of Hattie and Jaeger's synthesis of the characteristics of expert teachers. They identified that there were five dimensions, elaborated as 16 attributes and qualities, which single out expert teachers. The attributes they identified are distinctly similar to the world view research emerging from the SA TfEL Pedagogy Research Project.

…five major dimensions of excellent teachers. Expert teachers

A. can identify essential representations of their subject
A1. Expert teachers have deeper representations about teaching and learning
A2. Expert teachers adopt a problem-solving stance to their work
A3. Expert teachers can anticipate, plan, and improvise as required by the situation
A4. Expert teachers are better decision-makers and can identify what decisions are important and which are less important decisions

B. guide learning through classroom interactions
B5 Expert teachers are proficient at creating an optimal classroom climate for learning
B6 Expert teachers have a multidimensionally complex perception of classroom situations
B7 Expert teachers are more context-dependent and have high situation cognition

C. monitor learning and provide feedback
C8. Expert teachers are more adept at monitoring student problems and assessing their level of understanding and progress, and they provide much more relevant, useful feedback
C9. Expert teachers are more adept at developing and testing hypotheses about learning difficulties or instructional strategies
C10 Expert teachers are more automatic

D. attend to affective attributes
D11 Expert teachers have high respect for students
D12 Expert teachers are passionate about teaching and learning

E. influence student outcomes
E13 Expert teachers engage students in learning and develop in their students self-regulation, involvement in mastery learning, enhanced self-efficacy, and self-esteem as learners
E14 Expert teachers provide appropriate challenging tasks and goals for students
E15 Expert teachers have positive influences on students' achievement
E16 Expert teachers enhance surface and deep learning.[50]

These findings support the earlier findings from the L2L initiative that a key to developing teacher practice lies in developing greater epistemic understanding and reflection—helping teachers understand learning more deeply and reflecting on the impact of specific strategies on learning.

[50] Hattie J (2003)

The power of the TfEL Framework is that it articulates the pedagogical principles that characterise an expert teacher.

SA DECD teachers who identified as demonstrating a student and learning-centred approach and a design approach to teaching and learning reflected many, if not all, of these attributes. The power of the TfEL Framework is that it articulates the pedagogical principles that characterise an expert teacher.

The finding from the 2010–2013 research—that a significant number of SA DECD teachers viewed their role as 'covering the curriculum' and that this was correlated with adopting a planned, scripted approach to their teaching—highlights the need to develop teachers' capacity for learning design. Bringing emphasis to the 'design' aspect of Element 1.6: Design, plan and organise for learning has already been a strong feature of the SA approach when implementing the Australian Curriculum. The SA Learning Design model explicitly draws attention to this.

The research findings on teacher practice have led to a deeper understanding of what shapes the pedagogical repertoire of SA DECD teachers and the implications for determining what professional learning is required to improve the quality of pedagogy. However, we know that teachers only account for 30% of the variance in academic achievement. What has the SA research revealed about the 50% of variance contributed by students themselves?

3 | Baseline student characteristics and the impact on student engagement and achievement

As long as researchers held the assumption that student factors were immutable, the focus on improving academic achievement was all directed at what could be done to develop teacher quality. Now that it is widely accepted that intelligence is not fixed, understanding and acting on the sources of variance in academic achievement that is attributed to the students themselves becomes vitally important. The question is: which aspect(s) of what the students bring can teachers have an impact on?

Earlier studies on quality teaching[51] found that two aspects relating to students have a significant effect size with regard to academic achievement. Students' prior cognitive ability has an effect size of 1.04 and a student's disposition to learn has an effect size of 0.61. The SA research in 2010–2013 explored the impact of prior academic success on current success; students' lifelong learning attributes; students' disposition to learn; and their inter-relationships. It also investigated which TfEL elements had the greatest potential impact on students' disposition to learn and their academic achievement, as measured by NAPLAN.

Students' disposition to learn

Key finding 3.1: The average student in this study reports a neutral disposition to learning. Students in low SES primary schools reported a lower disposition to learning compared to primary school students generally. Secondary school students reported a lower disposition to learning compared to primary school students.

Disposition to learn has been measured in a number of ways by researchers, but the general focus is on understanding how open learners are to new and novel situations, their receptiveness to having their interest stimulated, and their subsequent willingness to engage actively in learning.

The following findings come from student responses to paper-based and online surveys. The survey questions were designed to elicit students' application; their self-perception as a learner, their response to difficulty and challenge; their response to exploring new ideas and skills; and their eagerness to take on learning new things that they did not know how to do. The 'disposition' score was obtained by averaging the scores on these questions.

Table 3 | Student disposition to learn scores 2010–2013

Student disposition to learn scores Scale 1 to 5 (1 = highest level of disposition to learn)					
	A	B	C	D	E
Students in SA DECD schools	Low SES primary 2010–2012 n=3951	Primary 2013 n=321	Secondary 2013 n=204	Primary and secondary 2013, IoD 1–4 n=191	Primary and secondary 2013, IoD 5–7 n=371
Mean SD Median	2.51 0.95 2.50	2.22 0.52 2.20	2.44 0.60 2.40	2.27 0.57 2.40	2.34 0.55 2.40

Table 3 shows the descriptive statistics for the student disposition scores.

These results in Table 3 show significant differences in disposition to learn as follows:

- students in low SES primary schools (column A) show a lower disposition to learn than primary students in general (column B)
- students in secondary schools (column C) show a lower disposition to learn than primary students (column B).

Overall, students in this study show a neutral disposition to learning.

In the 2010–2012 stage of the research in low SES primary schools, analysis of the individual elements that contribute to the overall disposition score showed that:

- students were not disposed to do more than they were asked to do—low application to learn
- students were most motivated and showed greatest disposition to learn when they explored new things.

Disposition to learn has been measured in a number of ways by researchers, but the general focus is on understanding how open learners are to new and novel situations, their receptiveness to having their interest stimulated, and their subsequent willingness to engage actively in learning.

[51] Hattie J (2003)

These findings pose a challenge to pedagogical practice characterised by 'content coverage and control' and a 'script approach to teaching and learning'. Factoring students' dispositions to learn into what and how one teaches requires the capacity to be alert and responsive to the learners' dispositions to learn.

Before considering which TfEL elements have the greatest impact on students' disposition to learn it is important to understand how other characteristics of the learners contribute to their academic achievement and lifelong learning capabilities.

Student views on fixed/variable intelligence—'fixed versus growth mindset'

Key finding 3.2: Approximately 40% of students in this study believe that intelligence is fixed and that they have a 'fixed mindset'.

An 'entity' view of intelligence assumes that intelligence is fixed. This view has been labelled having a 'fixed mindset'. An 'incremental' view of intelligence, on the other hand, assumes that intelligence can change. This variable view of intelligence has been labelled having a 'growth mindset'.

Carol Dweck and colleagues have undertaken extensive research over three decades into how certain assumptions about intelligence impact on learner effort and learning outcomes. An 'entity' view of intelligence assumes that intelligence is fixed. This view has been labelled having a 'fixed mindset'. An 'incremental' view of intelligence, on the other hand, assumes that intelligence can change. This variable view of intelligence has been labelled having a 'growth mindset'. Carol Dweck has investigated students' views of intelligence through survey questions that ask them to rate how strongly they agree or disagree with statements claiming that:

- you can learn new things but cannot change your intelligence
- your intelligence is something about you that you cannot change
- people have certain amounts of fixed intelligence.

The student scores on the survey questions are averaged.

These same survey questions were used to investigate how SA DECD students in both Stage 1 (2010–2012) and Stage 2 (2013) cohorts viewed their intelligence.

Figure 25 | Entity view of intelligence
SA DECD primary and secondary students 2013

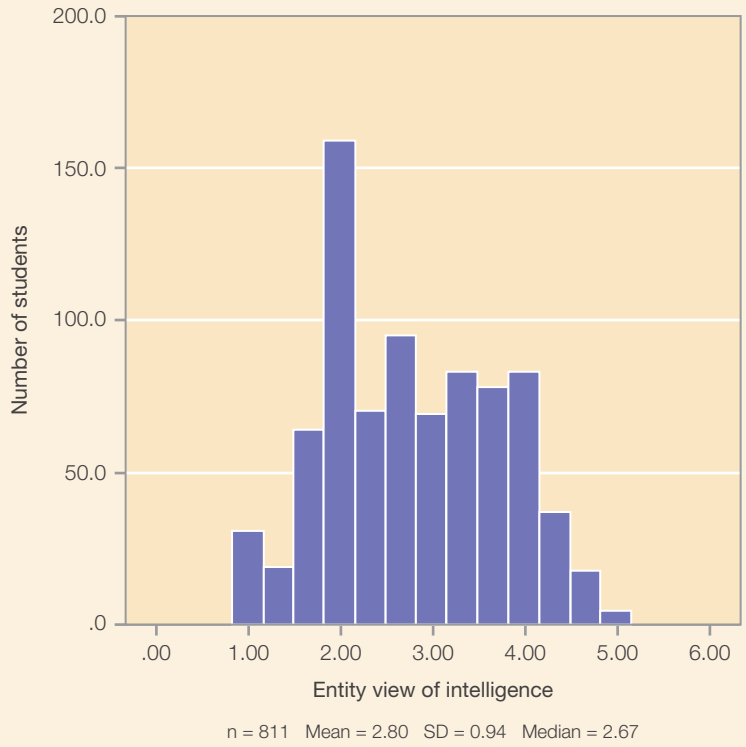


Figure 25 shows the distribution of mean (average) scores. A score of 1 indicates a very strong view that intelligence is fixed and cannot be changed. The distribution indicates that approximately 40% of students have a 'fixed mindset'. Further analysis of these scores showed that there were no significant differences between students in primary or secondary schools and no significant differences between students in schools with IoD 1–4 versus IoD 5–7.

Further discussion

Dweck and colleagues have found that the impact on learning for those holding an 'entity' or fixed view of intelligence is that they give up easily and avoid challenge because they attribute failure or difficulty to a lack of intelligence and they perceive they cannot do much about it. Those holding an 'incremental' view—a view that intelligence can be varied—are more likely to attribute failure or difficulty to a lack of effort or lacking the right strategy. The SA finding, that approximately 40% of students hold the view that intelligence is fixed, is consistent with international findings. The fact that two fifths of students in this study have a 'fixed mindset' indicates that it is crucial for both teachers and students to learn about the concept of neuroplasticity and that intelligence is not fixed. As the study of Blackwell et al[52] shows, when students learn that intelligence is not fixed, it has a positive impact on their motivation to learn, their persistence in the face of difficulty, and, ultimately, their academic achievement.

TfEL Element 1.1: Understand how self and others learn surfaces again as a high priority for professional learning for SA DECD teachers.

Students' 'learning power'

Key finding 3.3a: The average student in this study had a low score on resilience in learning compared to UK students.

Key finding 3.3b: Students in this study who self-reported a higher overall score on the Effective Lifelong Learning Instrument (ELLI) recorded a higher score on all dimensions except for resilience.

The instrument chosen to profile the students' lifelong learning capabilities was the Effective Lifelong Learning Instrument (ELLI). This measures a student's self perception of their 'learning power' in terms of seven characteristics of an effective lifelong learner:

- changing and learning (learning itself is learnable)

When students learn that intelligence is not fixed, it has a positive impact on their motivation to learn, their persistence in the face of difficulty, and, ultimately, their academic achievement.

- critical curiosity (desire to find things out)
- meaning-making (linking learning to what they know)
- resilience (embrace challenges, persevere)
- creativity (imaginative)
- learning relationships (interdependent)
- strategic awareness (reflective about learning, self awareness as learners).

Given that the TfEL Framework deliberately articulates principles and practice that will contribute to the development of lifelong learning capabilities (Domain 3: Develop expert learners), knowing the baseline ELLI profile of students in this study will provide an important reference point for monitoring the impact of the TfEL Framework over time.

[52] Blackwell et al (2007)

Figure 26 | ELLI profile—mean scores
SA DECD primary (Yr 3–7) and secondary students 2013

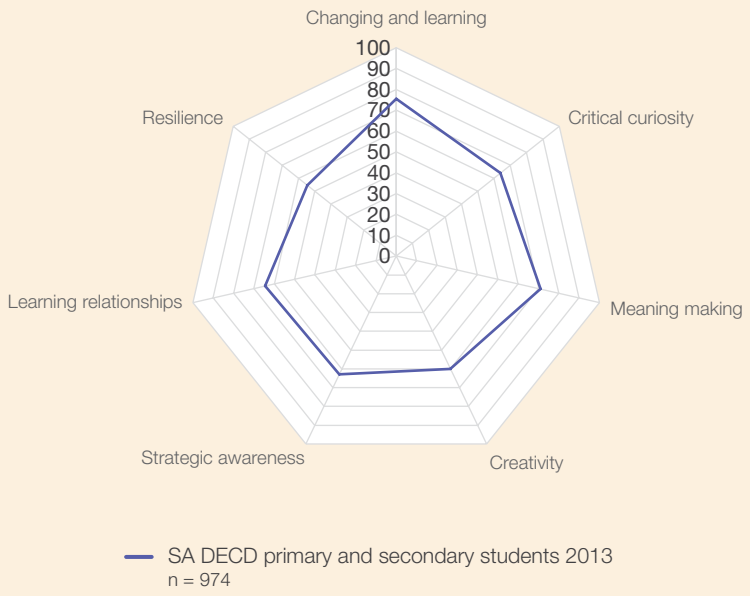


Figure 27 | ELLI profile—mean scores
Comparison of UK students with SA DECD students
SA DECD primary (Yr 3–7) and secondary students 2013

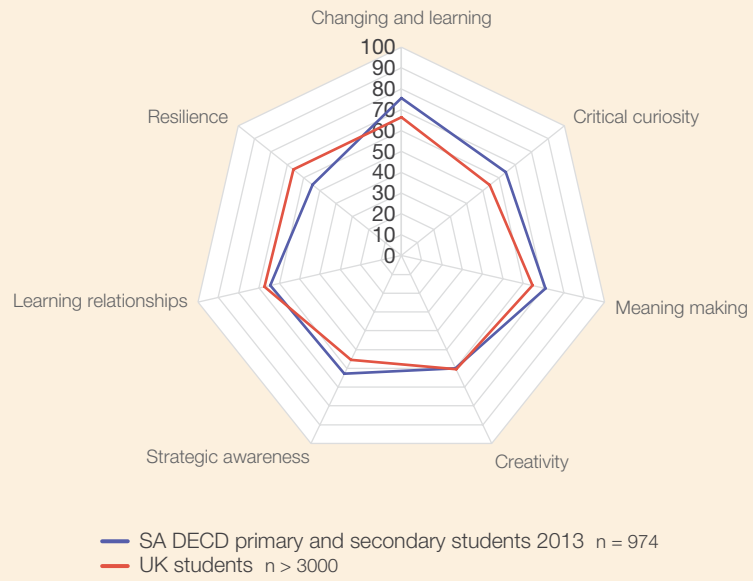


Figure 26 shows the mean scores on each of the ELLI dimensions for SA DECD primary and secondary students.[53] Students in this study showed a lower average score on resilience than on the other ELLI dimensions. This pattern of a lower average score on resilience can be claimed to apply to SA students in general, as it was also characteristic of the students in low SES primary schools in 2010–2012.

When compared to students in the UK, SA DECD students show significantly higher mean scores on changing and learning, critical curiosity, and meaning-making; similar mean scores on strategic awareness and creativity; but a significantly lower mean score on resilience.

The ELLI student data was clustered to establish if there were any distinctive patterns associated with sub-groups.

[53] Just as the 'spider' diagrams for the TfEL element scores show only the median score for wide range of scores, the same is true for these ELLI profiles. The ELLI profiles simply show the mean, or average score for a normal distribution of scores that ranges from very low to very high.

Figure 28 | ELLI profile—mean scores
Comparison of high self-report with low self-report
SA DECD primary (Yr 3–7) and secondary students 2013

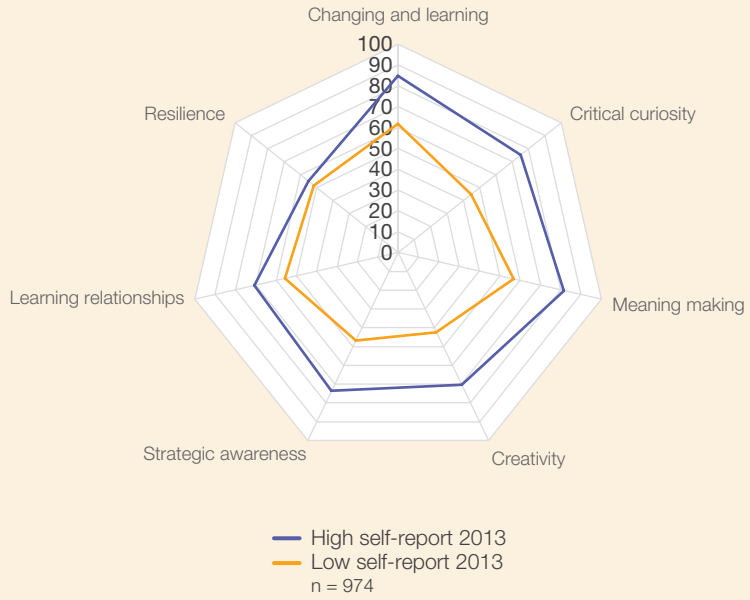


Figure 28 reveals two groups of students with distinctly different profiles. The group that reported higher learning power comprised approximately 60% of learners and the group reporting lower overall learning power made up 40% of learners. This pattern was also true for the students in low SES primary schools.

It is difficult to determine from the data whether this phenomenon is related to the majority of SA DECD teachers demonstrating a pedagogical practice of either high relationship–low challenge or content coverage and control, or whether it is related to a pattern observed elsewhere, referred to as 'fragile high-achievers'[54], in which high-achieving students show a high level of fragility and low resilience in the face of new challenges. Whatever the underlying reason for the observed pattern in SA of approximately 60% of learners reporting lower scores on resilience than the other ELLI dimensions, it highlights the need in SA to expose learners to high intellectual challenge in their learning and help them to develop the attitude and skill of being resilient in the face of challenges.

Summary

The baseline characteristics of SA DECD students in this study can be summarised as follows:

Disposition to learn:

- students in low SES primary schools showed a lower disposition to learn than primary students in general
- students in secondary schools showed a lower disposition to learn than primary students

Views about intelligence:

- approximately 40% of students held a view that intelligence is fixed, which is similar to students internationally

'Learning power' or lifelong learning capability:

- students reported a lower average score on resilience than UK students. This pattern of low scores on resilience was most pronounced for the 60% of students who reported high scores on other ELLI dimensions of being an effective lifelong learner.

Further discussion

Given that previous meta-analyses of over 500,000 studies[55] of sources of variance in student academic achievement show that prior cognitive ability, as measured by academic achievement scores, has an effect size of 1.04 and that student disposition to learn has an effect size of 0.62, three questions emerge:

1 How does a student's disposition to learn affect deep engagement in learning and how can teachers influence a student's disposition to learn?

[54] Deakin Crick R (2006) *Learning Power in Practice: A Guide for Teachers*, Sage Publications
[55] Hattie J (2003)

2 How can teachers help students learn about learning and about themselves as learners, particularly about neuroplasticity and the variable nature of intelligence?

3 How can teachers help learners develop the attitude and skill of being resilient in the face of learning challenges?

Responding to these three questions provides the means to realising the 50% variance in academic achievement attributed to the students themselves.

Responding to these three questions provides the means to realising the 50% variance in academic achievement attributed to the students themselves. Responding to these three questions also enacts the SA commitment to develop students' lifelong learning capability, which ultimately depends on their love of learning; their disposition to learn; their preparedness to exert effort and seek more effective strategies in learning, which depends on them believing that effort and strategies will make a difference; and their resilience in the face of learning challenges.

Impact of student characteristics on engagement and academic achievement

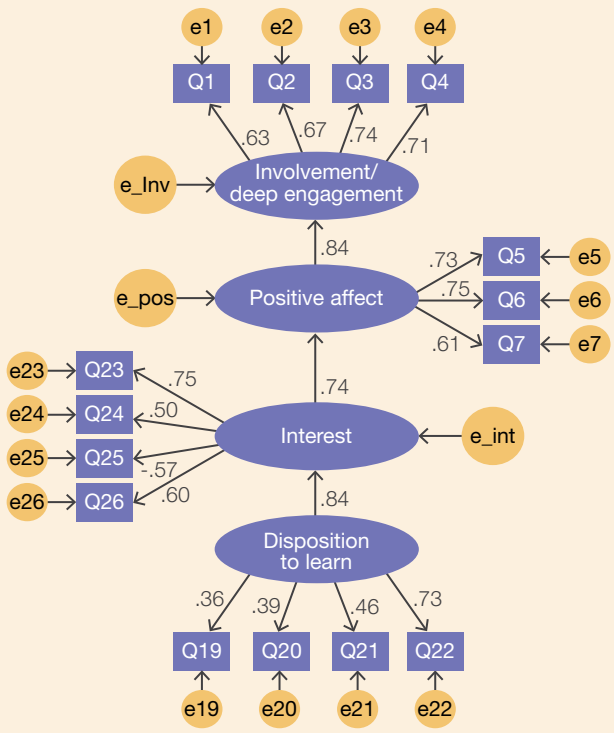
The relationship between a student's disposition to learn and deep engagement in learning

Key finding 3.4a: Learning disposition strongly predicts learner interest which predicts positive affect which, in turn, predicts level of engagement.

The SA pedagogy and engagement research prior to 2010 had started to reveal the nature of the set of relationships that exist between the characteristics of the learner, the quality of pedagogy, and the achievement of both academic and lifelong learning capabilities. The 2010–2013 research has added to this story.

Figure 29 analyses student responses to determine the effect of disposition on deep engagement. To read the diagram, start at the bottom with disposition to learn and work upwards to involvement/deep engagement.

Figure 29 | Structural analysis of variables influencing interest, positive affect and involvement/deep engagement in learning SA DECD low SES primary students 2010–2012



The figure shows that as learning disposition increases by 1 on the scale for disposition, interest goes up by 0.84 on the scale for interest; or, 72% of the variance in interest is due to variance in learning disposition. As interest increases by 1 on the scale for interest, positive affect, or wellbeing, increases by 0.74 on its scale; 53% of the variance in positive affect is due to the variance in interest. In turn, as positive affect increases by 1, deep engagement increases by 0.84; positive affect predicts 71% of the variance in involvement and deep engagement in learning.

In this analysis, the role of positive affect emerged as having a mediating role. What that means is that if positive affect is removed, it does not matter how interested a learner is, the impact of interest on engagement will be removed. This highlights the critically important role that wellbeing plays in ensuring deep engagement. Given our cultural propensity to fall into an 'either-or' way of thinking, the potential danger in highlighting the need in SA to increase the level of intellectual challenge is that people will disregard what has been a hallmark of SA pedagogy, student wellbeing and creating safe conditions—Domain 2: Create safe conditions for rigorous learning. What Figure 29 shows is that positive affect is a vital component in the story of how to engage students deeply in learning.

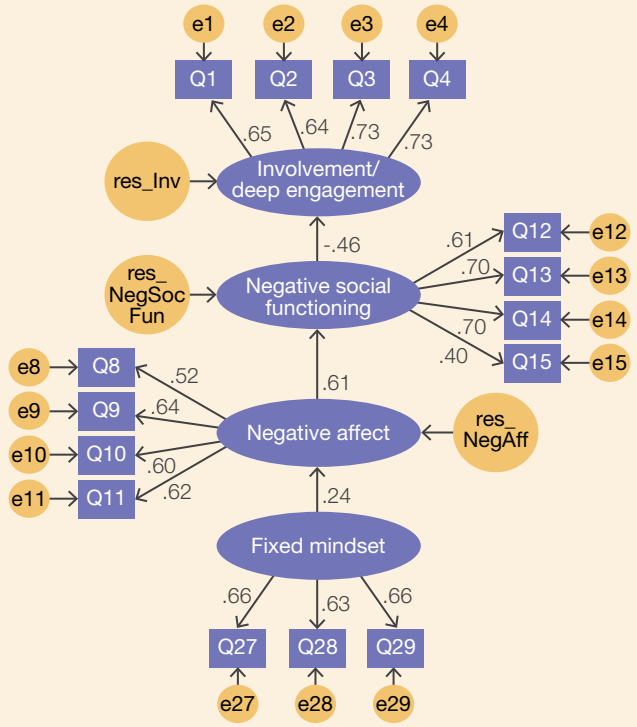
The relationship between holding a 'fixed mindset' and deep engagement

Key finding 3.4b: Having a 'fixed mindset' increases negative affect which is a strong predictor of negative social functioning which detracts from students becoming deeply involved in learning.

While positive affect plays a key role in contributing to deep engagement, as we would expect, negative affect detracts from deep engagement. It is easy to assume that negative affect is at the other end of a continuum to positive affect. Research into wellbeing and happiness[56] has shown that what makes people happy and have a sense of wellbeing and what makes people lack a sense of wellbeing and feel unhappy are different. Thus in this research they were measured separately.

Figure 30 illustrates that as the degree to which you hold a 'fixed mindset' increases—that is, the more you believe that your intelligence is fixed and beyond your control—the greater your negative affect. Starting at the bottom, negative affect in turn accounts for 36% of the variance in negative social function that in turn reduces deep engagement. The relationship between negative social functioning and reduced engagement in learning is undoubtedly self evident to teachers. What is enlightening is the role that having a 'fixed mindset' plays in contributing to this. Although the magnitude of the impact may appear slight (6% of the variance in negative affect is accounted for by having a 'fixed mindset') the complexity of the individual learner differences and the multiple personal and situational factors that contribute to whether a learner becomes deeply engaged or not means that every element that detracts from deep engagement needs to be considered.

Figure 30 | Structural analysis of variables influencing negative social functioning and involvement/deep engagement in learning SA DECD low SES primary students 2010–2012



[56] Cohn M, Frederickson B, Brown S, Mikels J & Conway A (2009) 'Happiness Unpacked: Positive Emotions Increase Life Satisfaction by Building Resilience', *Emotion*, June 2009; 9(3): pp 361–368; and Ryan R & Deci E (2006) 'Self-Regulation and the Problem of Human Autonomy: Does Psychology Need Choice, Self-Determination, and Will?' *Journal of Personality*, Vol 74, Issue 6, pp 1557–1586

Furthermore, the negative impact that holding a 'fixed mindset' has is not limited to its impact on negative affect. Holding a 'fixed mindset' was correlated with having a lower score on the ELLI dimension of resilience—a dimension for which SA students, in general, report low scores. The impact of reduced resilience is reduced persistence in learning that in turn reduces learner disposition to learn.

As the relationships between student variables and engagement start to be revealed, it becomes clear how complex effective teaching is. As Hattie[57] found in his study of expert teachers, teaching expertise does not reduce to a simple formula or simply employing one strategy or approach that has been found to have a high effect size. Given the role of learner disposition, interest and positive affect on increasing engagement and the counteractive effect on engagement of a 'fixed mindset', negative affect and negative social functioning, effective teaching requires that teachers be very intentional about maximising deep engagement.

The relationship between 'fixed mindset', 'learning power' and academic achievement as measured by NAPLAN

Key finding 3.4c: The more strongly a student holds a 'fixed mindset', the more their future performance will be influenced by prior performance.

Key finding 3.4d: The more highly students perform on NAPLAN, the more highly they rate themselves in terms of learning power and, conversely, the more poorly students perform on NAPLAN, the more they rate themselves as having low overall learning power.

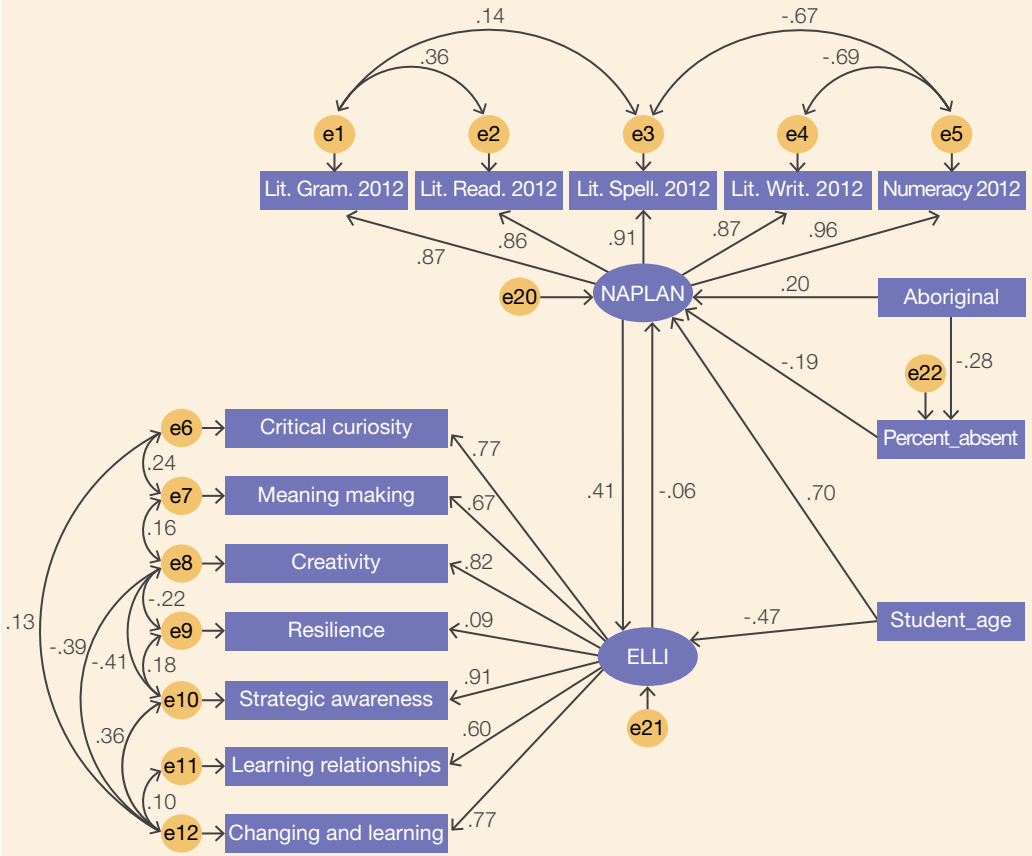
A tentative finding from Stage 1 of the SA TfEL Pedagogy Research Project in 2010–2012 was that the most powerful predictor of academic achievement was prior academic achievement. Having a 'fixed mindset', in addition to contributing to negative affect, also plays a part in cementing this relationship between prior and current academic achievement.

From this relationship, we can again see how crucial it is that students understand that their intelligence is not fixed and that effort, persistence, embracing challenges and learning strategies to monitor, manage and direct their thinking and learning will help them improve their performance. Another finding from the research was that a student's performance on NAPLAN affected their self-perception of their overall learning power—Figure 31.

Figure 31 illustrates that the direction of the effect from NAPLAN to overall rating on learning power (ELLI) accounts for approximately 17% of the variance in overall learning power being accounted for by different levels of achievement on NAPLAN. Essentially, if a student achieves well on NAPLAN their self-concept as a powerful learner is enhanced. If they do poorly on NAPLAN, how they rate themselves in terms of being a powerful learner is reduced.

[57] Hattie J (2003)

Figure 31 | Structural analysis of the relationship between ELLI and NAPLAN SA DECD primary and secondary students 2013



Summary of the relationship between learner variables, deep engagement, academic achievement and lifelong learning capability

Figure 32 demonstrates the connection between involvement, academic achievement and lifelong learning capability. A large body of research[58] shows that deep engagement and deep learning result in higher academic achievement, with the greatest impact of deep engagement being on measures of understanding, insight and complex problem solving as distinct from the mere reproduction of information or application of a routine procedure.

Figure 32 | The relationship between involvement/deep engagement, academic achievement and lifelong learner capabilities

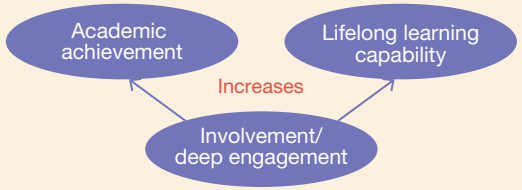
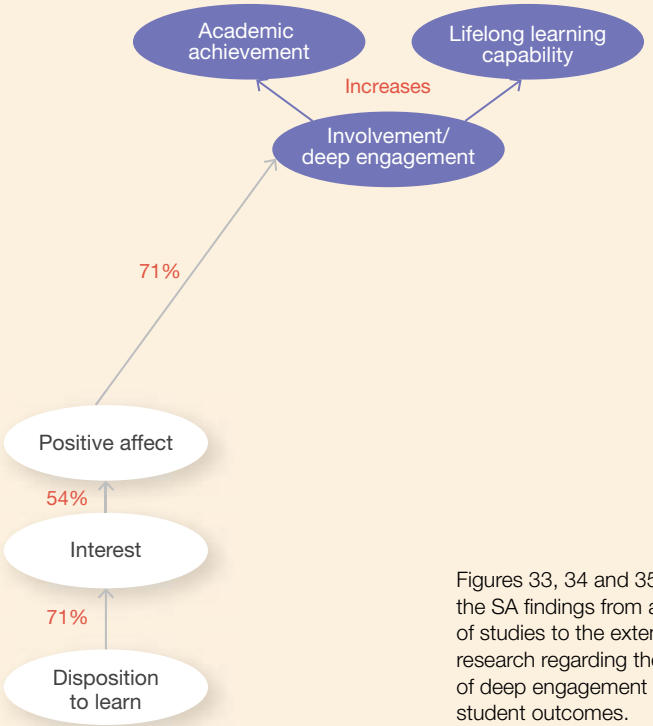


Figure 33 | The relationship between disposition to learn, interest, positive affect and involvement/deep engagement, academic achievement and lifelong learner capabilities

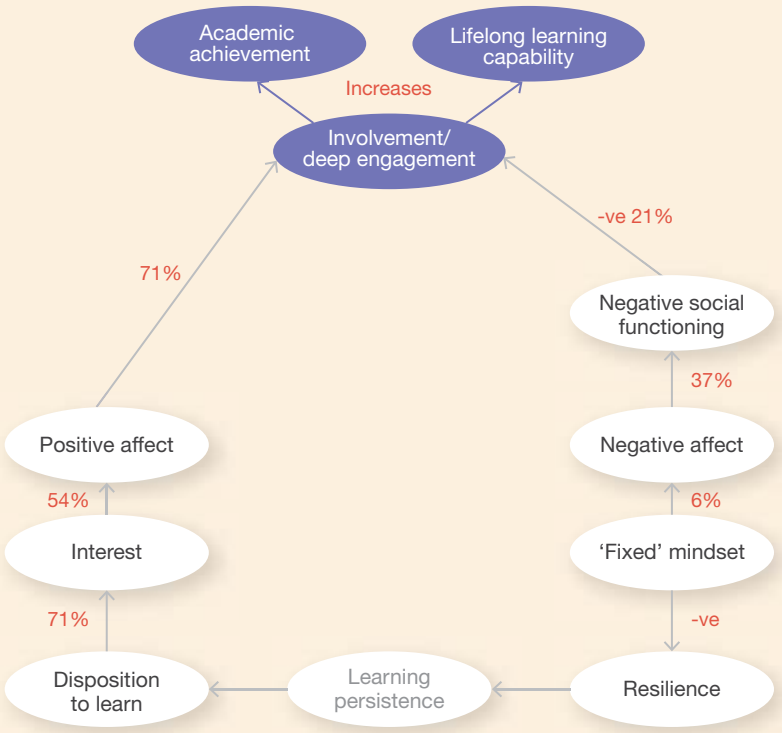


Figures 33, 34 and 35 connect the SA findings from a range of studies to the extensive research regarding the impact of deep engagement on student outcomes.

Figure 33 highlights a number of student-related variables that have a positive impact on students' level of engagement. Disposition to learn has a strong impact on their level of interest; interest accounts for half of the variance in positive affect, which in turn is a strong determinant of their level of deep engagement.

[58] Gijbels et al (2005) and Biggs J (1979)

Figure 34 | The relationship between variables that have a negative affect on involvement/deep engagement



The more strongly someone holds a 'fixed' view of intelligence, the more their future performance will be influenced by their previous performance.

Figure 34 points out that there are a number of things that have a negative impact on deep engagement. A 'fixed mindset' operates in two ways to have an overall impact on deep engagement. It accounts for only 6% of the variance in negative affect, which has a much larger impact (37% variance) on negative social functioning and consequently deep engagement and deep learning. The other feature of a 'fixed mindset' is that it has a negative impact on resilience and, when learning resilience is reduced, persistence and disposition to learn are also reduced, thus cycling around to have an indirect impact on interest, positive affect and engagement. Apart from lowering persistence, a 'fixed mindset' also contributes to shaping future academic achievement in terms of past achievement.

The teacher's challenge then is twofold—help students to adopt a 'growth mindset' and arouse interest in learning by connecting learning to the learners' intrinsic interests or deliberately stimulating interest through the design of the learning experiences.

What has the research found about the relationship between quality of pedagogy and specific TfEL elements and the impact pedagogy has on the student variables of disposition, resilience and view of intelligence (fixed/growth) that collectively determine the extent of deep engagement and academic achievement? What has the research uncovered that can help reveal the 50% of variance in academic achievement attributed to the learners themselves? Can this break what appears to be a vicious cycle between prior performance and future performance?

Apart from lowering persistence, a 'fixed mindset' also contributes to shaping future academic achievement in terms of past achievement.

4 | The relationship of quality of pedagogy and specific TfEL elements on student characteristics

Key finding 4.1: The TfEL elements act in a complementary fashion to have a positive impact on student involvement and deep engagement in learning. Specific domains and elements have a different level of impact on specific learner attributes that determine the depth of engagement in learning. Domains that had the greatest impact on learner attributes were:

- increasing positive affect—Domain 2: Create safe conditions for rigorous learning and Domain 3: Develop expert learners
- reducing negative social functioning—Domain 2: Create safe conditions for rigorous learning
- increasing student disposition to learn—Domain 4: Personalise and connect learning.

As reported in Key finding 2.3, teachers who adopted a design approach to teaching and learning were more adept at employing all TfEL elements. The most informative approach to understanding the relationship between quality of pedagogy, as articulated by the TfEL Framework, and academic achievement is to develop deeper insights into the impact of each of the TfEL domains and elements on the complex set of variables that interact to determine deep engagement, academic achievement and the development of lifelong learner characteristics.

As reported in Key finding 2.3, teachers who adopted a design approach to teaching and learning were more adept at employing all TfEL elements.

Stage 1 of the research thoroughly analysed the impact of TfEL elements on the learner variables of disposition to learn, engagement, positive and negative affect, and negative social functioning, as well as academic achievement as measured by NAPLAN. The findings, Figure 35, are in keeping with what would be expected theoretically.

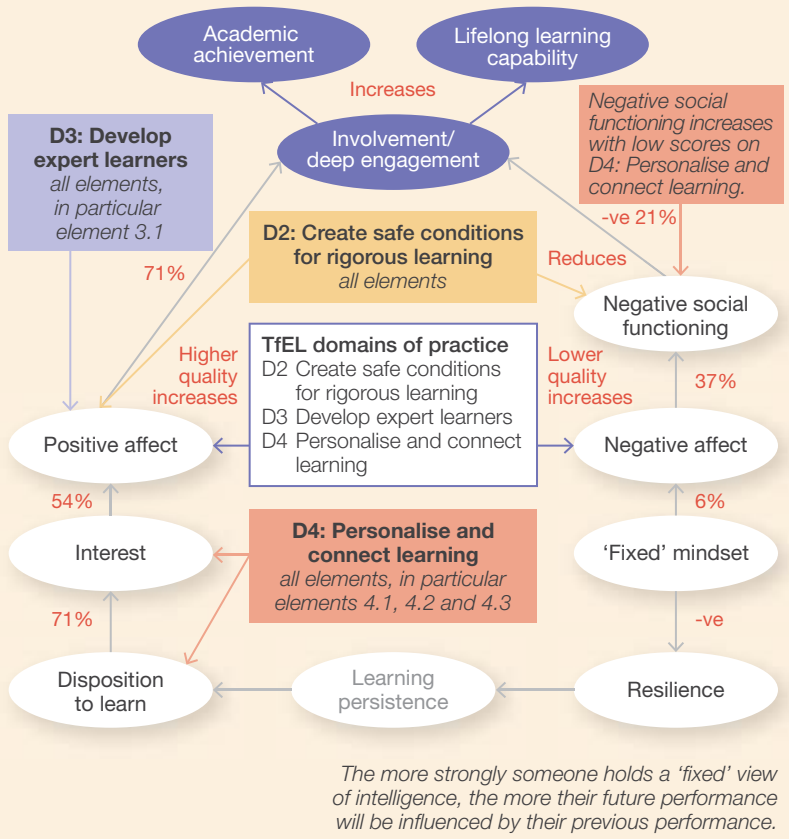
Figure 35 demonstrates these findings: that higher quality pedagogy, represented by a higher total score on a single point observation of practice, increased students' positive affect. Conversely, lower quality pedagogy as represented by a low total score on single point observation, was related to greater student negative affect. The impact of individual TfEL elements was dependent on other TfEL elements being present, illustrating the interdependence of the TfEL elements and highlighting the magnifying effect of the TfEL elements on each other.

A more in-depth analysis of the impact of individual TfEL elements revealed that higher scores on Domain 2: Create safe conditions for rigorous learning, had a direct positive impact on positive affect and on reducing negative social functioning, both of which contribute to higher levels of deep engagement. The other TfEL domain that had the greatest impact on positive student affect was Domain 3: Develop expert learners, with Element 3.1: Teach students how to learn, making the most significant contribution to this effect. This finding is in keeping with the research by Blackwell et al[59] that teaching students about how they learn, brain plasticity, and variable intelligence has a positive impact on student engagement and academic performance.

Given John Hattie's[60] findings that student disposition to learn has an effect size of 0.61, it is of particular importance to understand the aspects of pedagogy that have the greatest impact on disposition to learn. Not surprisingly, TfEL Domain 4: Personalise and connect learning was found to be the domain that had the strongest impact on learner disposition to learn. Element 4.1: Build on learners' understandings, Element 4.2: Connect learning to students' lives and aspirations, and Element 4.3: Apply and assess learning in authentic contexts are the three elements in Domain 4 that have the biggest effect. Interestingly, of the four Domain 4 elements, these are the three that emphasise a learning and learner-centred pedagogy over a teaching and teacher-centred pedagogy.

[59] Blackwell et al (2007)
[60] Hattie J (2003)

Figure 35 | The impact of TfEL domains and elements on learner variables



Domain 2 (D2): Create safe conditions for rigorous learning

2.1 Develop democratic relationships

2.2 Build a community of learners

2.3 Negotiate learning

2.4 Challenge students to achieve high standards with appropriate support

Domain 3 (D3): Develop expert learners

3.1 Teach students how to learn

3.2 Foster deep understanding and skilful action

3.3 Explore the construction of knowledge

3.4 Promote dialogue as a means of learning

Domain 4 (D4): Personalise and connect learning

4.1 Build on learners' understandings

4.2 Connect learning to students' lives and aspirations

4.3 Apply and assess in authentic contexts

4.4 Communicate learning in multiple modes

This analysis of the impact of TfEL elements on factors that have been shown to affect deep engagement has provided a partial answer to the two key questions for Stage 1 of the SA TfEL Pedagogy Research Project 2010–2012 that asked:

- What impact does the quality of pedagogy, referenced against the TfEL Framework, have on learner engagement and learner achievement—both academic achievement and the development of lifelong learning capability?
- Do particular elements of pedagogy have an impact on specific aspects of learner engagement, achievement and lifelong learning capability?

The research project has contributed to a deeper understanding of the interplay between TfEL elements and the student factors to determine the level of deep engagement in learning. In so doing it has shown, albeit indirectly, the impact of high quality pedagogy on academic achievement.

It was clear from the earlier L2L initiative and research that, if the TfEL Framework was to be successfully implemented, it would require a whole-site approach to authentic engagement and it would take time.

5 | The impact of the SA TfEL Pedagogy Research Project Stage 1: 2010–2012

Key finding 5.1: The SA TfEL Pedagogy Research Project had a significant impact on:
- student learning
- the professional learning culture.

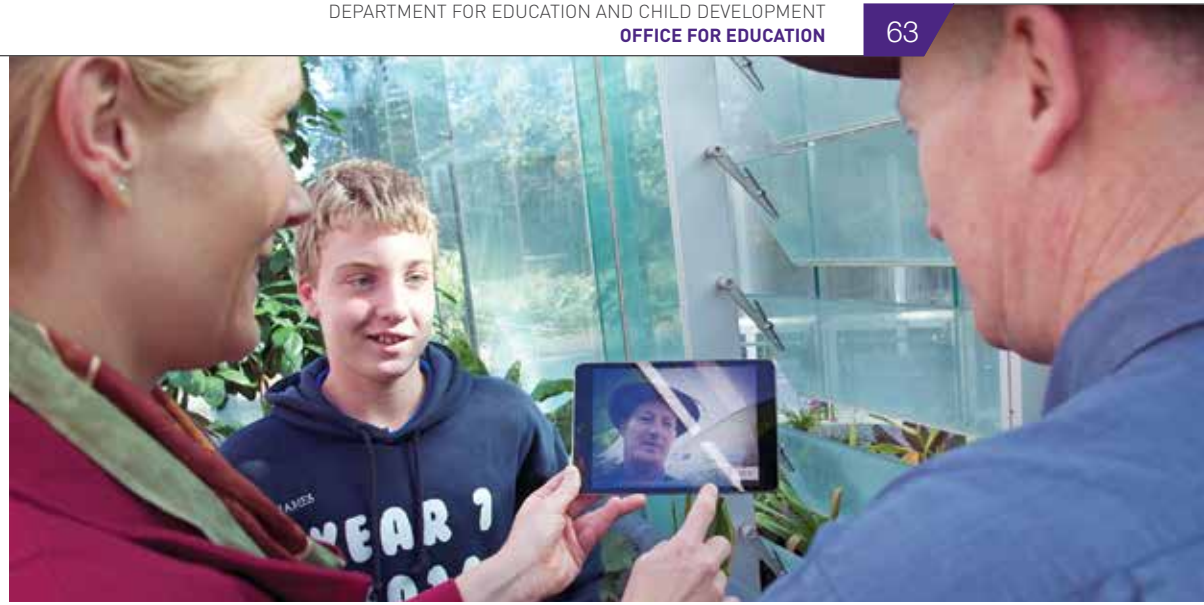
It was clear from the earlier L2L initiative and research that, if the TfEL Framework was to be successfully implemented, it would require a whole-site approach to authentic engagement and it would take time. The question that is pertinent here is can the overall quality of pedagogy be enhanced by professional collaboration supported by a whole-school commitment to improving the quality of pedagogy? But a broader question is, which factors from the SA TfEL Pedagogy Research Project 2010–2012[61] had an impact on learning and developing a whole-school professional learning culture?

These findings were determined from interviews conducted twice during the Stage 1: 2010–2012 research with leaders and the specialist teachers supporting each site. At the conclusion of the project, all teachers, site leaders and specialist teachers were invited to write a Most Significant Change (MSC) story to share what they perceived to be the most significant impact of the project.

The first set of interviews was conducted approximately one year into the project and the second set a year later. The interviews were coded to gain evidence of:

- what had changed as a result of the project
- which of the strategies designed to assist schools had proven most helpful.

[61] As the Stage 2 focus was on testing the generalisability of findings related to teachers' practice and the student variables, this aspect of the SA TfEL Pedagogy Research Project was restricted to Stage 1 of the research.



The coding also supported the identification of general factors that had impacted on the amount of progress achieved and the outcomes. The MSC stories were also coded to identify the elements contained in the views expressed.

Student learning

Key finding 5.1a: The most significant impacts on student learning were:

- increased learner focus
- assessment
- intentionality re learning outcomes
- lifelong learning focus
- increased student dialogue.

Figure 36 | Impact of the SA TfEL Pedagogy Research Project on student learning
'Most Significant Change' methodology
SA DECD low SES primary schools 2010–2012
Teachers, leaders, specialist teachers

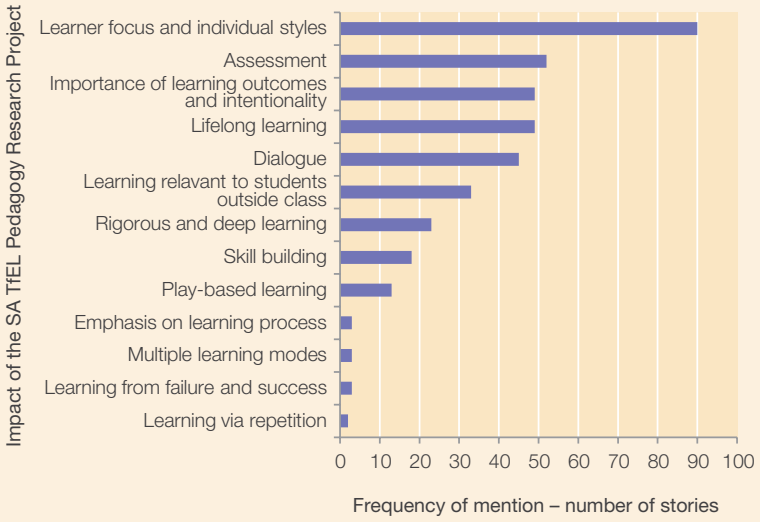


Figure 36 reports on the MSC stories, which revealed the teachers' perceptions of the impact that the research project had on student learning, with increased focus on the learner as being the most frequently mentioned impact, followed by assessment, importance of learning outcomes and intentionality, and a lifelong learning focus.

These findings are very important. Key finding 2.3 indicated that a high stage of pedagogical repertoire was highly correlated with having a 'design approach to teaching and learning', which in turn was highly correlated with teachers who employed a responsive pedagogy that was learning- and student-centred to ensure learners learned meaningfully. Stage1 of the research showed that the whole-school approach, combined with the professional learning groups and support in terms of time and specialist teacher assistance, was starting to develop more of a design approach to teaching and learning.

So how did the SA TfEL Pedagogy Research Project Stage 1: 2010–2012 impact on developing a professional learning culture?

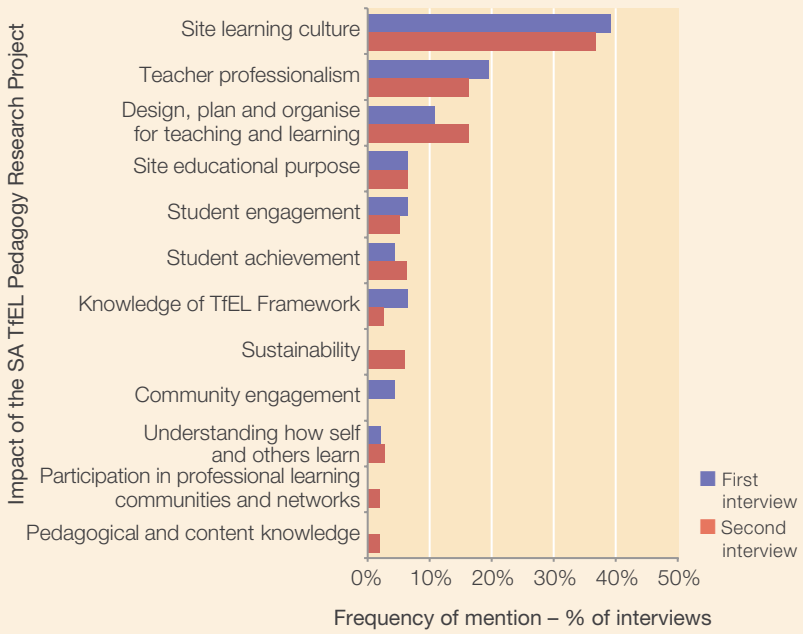
The responses from leaders, teachers and specialist teachers indicated that the conditions for significant change in teacher practice had been established and that they were beginning to enact the TfEL Framework.

Developing a professional learning culture

Key finding 5.1b: The most significant impacts on developing a professional learning culture were:

- collaborative focus
- teacher professionalism
- design, plan and organise for teaching (TfEL Element 1.6)
- structure and purpose
- challenge and support.

Figure 37 | Impact of the SA TfEL Pedagogy Research Project
Comparison of first and second interviews with leaders
SA DECD low SES primary schools 2010–2012



One of the roles of the specialist teachers working with each of the sites in Stage 1 was to support the development of collaborative professional learning groups to systematically develop teachers' understandings of the TfEL principles. At the end of two years, the most significant impact identified by leaders, specialist teachers and the teachers in general was indeed the development of a collaborative professional focus, which is demonstrated in Figures 37 and 38.

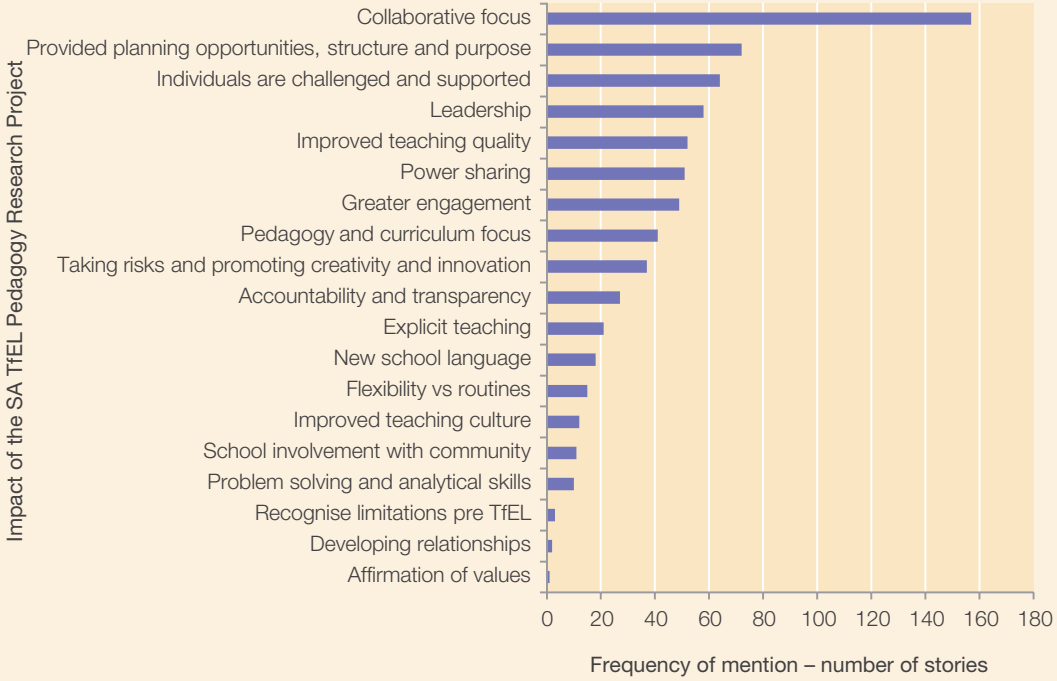
Figure 37 shows the frequency of mention of different impacts of the project at two stages of the research—the first interview one year into the project and the second interview two years into the project.

In both the first and second interview, leaders pointed primarily to the impact on the establishment of a site learning culture.

Figure 38 demonstrates how teachers and specialist teachers, through the MSC stories, also identified a collaborative focus as by far the most significant impact.

The responses from leaders, teachers and specialist teachers indicated that the conditions for significant change in teacher practice had been established and that they were beginning to enact the TfEL Framework. For example, note in Figure 37 the shift from interview 1 to 2 in frequency of mention by leaders of the impact of the project on design, plan and organise for teaching (TfEL Domain 1, Element 1.6). A collaborative learning culture and de-privatisation of teaching was definitely underway in all of the schools at the end of two full years. It was significant given the dominant culture at the time was one of privatised practice. The full impact in terms of improved pedagogy was yet to be realised: leaders and teachers were clear that it would take time to fully implement the TfEL Framework.

Figure 38 | Impact of the SA TfEL Pedagogy Research Project on professional learning culture
'Most Significant Change' methodology
SA DECD low SES primary schools 2010–2012
Teachers, leaders, specialist teachers



Strategies that had the greatest impact on developing a professional learning culture

Key finding 5.2: The most effective strategies that contributed to the development of a professional learning culture, as reported by leaders, specialist teachers and teachers, were:

- establishing professional learning communities
- focused professional support in the form of a specialist teacher
- peer observations
- self-review.

Figures 39–41 illustrate the perceptions of leaders, specialist teachers and teachers regarding the strategies that most supported change.

Although articulated slightly differently by the three groups, collectively these responses indicate:

1. the importance of establishing professional learning communities—both the structure and the safe conditions to engage openly and constructively in these groups
2. focused professional support in the form of a specialist teacher
3. peer observations—the willingness to accept the challenge of opening one's own practice to others as well as enriching one's own practice by observing peers
4. self-review against an agreed framework for effective pedagogy: the TfEL Framework.

It is not the Framework itself that is critical, but rather that it provides a common reference point.

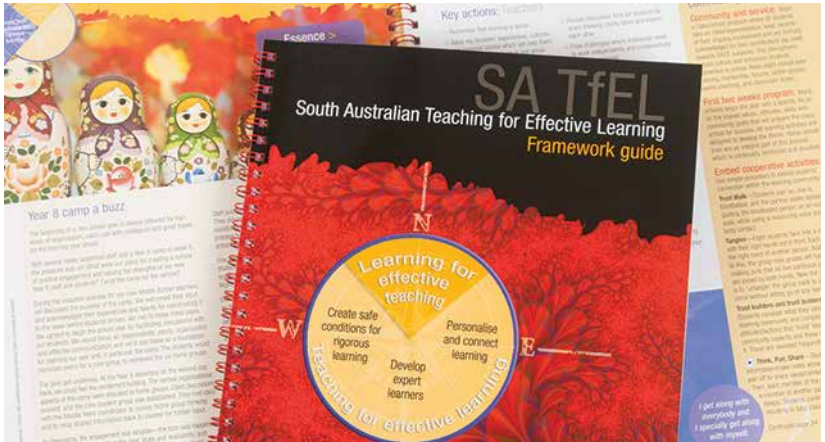
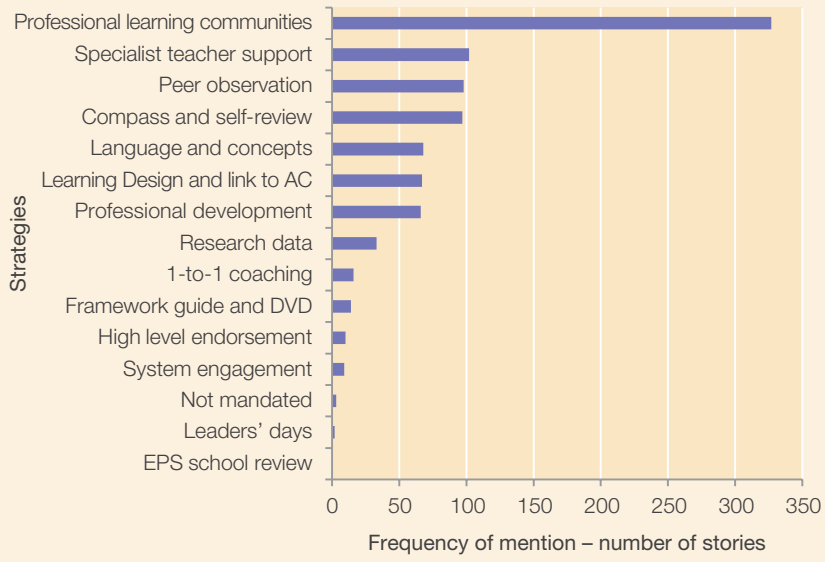


Figure 39 | Strategies that had the greatest impact
'Most Significant Change' methodology
SA DECD low SES primary schools 2010–2012
Teachers, leaders, specialist teachers



The SA TfEL Framework guide and accompanying DVD per se did not figure highly in the responses, which is not surprising as one of the implicit strengths of having the TfEL Framework is that it aligns professional judgement and self-review against a common set of principles and takes peer observation and professional dialogue beyond 'blind leading the blind' and/or discussions of personal teaching style. It is not the TfEL Framework itself that is critical, but rather that it provides a common reference point for teacher professional dialogue.

The development of the pre-conditions for significant pedagogical development in the schools was not uniform across the sites in Stage 1 of the project, as is revealed in the factors that supported and inhibited change.

Figure 40 | Factors that most supported change—leaders' views
SA DECD low SES primary schools 2010–2012

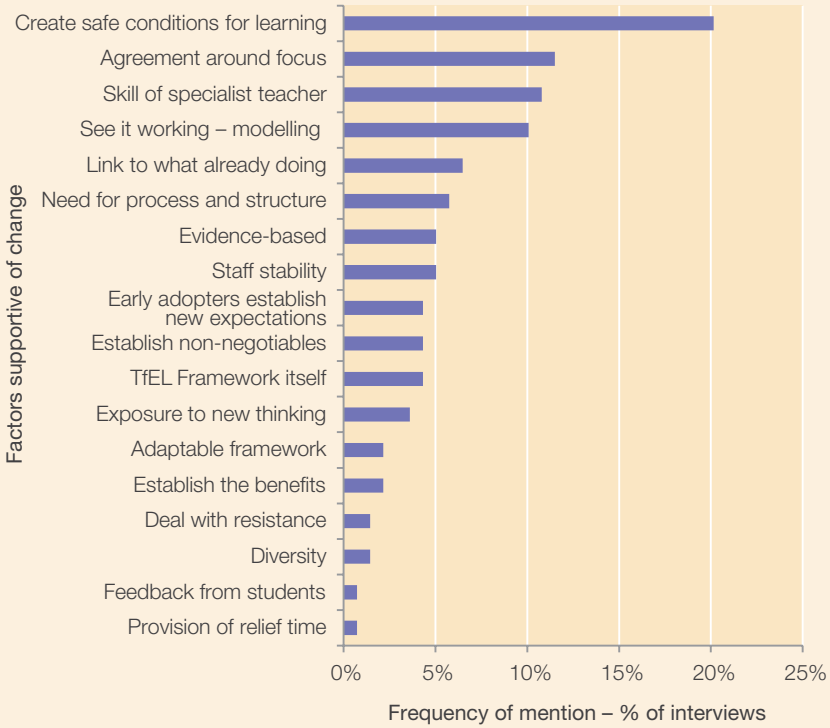
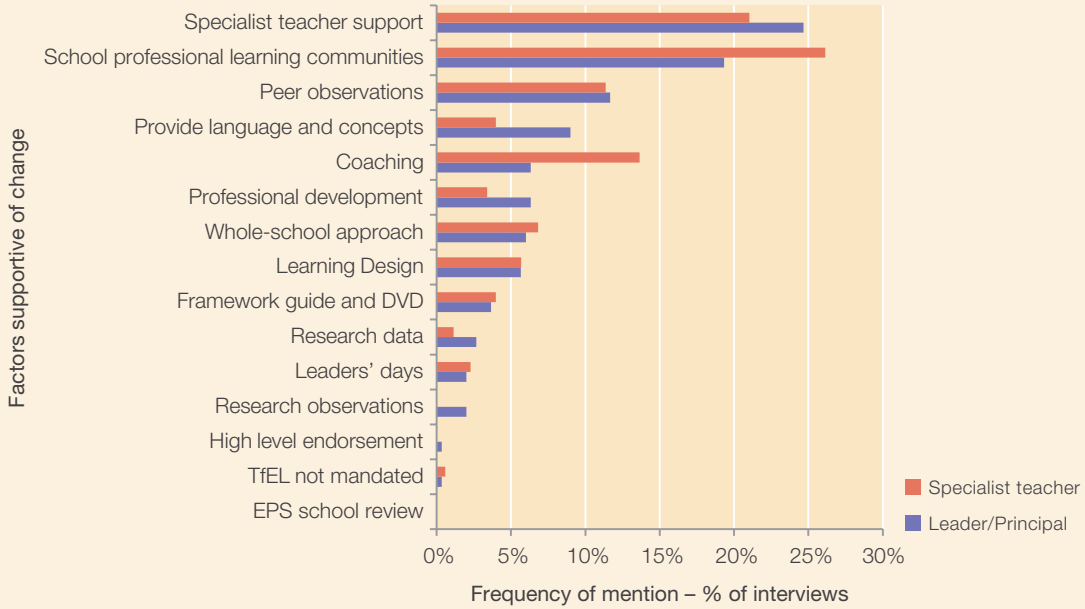


Figure 41 | Most effective strategies to support change
Specialist teachers' compared with leaders' views
SA DECD low SES primary schools 2010–2012

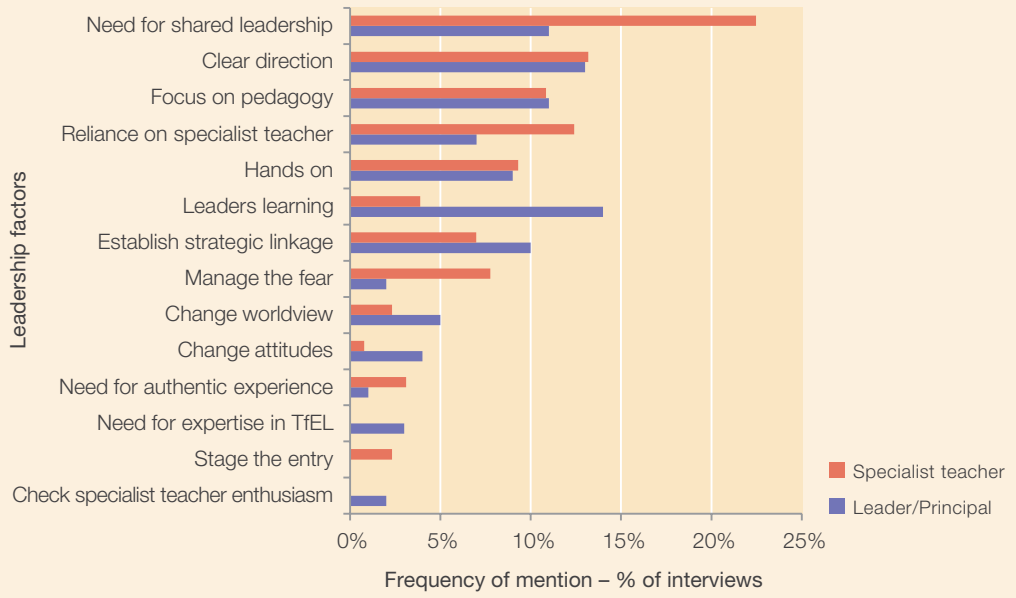


Leadership factors that supported whole school change

Key finding 5.3: The leadership approaches necessary to support embedding the TfEL Framework and improving practice were identified as:

- shared leadership
- clear direction
- a focus on pedagogy
- leaders' learning.

Figure 42 | Leadership factors needed to embed TfEL principles and improve practice
SA DECD low SES primary schools 2010–2012
Leaders, specialist teachers



Progress in developing a whole school approach to embedding the TfEL Framework was strongest where leaders adopted a high level of engagement with the Framework and a commitment to developing a whole school approach. The progress was weakest where they effectively delegated responsibility for the project to the specialist teacher. This difference in leaders' engagement and perception of the importance of shared leadership is highlighted by the difference between the leader and specialist teacher view of the need for shared leadership, with specialist teachers mentioning this factor twice as frequently as leaders themselves.

Some of the other differences between the specialist teacher and leader views, for example 'manage the fear', reflect the difference in degree of direct contact the specialist teachers and leaders had to the individual responses of teachers. The specialist teachers worked directly with the teachers and were confronted with the need to establish strong trusting and supportive relationships as a precursor to being able to observe practice and give feedback as well as creating safe conditions for the professional learning groups. The specialist teachers themselves were highly supported by the centrally-based research team to develop protocols and processes to assist them in facilitating professional dialogue and creating a climate and culture of authentic engagement.

The four domains of the TfEL Framework are as applicable to the work of leaders with teachers as they are to teachers with learners. Just as a teacher leads the learning of their students, the principal leads the learning of his or her staff. It is just as important for leaders to enact Domain 2: Creating safe conditions for rigorous learning, Domain 3: Develop expert learners and Domain 4: Personalise and connect learning for teachers, as it is for teachers to do so for students. Just as expert classroom teachers take a 'design' approach to teaching and learning, so too will expert leaders of learning take a design approach to professional learning with their staff.

Just as important as investigating the leadership factors that supported change, it was important to explore the factors that inhibited the development of a whole school approach to embedding the pedagogical principles of the TfEL Framework.

Factors identified by leaders that inhibited developing a whole school approach

Key finding 5.4: The most commonly occurring factors that were perceived by leaders to inhibit change were:
- site cultural issues
- multiple competing demands
- staff turnover.

Figure 43 | Factors that most inhibited change—leaders' views
SA DECD low SES primary schools 2010–2012

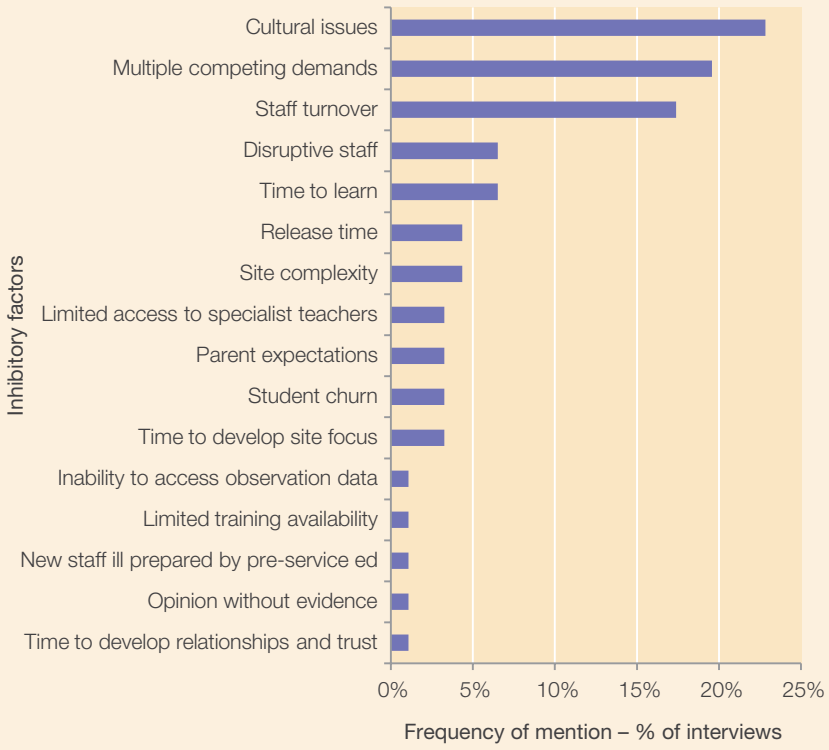


Figure 43 lists the factors that leaders identified that had the greatest inhibitory impact on progress towards embedding the TfEL Framework.

A recurring theme from many of the leaders at the Leader Days held throughout Stage 1 of the project was their perception that there were too many competing demands for them to deal with and this had an impact on their ability to incorporate yet another demand—in conducting research at their site. What was very clear from the dialogue on these days was that the leaders found it difficult to integrate various centrally-developed projects and programs that they were required to respond to. This is an issue for the system as much as it is a need for leaders to develop the capability to integrate.

6 | Student perceptions of teachers' pedagogy

In addition to conducting single point observations to gather baseline data on teachers' practice, a random sample of 4–5 students was selected from each of the class groups observed. These students were asked to give feedback on their perceptions of their teacher's practice. Students completed the TfEL Compass[62] online survey that is designed to encourage and support teachers to reflect on their own practice, and to gather feedback from their students and trusted colleagues. The TfEL Compass is primarily a reflection and perception-gathering tool, not an evaluation and measurement tool.

The selected students were given a number of statements and were asked to rate how true each statement was of their teacher's practice or its impact on their learning. Students were invited to make comments and illustrate their rating with specific examples. The language and number of statements differed to suit the year level of the students: older students (Years 7/8–12) were given 48 statements, younger students (Years 3/4–6/7) were given 24 statements, and very young children (Year 3 and below) were given 12 statements.

Below are some of the statements, together with the TfEL elements to which they relate. Students were asked to rate them from 'true—not true'.

Element 2.4: Challenge students to achieve high standards with appropriate support

- *The feedback the teacher gives me on my learning includes clear expectations on how to improve.*

Element 3.2: Foster deep understanding and skilful action

- *I am encouraged to question what I know, to look at things from different angles and not to be satisfied until I understand.*

Element 4.3: Apply and assess in authentic contexts

- *What I learn with this teacher helps me understand things/people in my life outside school.*

[62] TfEL Compass: An online professional learning tool for teachers to reflect on their teaching and learning practices through self-reflection and feedback from students and trusted colleagues. For more information, contact compass@sa.gov.au

Students' views on being asked to give feedback

The research officers collected students' views on being asked to complete the TfEL Compass. A summary of their willingness to participate and the nature of their engagement is presented in Table 4.

Key finding 6.1: Students value the opportunity to give feedback on their teachers' practice. They consider that it is important for teachers to understand what helps them learn. They also reported that the process of giving feedback via the TfEL Compass helped them reflect on their own learning.

Table 4 | Student engagement with completing the TfEL Compass survey

Focus question	Percentage of students
What percentage of students willingly engaged in completing the survey?	99%
What percentage of the students put obvious thought into their responses?	94%
What percentage of students valued the chance to record their opinions?	91%
What percentage of students wanted to know more about the process and/or the results?	86%
What percentage of students wanted to engage in conversation with the research officers to clarify meaning, expand on their opinions and/or talk about examples?	89%

The research officers also captured the following sample comments from conversations with the students. These conversations revolved around being given a voice about their learning and reflections on teacher practice and the impact on their learning.

On student voice about learning:

I haven't been asked these kinds of questions before.

It's the first time I've been asked questions about what's happening in my classroom.

If no-one knows how you feel they won't be able to change.

It tells the teacher where you might need more challenges.

It gave us a chance to think about how we learn and what teachers do to help us.

My teacher does a lot for me and it's good for him to know about how we are learning.

This feels strange. I never get chosen for things, it's usually the smart kids.

Reflections on teaching and learning:

Good idea—it's not just what the teachers think about learning: it's about what we think.

I get to talk about how my learning is going and how my teacher is teaching. Teachers might teach us more if they got this.

It can help out teachers and how they learn their teaching skills.

Student perceptions of their teachers' practice and the impact on their learning

Key finding 6.2: The qualitative difference in the learning experiences of students taught by teachers who had a highly developed or a limited pedagogical repertoire is clearly evident in the student perceptions of teacher practice and the impact of this practice on the quality of their learning.

Key finding 6.3: The difference in impact on the learners of teaching quality is not simply in the quality of the learning experience itself, but also in the impact high quality pedagogy has in developing reflective, self-directed lifelong learning capabilities.

Whereas the single point observations of teachers, conducted by the research officers, provided an objective, moderated assessment of practice as a one-off snapshot, the student feedback added two further aspects to the baseline data: their subjective assessment of the impact of teachers' practice and a more comprehensive view of practice across time. Students had been taught by the teacher for whom they gave feedback for at least one term.

A question was raised earlier in this report regarding whether or not one could reasonably expect to observe each of the TfEL elements with the same frequency in any one learning session. The student feedback provides more information on how each element is experienced by the students over time.

Key finding 1.3 highlighted the three TfEL elements that were least observed by the research officers:

2.3 Negotiate learning

3.3 Explore the construction of knowledge

4.3 Apply and assess in authentic contexts.

Tables 5–7 summarise what emerges from the student feedback on these three elements, illustrating the students' perceptions of their experience (or lack thereof). The tables provide the student ratings and a sample of typical comments, contrasting those students who experienced teachers with a highly developed pedagogical repertoire with those who experienced teachers with a limited pedagogical repertoire.

A comparison of the mean scores on each element for teachers with a highly developed versus a limited pedagogical repertoire, together with the samples of illustrative comments that accompany the student ratings, give an idea of the range of pedagogical practice that is experienced by students in SA DECD schools. What becomes immediately obvious by comparing the two sets of student comments is the vastly different impact that the teachers are having, not just on the quality of the learning experience itself, but of the impact that high quality pedagogy has on students' abilities to reflect on and direct their own learning and on developing effective and reflective lifelong learners.

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Table 5 | Students' perceptions of teacher practice for **Element 2.3: Negotiate learning**
Teachers with a highly developed pedagogical repertoire compared with teachers with a limited pedagogical repertoire

2.3 Negotiate learning			
Highly developed pedagogical repertoire		**Limited pedagogical repertoire**	
High school (HS) Mean rating 11.88/16	Teachers n=10; Students n=43	High school Mean rating 8.97/16	Teachers n=10; Students n=40
Primary school (PS) Mean rating 11.79/16	Teachers n=10; Students n=46	Primary school Mean rating 8.38/16	Teachers n=10; Students n=42
Students were asked to rate how true each of four statements were in their experience. Some student comments are included to illustrate their thinking.			
• ***In terms of what we are learning, the teacher makes it clear to us what is negotiable and what is non-negotiable.***			
When we have assignments the teacher states to us which particular sections can be negotiated. (HS) The teachers here are open to different ways of learning and help us decide how. (PS)		It's not made clear. (HS) Really? I have no examples of this. (PS)	
• ***When this teacher gives me opportunities to direct my own learning I really get engaged in the learning and feel as if I own it.***			
Yes and I like being involved in how I learn things, it helps me understand and I get more out of the course. (HS) We do discovery learning. We are given [the opportunity] to use the whole building and different resources. We are given a choice of topic that helps us stay interested. (PS)		It never happens so I can't comment. (HS) The teacher decides. (PS)	
• ***I am regularly encouraged to follow my own interests and questions and to direct my own learning.***			
Almost every research assignment we choose our own things to research within specific criteria. (HS) When it's something I'm interested in ☺. (PS)		It's maths—I don't [think] there is much leeway for people who want to follow their own interests or questions. (HS) I've always been told to ask questions but when I raise my hand I'm told to put my hand down. (PS)	
• ***The teacher listens to me and he/she answers my questions and responds to my ideas.*** • ***The teacher takes time to answer my questions and responds to my ideas.***			
She will often suggest things I hadn't thought of or she helps me to develop my ideas. (HS) He always listens but sometimes he suggests an approach to how we can learn it ourselves with more depth. (PS)		When I ask a question it's usually about going deeper into the subject and often she tells me to ask her later and then I forget. (HS) No—not true. (PS)	

Table 6 | Students' perceptions of teacher practice for **Element 3.3: Explore the construction of knowledge**
Teachers with a highly developed pedagogical repertoire compared with teachers with a limited pedagogical repertoire

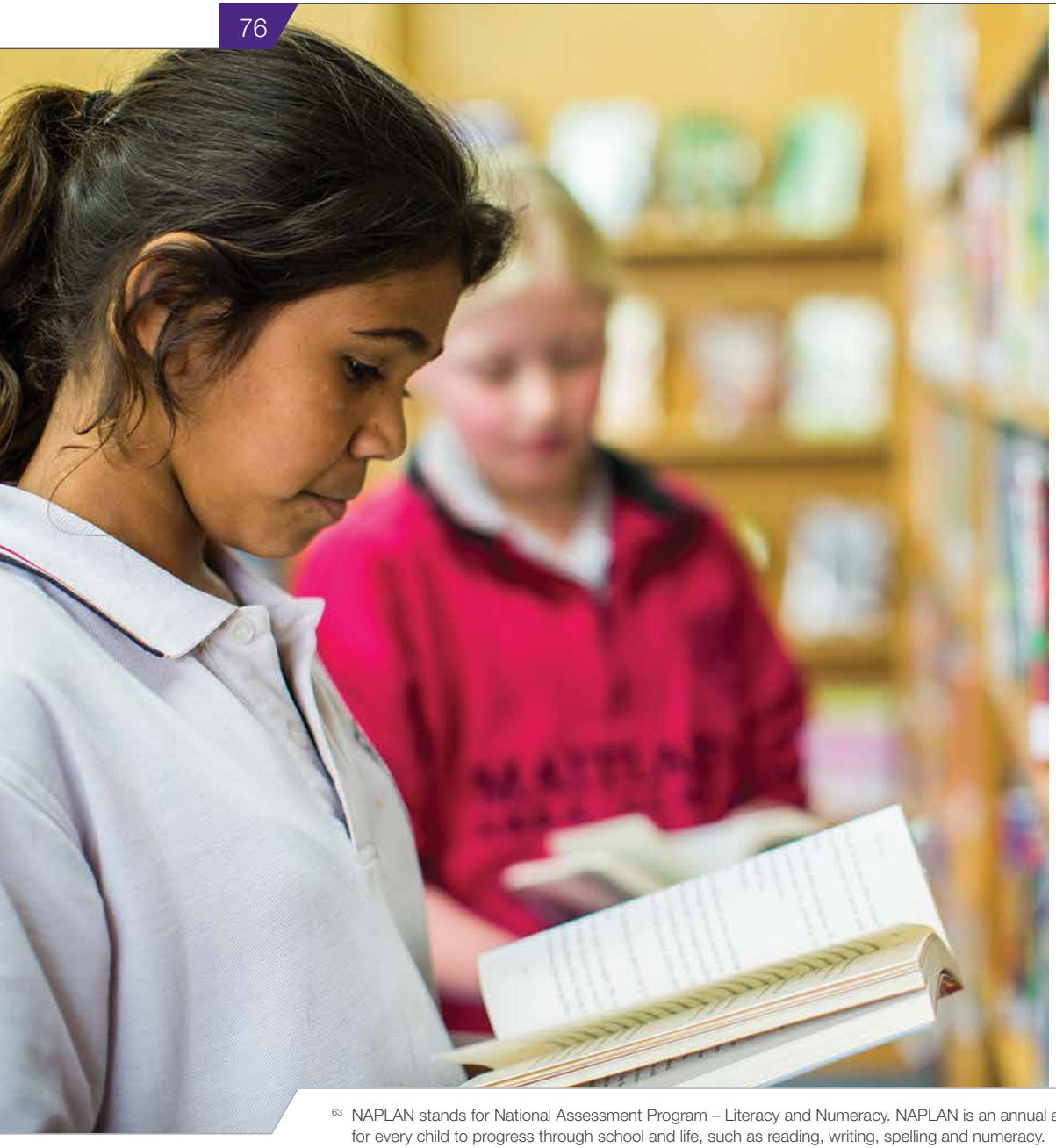
3.3 Explore the construction of knowledge			
Highly developed pedagogical repertoire		**Limited pedagogical repertoire**	
High school (HS) Mean rating 11.55/16	Teachers n=10; Students n=43	High school Mean rating 9.45/16	Teachers n=10; Students n=40
Primary school (PS) Mean rating 10.89/16	Teachers n=10; Students n=46	Primary school Mean rating 8.56/16	Teachers n=10; Students n=42
Students were asked to rate how true each of four statements were in their experience. Some student comments are included to illustrate their thinking.			
• ***We explore different ways of looking at things: eg how different cultures view the world, how our own experiences can affect how we view the world.*** • ***We look at how people from different places and countries have different ways of understanding things.***			
We are given the chance to discuss scientific debates and how opinions do vary. (HS) Yes we always do. (PS)		We haven't really got to that topic..! (HS) My dad teaches me life not school. (PS)	
• ***We are encouraged to question the basis or evidence for ideas and to detect bias.*** • ***We are encouraged to question why people might think what they do.***			
This is true in all subjects. (HS) She encourages us to think about what other people might think. (PS)		As this is for Maths we don't look at other cultures. (HS) She doesn't care. (PS)	
• ***The teacher helps us see how ideas in one subject or topic connect to another subject or topic.*** • ***The teacher helps us see how ideas we are learning are linked to other things we learn.***			
In our metacognitive journal we are always asked to link things we are learning to one another. We are encouraged to look at the links between what we are learning in all subjects and how they complement each other. (HS) She encourages us to connect with our prior knowledge. (PS)		Rarely. (HS) Very rarely. (PS)	
• ***The teacher really makes us think and question how we know something and whether we can be sure of what we think we know.***			
Our teachers do all that because they want us to get better at learning. (HS) I can strongly agree with that. (PS)		Sometimes! (HS) No. (PS)	

Table 7 | Students' perceptions of teacher practice for **Element 4.3: Apply and assess in authentic contexts**
Teachers with a highly developed pedagogical repertoire compared with teachers with a limited pedagogical repertoire

4.3 Apply and assess in authentic contexts			
Highly developed pedagogical repertoire		**Limited pedagogical repertoire**	
High school (HS) Mean rating 11.14/16	Teachers n=10; Students n=43	High school Mean rating 10.3/16	Teachers n=10; Students n=40
Primary school (PS) Mean rating 11.53/16	Teachers n=10; Students n=46	Primary school Mean rating 8.3/16	Teachers n=10; Students n=42
Students were asked to rate how true each of four statements were in their experience. Some student comments are included to illustrate their thinking.			
• ***We are often involved in learning through projects and issues that are real to us.*** • ***We do projects and work on real problems.***			
We are given projects that are relevant to us and today's society. We were recently given an assignment to research a disease that is prominent in our family or that is affecting someone we know. (HS) REAL PROBLEMS are fun! (PS)		We always learn about things that we don't kind of want to and don't get a say in anything. (HS) We do projects but there is nothing really to work out. (PS)	
• ***We connect what we are learning to applications beyond learning at school.*** • ***What I learn helps me understand things/people in my life outside school.***			
The things we learn help me understand practical things in my everyday life, for example: when my dad talks about using trig and Pythagoras when he's building things for our garden or aligning the roof of our verandah with the hill. (HS) Most things that I have learned I usually use outside the school grounds. (PS)		Not really. (HS) Sometimes but mostly no. (PS)	
• ***I judge how well I think I have learned something against goals, standards or criteria we set.***			
I always make a goal and go back and forth and see if I have achieved it, or can achieve it. (HS) Yes. I do. (PS)		I tend to judge how well I did by the grade the teacher decides. (HS) We don't really have learning goals in this class. (PS)	
• ***We demonstrate what we have learned and get feedback and advice from a variety of people.***			
The school works closely with the community to have a wide range of people look at our work. (HS) Feedback is very good because you would love helping others and it will make you very happy and them. (PS)		Not really. (HS) What do you mean? (PS)	

SECTION 4

APPLYING THE KEY FINDINGS TO IMPROVE TEACHING QUALITY AND STUDENT LEARNING OUTCOMES



Applying the key findings to improve teaching quality and student learning outcomes

How do the findings from the SA TfEL Pedagogy Research Project inform teachers and leaders about how to improve the dual outcomes for SA learners—improved academic performance and the development of lifelong learner capabilities?

Examining SA academic achievement

Of the many measures of academic achievement, NAPLAN[63] and PISA[64] results respectively provide national and international comparators for SA academic achievement.

How do SA students' NAPLAN results compare with the national results?

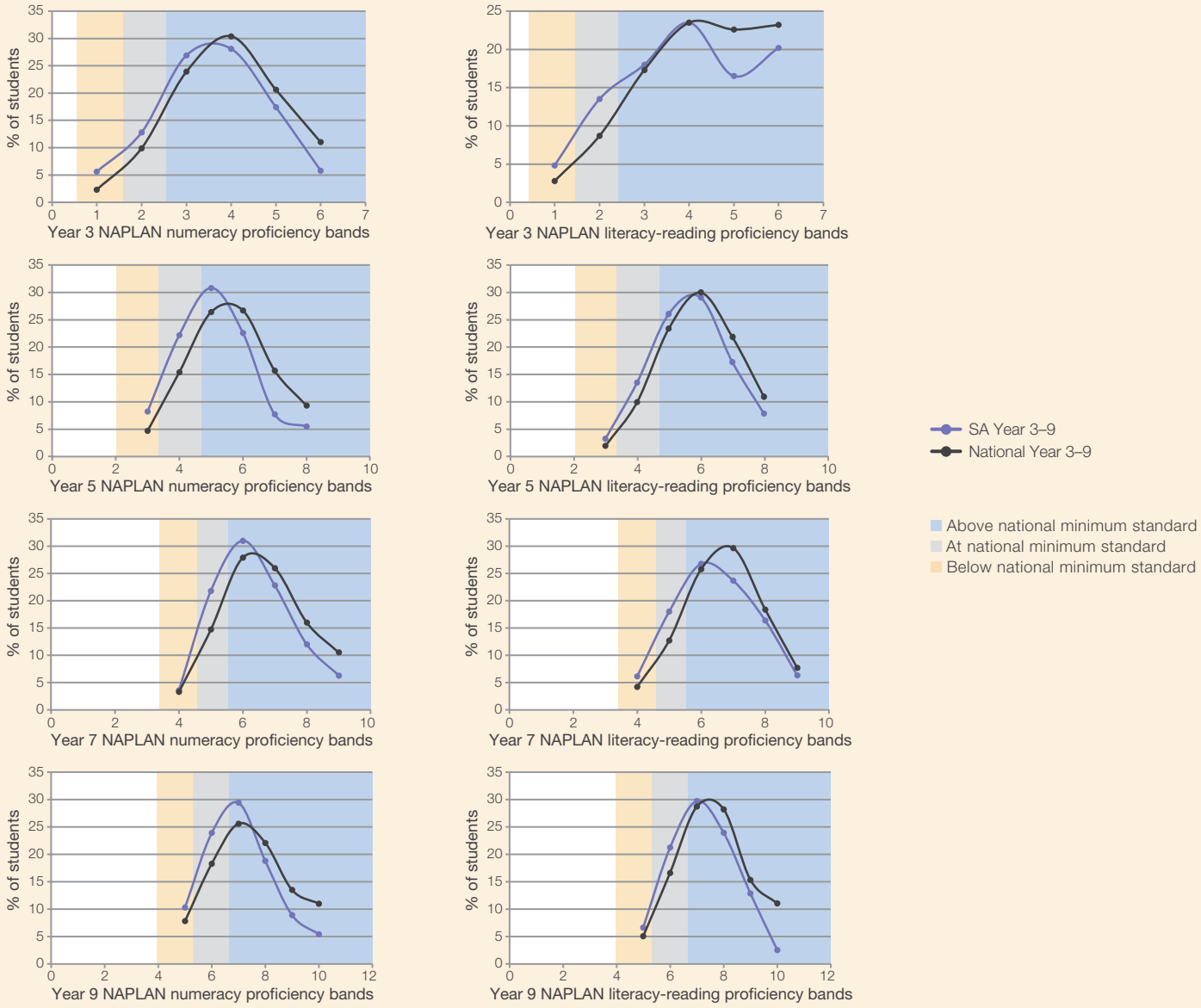
Figure 44 shows a comparison of the achievement of SA students versus national students in general as a percentage of students in each of the proficiency bands for numeracy and literacy—reading for each of Years 3, 5, 7 and 9 for 2013.

Looking firstly at numeracy, the left hand column of Figure 44 shows a repeated pattern that begins in Year 3 and continues, with some slight variations, through Years 5, 7 and 9. Essentially, the NAPLAN proficiency bands data shows that SA has a lower percentage of students achieving in the top proficiency bands and, by corollary, a higher percentage of students achieving in the lower proficiency bands.

[63] NAPLAN stands for National Assessment Program – Literacy and Numeracy. NAPLAN is an annual assessment for students in Years 3, 5, 7 and 9 in Australia. NAPLAN tests the skills that are essential for every child to progress through school and life, such as reading, writing, spelling and numeracy.

[64] PISA stands for Programme for International Student Assessment which is a worldwide study by the Organisation for Economic Co-operation and Development (OECD) in member and non-member nations of 15-year-old school pupils' performance with regard to mathematical, scientific and reading literacies.

Figure 44 | Year 3–9 NAPLAN proficiency bands for numeracy and literacy—reading
SA vs National 2013



Essentially, the NAPLAN numeracy data shows that SA has a lower percentage of students achieving in the top proficiency bands and, by corollary, a higher percentage of students achieving in the lower proficiency bands.

For literacy—reading, in the right hand column of Figure 44, the pattern is less regular. In Year 3 the difference between the percentage of SA students and the percentage of students nationally is negligible for bands 3 and 4, several percentage points different for bands 1 and 6, with a strong dip in the numbers of SA students scoring in band 5 compared with the national percentage of students scoring in this band. Year 5 results show an overall lower percentage of SA students scoring in the top two proficiency bands with very similar percentages scoring in band 6. In Year 7, the percentages in the highest two bands for SA students are quite similar to the national percentages with the largest difference between SA students and students nationally occurring for band 7. In Year 9, the largest difference shows up in the highest proficiency band.

The NAPLAN data suggests that SA students hit a 'glass ceiling'.

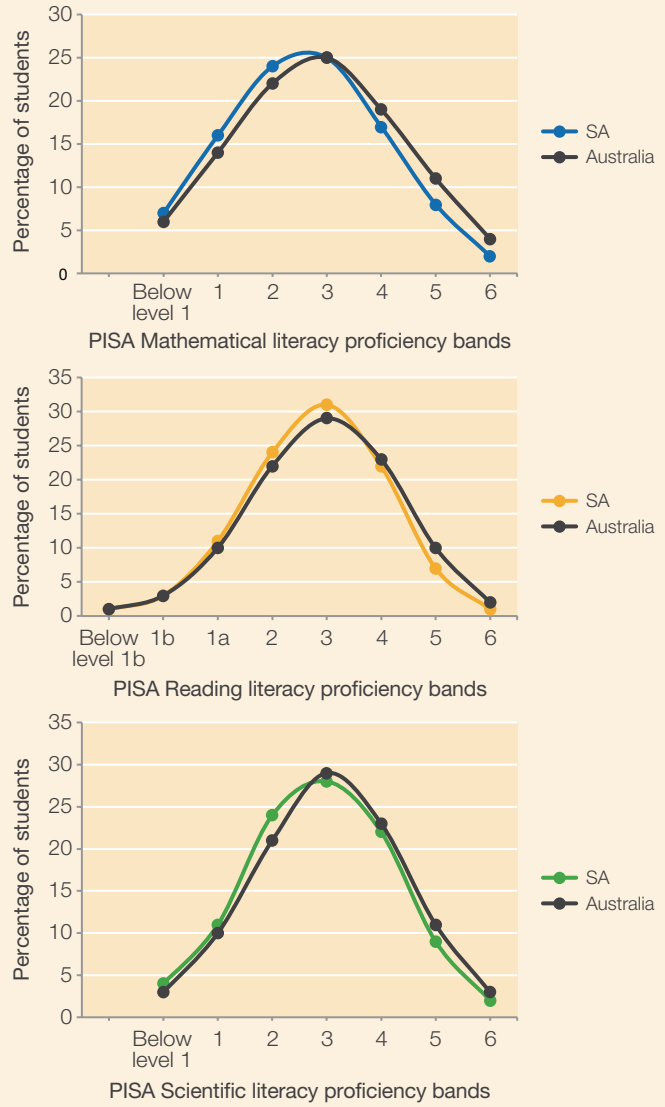
Despite the irregularity of the pattern in literacy—reading compared with numeracy, it is reasonable to make the general claim that SA DECD has a lower percentage of students achieving in the top proficiency bands for NAPLAN tests in both literacy—reading and numeracy, with this pattern being most consistently evident and more pronounced in numeracy. This pattern is not unique to the 2013 data—rather, it is a general feature of SA NAPLAN results. The NAPLAN data suggests that SA students hit a 'glass ceiling'.

How do SA students perform on PISA?

PISA tests 15 year olds' critical thinking in math, science, and reading. The test questions are intended not to measure memorisation of facts, but rather demand that students draw on knowledge and real-world problem solving skills.

Figure 45 shows that the SA 'glass ceiling' trend is also apparent in the 2012 PISA results[65]. In all three literacies it can be seen that SA is under-represented in the higher proficiency bands, with this being most obvious with regard to mathematical literacy. Care needs to be exercised, however, in making any specific claims about the relationship between NAPLAN results and PISA results, as the proficiency bands are constructed on a

Figure 45 | PISA proficiency bands for mathematical, reading and scientific literacy SA students from all SA schools vs Australia 2012



[65] Thomson S, De Bortoli L & Buckley S (2013) *PISA 2012: How Australia measures up – The PISA 2012 assessment of students' mathematical, scientific and reading literacy*, Australian Council for Educational Research (ACER), accessed at http://www.acer.edu.au/documents/PISA-2012-Report.pdf

different set of criteria and, in addition, SA PISA results are from a representative sample of SA students across all schooling sectors. What is clear, though, is that whether it is according to NAPLAN proficiency bands or PISA proficiency bands, SA students have a lower representation in the higher proficiency bands than the average Australian student.

To understand how to respond to this trend and how to make a difference, further analysis of the NAPLAN results was undertaken.

What contributes to a lower percentage of SA students scoring in the top bands of proficiency as measured by NAPLAN?

NAPLAN numeracy tests assess both understanding of specific content and the proficient use of this content knowledge in a range of contexts from straightforward application, in which one can see immediately what one needs to do, to more complex situations, which require complex reasoning, multiple steps of reasoning, and/or a strategic approach to enable one to solve the item quickly in the time constraints the test imposes.

A first analysis of the NAPLAN results might suggest that lack of specific content knowledge could be a factor in SA students' below average performance. Lack of specific content knowledge may well contribute to the below average performance, but it cannot be the dominant or critical factor underlying the 'glass ceiling' effect. If the pattern in the data was due to lack of specific content knowledge, one would expect that this would appear across all proficiency bands, not just predominantly in the higher proficiency bands. The fact that there appears to be a 'glass ceiling' suggests something other than, or in addition to, a lack of content knowledge is operating.

Although not yet constructed with reference to the Australian Curriculum: Mathematics, each NAPLAN numeracy test covers a range of proficiencies—effective use of basic understanding of concepts and principles—'fluency'—as well as the application of this basic understanding in contexts that require more complex reasoning and problem solving—'fluency plus'.

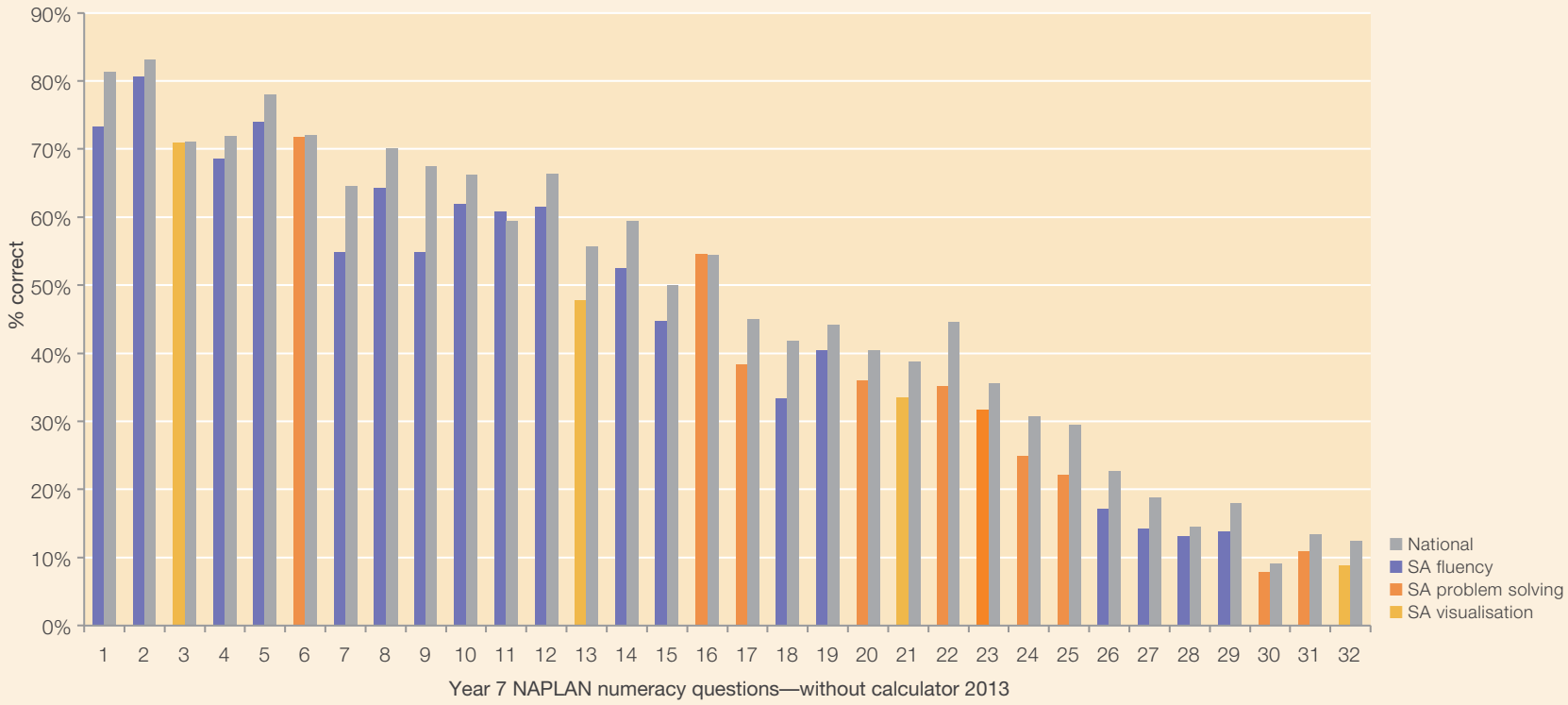
To interrogate whether the poorer performance in the higher bands was due to different levels of mathematical reasoning and problem solving proficiency—'fluency plus'—the individual items from the 2013 NAPLAN Year 3–Year 9 numeracy tests were coded by item according to the following scheme:

- **Fluency**—requires direct interpretation and application of specific content knowledge and basic understanding in straightforward situations
- **Visualisation**—requires the specific cognitive process of creating an internal visual image and subsequent manipulation of this image
- **Problem solving**–'fluency plus'—includes application of basic understanding to authentic, unfamiliar contexts and/or understanding, combined with complex reasoning and the employment of effective strategies.

Figure 46 shows the percentage of Year 7 2013 SA students who gave the correct answer on each test item for the NAPLAN numeracy–without calculator test, compared with the national percentage correct results. The bars for SA show the coding of each of the items according to the scheme outlined above.

The fact that there appears to be a 'glass ceiling' suggests something other than, or in addition to, a lack of content knowledge is operating.

Figure 46 | Year 7 NAPLAN numeracy—Percentage of questions correct SA vs National 2013



As can be seen from Figure 46, for almost all of the items, the % of SA students who provided the correct answer is lower than the % of students nationally who were correct.

To ascertain whether there was any difference in the mathematical proficiencies coded—fluency, visualisation and problem solving—the relative proportion of SA correct versus national correct was plotted for each item type. This is shown in Figure 47. Each bar shows the average % correct for SA for a particular item type as a proportion of the average % correct for Australian students. Taking the first cluster of bars for Year 3, this shows that if the average % correct for Australian students on fluency items was 100%, SA's average % correct on the same type of item was 89%.

Figure 47 | Year 3–9 NAPLAN numeracy
Relative proportion of mean % answers correct by item type
SA as percentage of National 2013

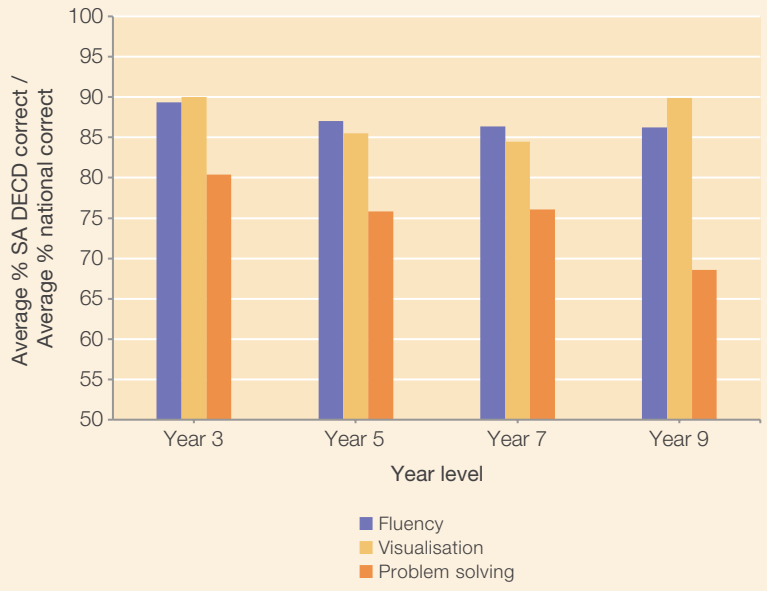
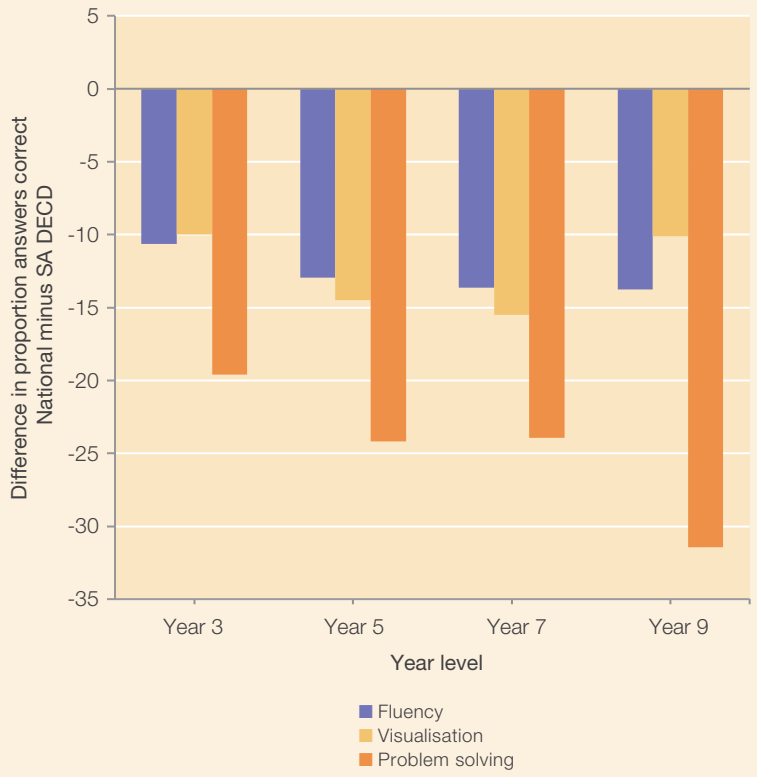


Figure 48 | Years 3–9 NAPLAN numeracy
Difference in relative proportion mean % answers correct by item type
National minus SA 2013



Viewing the data another way, Figure 48 illustrates the proportionate 'shortfall' in SA % correct compared with national % correct for each coded item type from Year 3–Year 9.

Both Figures 47 and 48 illustrate that SA students fall below the national results in all three numeracy item types—fluency, visualisation and problem solving—with the greatest difference between SA and national performance being on problem solving. The performance on problem solving items deteriorates between Year 3 and Year 5, remains similar between Year 5 and Year 7, and then deteriorates again, markedly, in Year 9.

Further discussion

In an attempt to respond to the 'pressure to perform', it would be easy to think that obtaining a higher level of success on NAPLAN could be obtained by more direct instruction and more drill: more 'teaching to the test'. The power of the above analysis of SA students' performance by item type is that it shows that a simplistic approach will not achieve the

Reasoning and problem solving proficiencies are not directly 'instructable' but they are 'learnable'. They are learned when teachers skilfully engage students in questioning and challenging and with responsive prompting. This requires teachers to adopt a responsive, learner- and learning-centred pedagogy, with the ability to discern when to teach explicitly versus when to encourage and facilitate the learners' construction of their own understanding through reasoning and problem solving.

desired result. The analysis illustrates that increasing students' content knowledge and basic understanding (fluency) will increase SA performance on NAPLAN numeracy where knowledge gaps exist, but that alone will not raise SA performance in the area where the biggest shortfall in SA performance occurs, which is in the higher proficiency bands, for which success relies on problem solving, reasoning and strategising.

Reasoning and problem solving proficiencies are not directly 'instructable' but they are 'learnable'. They are learned when teachers skilfully engage students in questioning and challenging and with responsive prompting. This requires teachers to adopt a responsive, learner- and learning-centred pedagogy, with the ability to discern when to teach explicitly versus when to encourage and facilitate the learners' construction of their own understanding through reasoning and problem solving. Direct instruction and drill will not help SA students break through the 'glass ceiling'. The challenge for SA teachers is to develop the students' capacity to reason and problem solve.

Direct instruction and drill will not help SA students break through the 'glass ceiling'. The challenge for SA teachers is to develop the students' capacity to reason and problem solve.

Developing students' problem solving capacity and developing content knowledge and basic understanding—fluency—are not mutually exclusive. It is not a case of 'either' direct instruction 'or' problem solving. The challenge is to develop basic understanding *through* reasoning and problem solving and to encourage active application of this understanding in a range of familiar and unfamiliar contexts to consolidate the understanding and develop fluency and transfer. This approach will require of teachers a preparedness to move beyond a 'content and control' orientation and beyond a 'low challenge' approach, both of which were found in the research to be correlated with a limited pedagogical repertoire (Key findings 2.1 and 2.2). Essentially the challenge is for teachers to embrace the development of all elements of the TfEL Framework in their practice and to adopt responsive, learning-centred pedagogical practice, combined with a design approach to teaching and learning.

What does PISA tell us about lifelong learning capabilities?

OECD assesses the mathematical, scientific and reading literacy of fifteen year old students through the Programme for International Student Assessment (PISA) every three years. Each time the assessment is undertaken, one of these learning areas is singled out for a more in-depth consideration of students' motivation and attitudes to complement the performance data. In 2012, mathematics was singled out for this in-depth consideration. For South Australia, this was very timely. A driving agenda in the SA TfEL Pedagogy Research Project is developing insights into how to unleash the learning potential of the students: how to reveal the 50% of variance in academic achievement due to the learners themselves. The results of PISA 2012 provide a number of insights into Australian students' motivation to learn and achieve success in mathematics.

As indicated in the last section, the PISA performance data is broadly consistent with the 2013 NAPLAN data and shows South Australian students have the lowest levels of proficiency of any state and territory other than the Northern Territory, with an under-representation in the highest performance bands and an over-representation in the lower bands. This is particularly the case for female students. The comprehensive analysis in PISA 2012 of students' motivation to learn and succeed in mathematics gives a more complete picture of South Australian learners and some of the factors that underpin their academic performance and attitude to learning.

Several indicators were developed in the PISA assessment program of students' motivation and engagement in their mathematics education and allow for national and international comparisons.

Intrinsic motivation to learn mathematics

The level of enjoyment of mathematics was assessed through a survey in which students were asked to indicate the extent to which they reported agreement with four statements:

- I enjoy reading about mathematics
- I look forward to my mathematics lessons
- I do mathematics because I enjoy it
- I am interested in the things I learn in mathematics.

While caution in interpreting students' responses to individual questions is warranted, the proportion of South Australian students who 'agreed' or 'strongly agreed' with each of these statements was the lowest in the country. Australian females and South Australians were the only groups to fall below the OECD average index for their intrinsic motivation to learn in mathematics. The group with the highest index for intrinsic motivation was the Northern Territorians. Rural students demonstrated higher levels of intrinsic motivation than metropolitan or regional students.

Instrumental motivation to learn mathematics

Students' perception that mathematics might be important to their future was examined through the extent to which they reported agreement with four statements:

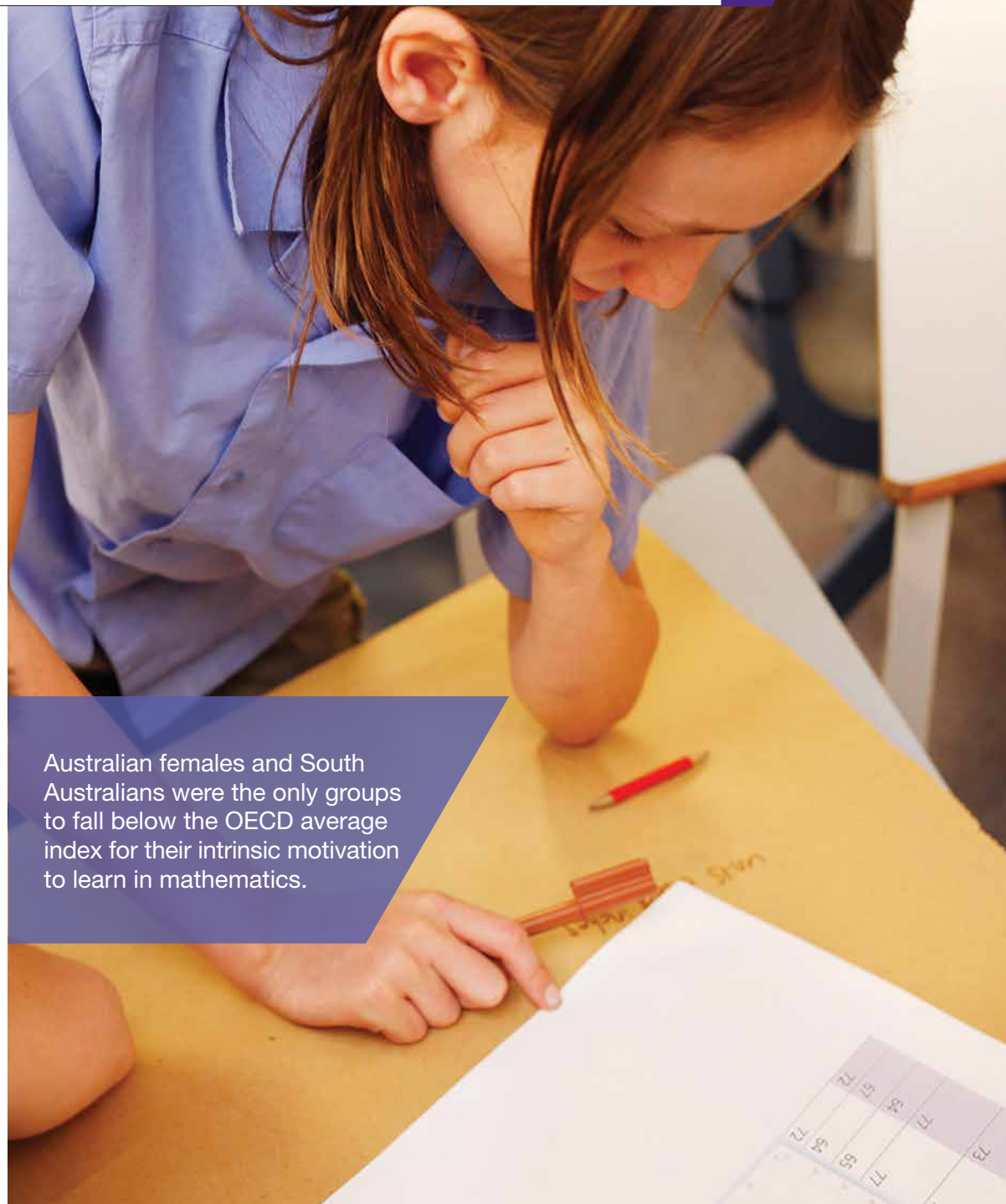
- Making an effort in mathematics is worth it because it will help me in the work that I want to do later on
- Learning mathematics is worthwhile for me because it will improve my career prospects and chances
- Mathematics is an important subject for me for what I want to study later on
- I will learn many things in mathematics that will help me get a job.

Again, across these items, South Australians had the lowest index. It is important to note that students in Tasmania and the Northern Territory had the highest index. Rural students demonstrated higher levels of instrumental motivation than metropolitan or regional students.

Students' self-concept in mathematics

In PISA, self-concept depends on students' competency-based beliefs, again assessed by their reported levels of agreement with a series of statements:

- I am just not good at mathematics
- I get good grades in mathematics
- I learn quickly in mathematics
- I have always believed that mathematics is one of my best subjects
- In my mathematics class, I understand even the most difficult work.



Australian females and South Australians were the only groups to fall below the OECD average index for their intrinsic motivation to learn in mathematics.

Students from the ACT and Tasmania stand out, with a high index on these items indicating a high self-concept and, while South Australians have the lowest index, it is not dissimilar to a number of other states. This may be an important finding in that while SA students' performance and general disposition towards mathematics is low, this is not reflected so strongly in their self-concept. This may indicate low levels of expectation from teachers, parents and students themselves. The fact that the percentage of SA students who perceive that they get good grades in mathematics is higher than all of the states who outperform SA on PISA (except ACT) suggests that there may well be a low level of expectation or low level of challenge in SA students' experience of assessment.

The fact that the percentage of SA students who perceive that they get good grades in mathematics is higher than all of the states who outperform SA on PISA (except ACT) suggests that there may well be a low level of expectation or low level of challenge in SA students' experience of assessment.

Students' self-efficacy in mathematics

In PISA, self-efficacy also depends on students' competency-based beliefs, but is more specific and measures how competent students anticipate they will be on a defined task. Students are asked to rate how confident they would feel on a range of tasks.

Table 8 | Students' rating of their confidence in maths

	% 'confident' or 'very confident'	
Task descriptions	**SA**	**Range (other states and territories)**
Using a train timetable to work out how long it would take to get from one place to the other	80	80–90
Calculating how much cheaper a TV would be after a 30% discount	70	71–82
Calculating how many square metres of tiles you would need to cover a floor	71	65–79
Understanding graphs presented in a newspaper	82	83–89
Solving an equation like $3x + 5 = 17$	84	81–95
Finding the actual distance between two places on a map with a 1:10,000 scale	50	49–64
Solving an equation like $2(x + 3) = (x + 3)(x - 3)$	70	64–81
Calculating the petrol consumption rate of a car	45	50–58

The general self-concept of South Australians does not translate well into self-efficacy. That is, while they report that they seem to be doing quite well in mathematics, when challenged with specific problems, SA students have the overall worst index of any state and territory (with SA, NT and Tasmania being below the OECD average). For almost all of the tasks listed in the table, SA is consistently lowest or next to lowest (usually only behind the NT).

Students' perceived locus of control in school and in mathematics

These two measures are reported separately by the OECD but combined here for comparison.

Table 9 | Students' perceived locus of control

Students' perceived locus of control in school	SA % (others range)	Students perceived locus of control in mathematics	SA % (others range)
If I put in enough effort, I can succeed in school	96 agree (96–98)	If I put in enough effort, I can succeed in mathematics	93 agree (92–96)
It is completely my choice whether or not I do well in school	87 agree (86–89)	Whether I do well or not in mathematics is completely up to me	85 agree (84–88)
Family demands or other problems prevent me from putting a lot of time into my school work	59 disagree (55–63)	Family demands or other problems prevent me from putting a lot of time into my mathematics work	64 disagree (59–71)
If I had different teachers, I would try harder at school	58 disagree (53–64)	If I had different teachers, I would try harder in mathematics	60 disagree (59–66)
If I wanted to, I could perform well at school	93 agree (92–94)	If I wanted to, I could do well in mathematics	87 agree (87–91)
I do badly at school whether or not I study for my exams	78 disagree (79–84)	I do badly in mathematics whether or not I study for my exams	69 disagree (69–78)

South Australian students' perception of control is generally in line with the other states and territories (if at the low end) in both mathematics and school more generally. The discrepancy between the perceived level of control in school and in mathematics is largely consistent with that across the country.

Attributions of failure in mathematics

Students' self responsibility for failure in mathematics was measured by imagining that they had performed badly on a weekly mathematics quiz and, given this situation, the likelihood that they would have had the following thoughts:

- I'm not very good at solving mathematics problems
- My teacher did not explain the concepts well this week
- This week I made a bad guess on the quiz
- Sometimes the course material is too hard
- The teacher did not get students interested in the material
- Sometimes I am just unlucky.

A greater proportion of South Australian students were likely/very likely to think 'I'm not very good at solving mathematics problems' in this scenario than students from any other state or territory (55% compared to a range of 47–53%). There was a notable gender imbalance across the country, with 60% of female students likely/very likely to think in this way compared to 44% of male students.

Mathematics anxiety

Students were asked about the extent to which they agreed with the following statements to determine the level of mathematics anxiety:

- I often worry that it will be difficult for me in mathematics classes
- I get very tense when I have to do mathematics homework
- I get very nervous doing mathematics problems
- I feel helpless when doing mathematics problems
- I worry that I will get poor grades in mathematics.

Other than the NT, South Australian students have the highest index for mathematics anxiety (along with Queensland). Across Australia, a greater proportion of female students agree with these statements than male students.

Subjective norms

To get some insight into the influences of others on students' beliefs, the following statements were used and again, students were asked about the extent to which they agree with them:

- Most of my friends do well in mathematics
- Most of my friends work hard in mathematics
- My friends enjoy taking mathematics tests
- My parents believe it's important for me to study mathematics
- My parents believe that mathematics is important for my career
- My parents like mathematics.

It is easy to over-interpret students' responses to these questions because it is capturing what students are reporting what they think about what someone else thinks. Even with that in mind, SA students again have the lowest index score.

Summary of the NAPLAN and PISA data

Overall the data from PISA 2012 paints a picture that students in South Australia have the poorest disposition towards learning mathematics than students from any other state or territory. This cannot be explained away by rurality or the socio-economic makeup of the community. South Australians are the least motivated, least engaged students who might generally value mathematics education, but not for their own futures.

NAPLAN and PISA data indicate that SA students hit a 'glass ceiling' and perform less well than other Australian students in the higher proficiency bands that require application of basic mathematical understanding to authentic, unfamiliar contexts and/or understanding combined with complex reasoning and employing effective strategies.

Overall the data from PISA 2012 paints a picture that students in South Australia have the poorest disposition towards learning mathematics than students from any other state or territory.

PISA data surfaces some important insights into SA students' attitudes and motivation to learn mathematics. When the PISA and NAPLAN data are combined with the SA TfEL Pedagogy Research Project student data, a picture of the characteristics of SA students emerges as follows.

The PISA 2012 data shows SA students have:

- the lowest disposition to learn mathematics of students in all the Australian states
- a perception of how well they are performing in mathematics that is higher than all of the states (bar one) who actually perform more highly than them on PISA
- have an average, by Australian standards, self-concept as a mathematics learner
- have the lowest mathematics self-efficacy—confidence in applying mathematics to everyday situations
- the highest percentage (40%) of students in all states and territories who report that they are just 'not good at mathematics'.

In addition to the NAPLAN and PISA data, the SA TfEL Pedagogy Research Project data showed that:

- students in this study have, on average, a neutral disposition to learning, with secondary students showing a lower disposition to learn than primary students
- students in this study have a lower average score on resilience than their UK counterparts and that was most pronounced for those who reported higher scores on other dimensions of being a lifelong learner
- approximately 40% of students in this study hold a view that intelligence is 'fixed'.

Using insights from the key findings to improve academic outcomes

In addition to describing the baseline characteristics of SA DECD students, the SA TfEL Pedagogy Research Project data on quality of pedagogy and the impact of TfEL elements on deep engagement provides considerable direction as to what is required to raise the academic achievement of SA students. Although the deeper analysis with regard to NAPLAN and PISA has been, due its availability, on mathematics, the same principles apply to other academic areas.

There are two key questions to ask of the research. One question relates to the development of teachers' pedagogical repertoire and the other to unlocking the 50% of variance due to what the students bring.

1 | Developing teachers' pedagogical repertoire

When the SA pedagogy research began in the late 90s, the response to a limited pedagogical repertoire was to teach numerous strategies: to provide a 'bag of tricks'. And, the response to teachers who wanted a 'script' was to provide them with a script to fill the void. Neither of these approaches achieved widespread success in developing teachers' capacities to develop their own strategies or design their own 'script'.

What insights does the SA TfEL Pedagogy Research Project findings provide on how to unlock teachers' capacities to develop their own strategies and design their own 'script'?

Perhaps the most important finding was uncovering the relationships that exist between teacher world views (their epistemic assumptions and their beliefs about their role) and their pedagogical practice and approach to teaching and learning. To be successful in any lasting way, any attempts to develop teachers' pedagogical repertoires must engage teachers in:

- developing their epistemic assumptions through a deeper understanding of learning and knowing (TfEL Domain 1: Element 1.1: Understand how self and others learn and Element 1.2: Develop deep pedagogical and content knowledge)
- an examination of their educative purpose and role (TfEL Domain 1: Element 1.5: Discuss educational purpose and policy)

- learning to design responsively for learning, in addition to planning and organising for teaching and learning (TfEL Domain 1: Element 1.6: Design, plan and organise for teaching and learning)

Applying the findings of the SA TfEL Pedagogy Research Project to questions 1 and 2 above is best achieved by addressing the questions as intertwined.

2 | Unleashing the students' potential to help their own learning

What can be done to:

- enhance students' disposition to learn?
- develop greater resilience?
- teach students (and teachers) that intelligence, and consequently performance, is not fixed and that they can learn how to learn in areas that they think they are 'no good at'?

Enhancing students' disposition to learn

Stage 1 of the research showed that Domain 4: Personalise and connect learning had a positive impact on raising both disposition to learn and interest. In particular, Elements 4.1: Build on learners' understandings, 4.2: Connect learning to students' lives and aspirations and 4.3 Apply and assess in authentic contexts were shown to have the biggest impact (Figure 35, p.61)

Helping teachers develop the capacity to design learning experiences that build on prior understandings, that connect to students' interests and that involve application in authentic contexts will not only increase students' disposition to learn, but will also increase their self-efficacy (confidence in applying learning to everyday contexts) and increase their problem solving and reasoning ability—the very same capabilities that are associated with achieving in the higher proficiency bands of both NAPLAN and PISA.

Develop greater resilience in learners by developing their beliefs about intelligence and the nature of learning

The SA TfEL Pedagogy Research Project findings indicate two areas that potentially contribute to low resilience in learners. One relates to the students themselves and the other to teacher behaviour.

The finding (Key finding 3.2) that approximately 40% of students believe that intelligence is fixed, combined with the PISA 2012 data showing that 40% of SA students consider that they are 'just not good at mathematics', provides the key to affecting what the students bring.

Any pattern of low learner resilience potentially has multiple contributing factors associated with past experiences, experiences outside of school and, no doubt, genetic factors. The question is: what school-based factors might be contributing to low resilience, and how might these be altered?

Much of the current work on developing resilience[66] has grown from the work of Albert Ellis[67] in the 1950s and 1960s. Albert Ellis' key premise was that it is the individual's beliefs that determine the consequences of adversity. He proposed that, when an individual experiences a failure or an inability to succeed at something, the consequence is mediated by the individual's belief about the cause of the inability. The consequence of 'adversity' in learning for students who believe that they 'just can't do maths' is low resilience; they give up and do not engage because they believe they have an inherent inability. Resilient individuals on the other hand bounce back and keep trying because they believe they can overcome the 'adversity' if they try harder, use different approaches, or get help. Central to developing learner resilience is developing the learner's understanding of brain plasticity and variable intelligence: in other words, developing their self-belief as learners (TfEL Elements 3.1: Teach students how to learn and 2.2: Build a community of learners).

Central to developing learner resilience is developing the learner's understanding of brain plasticity and variable intelligence: in other words, developing their self-belief as learners (TfEL Elements 3.1: Teach students how to learn and 2.2: Build a community of learners).

[66] See, for example, the work of the Positive Psychology Center at the University of Pennsylvania http://www.ppc.sas.upenn.edu/prpsum.htm (accessed 17 June 2014)

[67] Ellis A (1962) *Reason and Emotion in Psychotherapy*, Lyle Stuart, Oxford, England

The task is to help teachers understand that the greatest nurturing they could offer learners is to design learning experiences that are perceived by learners as achievable challenges and that encourage them both to think for themselves and to persist.

As cited previously, much work has been undertaken to provide evidence of the positive impact on academic achievement through explicitly teaching students about variable intelligence. Students also develop greater resilience through developing a language for learning and understanding that deep learning is a product of being challenged, of being stuck in 'the pit'[68] and finding your way out. In addition to the impact on positive affect of all of the elements of Domain 2: Create safe conditions for rigorous learning (Figure 35), the research highlighted the impact on positive affect of Element 3.1: Teach students how to learn. Both Domain 2: Create safe conditions for rigorous learning and Domain 3: Develop expert learners provide direct guidance to teachers as to how they too can have an impact on positive student affect. Figure 35 demonstrates that this accounts for 71% of the variance in deep engagement in learning.

The argument above applies equally to teachers. In 2010, 58% of SA DECD teachers were aged 45 years and over and, of this group, more than a quarter were aged over 60 years. For these teachers, their own schooling experience and their teacher education occurred before there was widespread understanding of brain plasticity and variable intelligence. They grew up in a world that embraced that you are 'born smart or you ain't': that you are either good at or not good at maths, writing, language, art, music etc.

Consequently it is possible that their own understandings of variable intelligence, and thus their own beliefs in the ability of all of their learners to learn, are limited. Even when an understanding of the implications of brain plasticity for learning are understood, layers of habits and practices need to be unlearned in order to learn how to teach from an assumption that all learners can learn and that it is the role of a teacher to help them learn.

Many teachers, as found in the research (Key finding 2.1), view their role as needing to 'teach' the curriculum and adopt a set of practices devoted to 'content coverage and control' rather than practices devoted to 'responsive–learning and student-centred' pedagogy. The fundamental shift required for the teachers who hold a 'content coverage and control orientation' is to understand that the curriculum represents every student's entitlement to learn: it is the teacher's role to do everything in their power to ensure that this learning happens.

[68] See, for example, the work of Stonefields School, NZ on developing learner qualities and the language of learning, http://www.stonefields.school.nz/page/Vision/ (accessed10 May 2014)

Further insights from the world view findings (Key findings 2.1 and 2.2) showed that teachers who perceived that their prime role was to care for students adopted a high relationship–low challenge approach to their practice. The teachers who leant towards this world view expressed that they wanted to protect learners from failure: they avoided approaches that challenged students and those strategies that encouraged students to think for themselves. The task is to help teachers understand that the greatest nurturing they could offer learners is to design learning experiences that are perceived by learners as achievable challenges and that encourage them both to think for themselves and to persist. The secret to effective, responsive pedagogy is being able to read the 'teachable moment' and provide just enough support to prevent withdrawal into disengagement (TfEL Element 3.4: Challenge students to achieve high standards with appropriate support).

Making the shift from planning to designing

As discussed above, a fundamental step in helping teachers move beyond practices associated with 'content coverage and control' or 'high relationship–low challenge' towards a 'responsive pedagogy' that puts the learner and effective learning at the centre, involves helping teachers clarify their role as 'causing learning' rather than one of 'rescuing' from failure or steadfastly 'covering' the curriculum, regardless of whether learning has happened or not.

What will be critical on the part of leaders is to give teachers permission to make this shift: to actively promote responsive pedagogy that seeks to understand each learner and respond to their needs. Many teachers hold on to 'covering' the content in the face of non-learning because they fear reprisal if they have not 'covered' everything.

What is critical for the system is to focus on developing teacher capacity to design for learning; to understand the difference between planning and designing; to understand the difference between tasks that stimulate thinking and the application of understanding to real world contexts versus tasks that demand straight recall or direct application in a 'textbook' context. SA DECD has taken a deliberate approach to support the shift from planning to designing through the development of the learning design process and the SA DECD approach to the implementation of the Australian Curriculum.

Fundamental to the success of this approach to developing teacher capacity to design rather than to plan; to respond rather than to control; and to challenge rather than to protect from failure, will be engaging teachers in examining their understanding of their role, combined with the development of far greater epistemic awareness and reflection.

Raising the bar on intellectual challenge—breaking the 'glass ceiling'

The evidence from both NAPLAN and PISA data is unequivocal in terms of identifying that the greatest challenge for SA DECD—its leaders and teachers—is to break the 'glass ceiling' that prevents SA DECD students from achieving in the higher proficiency bands. The imperative to do this must be driven not simply by a desire to be seen to be performing by national standards, but also by a recognition that performance in the higher proficiency bands is fundamental to developing the students' lifelong learning capability and their capacity to thrive in an increasingly complex world.

Returning to the key findings regarding the baseline pedagogical profile of SA DECD teachers, a general finding was established that the three least observed elements of practice for SA DECD teachers are 2.3 Negotiate learning, 3.3 Explore the construction of knowledge and 4.3 Apply and assess in authentic contexts and the degree to which these observation scores are lower across the three groups of pedagogical quality (Key finding 1.3, Figure 16, p.36).

Having the confidence, ability and flexibility to design learning experiences that involve intellectual challenge, to be at ease with a 'design' versus 'script' approach to teaching and learning and to actively explore the construction of knowledge with learners requires deep pedagogical content knowledge (Element 1.2: Develop deep pedagogical content knowledge). Any attempt to develop teachers' capacity to design learning experiences needs to incorporate processes for ensuring teachers are developing deep pedagogical and content knowledge, as well as learning how to design thought-provoking tasks.

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Element 3.3 has the potential to develop learners who understand the nature of 'intellectual stretch' in all learning areas, learners who see a fundamental purpose in 'knowing' beyond achievement on a test.

Element 3.3: Explore the construction of knowledge also contributes to increasing intellectual challenge by developing students' metacognitive capacity—their ability to reflect on their own learning and thinking. The more they understand about learning, thinking and knowing, the more they understand the nature of learning and the nature and purpose of 'knowing' mathematics, science, art, history etc. Element 3.3 has the potential to develop learners who understand the nature of 'intellectual stretch' in all learning areas, learners who see a fundamental purpose in 'knowing' beyond achievement on a test.

Supporting teachers to embrace the challenge of extending their practice

The SA TfEL Pedagogy Research Project Stage 1 research identified that the strategies that had the greatest impact on the development of a professional learning culture (Key findings 5.1b and 5.2) were:

- creating safe conditions for learning
- establishing a collaborative focus through the establishment of professional learning communities or groups
- providing challenge and focused professional support
- reflective practice through self-reflection and peer observations
- providing time, opportunities, structure and purpose
- learning to 'design' for teaching and learning using the learning design process and TfEL.

Each of these strategies show school leaders what will make the difference and what will support teachers in developing their pedagogical repertoire. The research also identified successful leadership approaches (Key finding 5.3):

- sharing leadership
- establishing clear direction
- focusing on pedagogy
- getting involved as learners themselves.

These leadership approaches apply to all leaders—school leaders, education directors and system leaders.

Along with the school-related factors of site culture and staff turnover, the leaders in the SA TfEL Pedagogy Research Project schools identified 'multiple competing demands' as one of the top three barriers to developing a whole school approach to pedagogy (Key finding 5.4). Perhaps the biggest challenge for system leaders is to work actively together across all portfolios and units within the Office for Education to align initiatives around common priorities and to work together to integrate initiatives and to articulate and communicate the complementary nature of initiatives to reduce the perception of competing demands.

Looking to the future

In summary, we now have a wealth of solid evidence to inform our priorities for the future. The key findings from the National Partnerships SA TfEL Pedagogy Research Project 2010–2013 clearly set out directions for collective professional learning across all DECD schools and the system. Maintaining our strong supportive learning environments, whilst increasing the intellectual challenge and expectation of our learners, is at the heart of future improvement in student engagement and achievement if we are to break the 'glass ceiling' that prevents students from achieving in the higher proficiency bands and if we are to develop in SA students lifelong learner capabilities fundamental to their capacity to thrive in an increasingly complex world.

Glossary

ELLI—Effective Lifelong Learning Inventory (ELLI) tool developed by Professor Ruth Deakin Crick, Graduate School of Education, University of Bristol, UK. ELLI identifies seven characteristics of an effective lifelong learner: changing and learning (learning itself is learnable); critical curiosity; meaning making; resilience (embrace challenges); creativity (imagination); learning relationships (interdependence); strategic awareness (self awareness as learners).

Epistemic: The term 'epistemic' is used in this resource to refer to a person's assumptions and beliefs about knowledge and how it is acquired, and the influence those assumptions and beliefs have on their approach to learning and to teaching.

IoD: The Index of Educational Disadvantage allocates resources to address the educational needs of students from low socio-economic backgrounds. The Index groups schools into seven distinct categories of relative disadvantage, with all schools within a particular category being given the same rate of allocation. Category 1 schools serve the most disadvantaged families and Category 7 the least.

Meta-learning: Meta-learning refers to a student's capacity for thinking about and monitoring their own learning and thinking—their metacognitive capacity. Along with a positive sense of self as a learner and a positive disposition to learn, one's metacognitive capacity is a key aspect of being a capable and successful lifelong learner.

Mindset: The terms 'fixed mindset, fixed intelligence, entity view of intelligence' and 'growth mindset, variable intelligence, incremental view of intelligence' are sets of interchangeable terms used in the research literature eg Dweck (2006), Blackwell et al (2007)

Most Significant Change (MSC): Most Significant Change data collection involves the collection of qualitative data through personal narrative. It was developed for NGOs by Dr Rick Davies. Dr Jessica Dart adapted the methodology for the education context in partnership with the SA Learning to Learn Initiative. See Davies R & Dart J (2005).

NAPLAN stands for National Assessment Program—Literacy and Numeracy: NAPLAN is an annual assessment for students in Years 3, 5, 7 and 9 in Australia. NAPLAN tests the skills that are essential for every child to progress through school and life, such as reading, writing, spelling and numeracy.

Pedagogical repertoire refers to the range of TfEL elements observed and the quality of practice as determined by the four TfEL quality tests. A high pedagogical repertoire indicates that a high range of TfEL elements were observed in the teacher's practice and that they were rated highly in terms of intentionality, effectiveness, consistency and responsiveness.

PISA stands for Programme for International Student Assessment, which is a worldwide study by the Organisation for Economic Co-operation and Development (OECD) in member and non-member nations of 15-year-old school pupils' performance with regard to mathematical, scientific and reading literacies.

Quality tests: The TfEL Framework identifies four quality tests that are applied to each element of practice to address the complexity of teaching practice. The quality tests are intentionality, effectiveness, consistency and responsiveness. They identify the qualitative nature of effective teaching and learning.

Significant difference: When the terms 'significantly different' or 'significant difference' are used in this resource it indicates that the likelihood of a difference in scores being simply due to chance is less than 5% ($p < 0.05$). When a difference in two scores is noted as not significantly different it means that the observed difference has a greater than 5% likelihood of being simply due to chance.

Standardised: A standardised scale indicates where scores fall in relation to the mean (average) score. The mean score is assigned zero. A score of +1 indicates the score falls one standard deviation above the mean score. One standard deviation above the mean corresponds approximately to the top 16% of ratings. A score of -1 corresponds to approximately the bottom 16% of ratings.

TfEL Compass: An online professional learning tool for teachers to reflect on their teaching and learning practices through self-reflection and feedback from students and trusted colleagues. For more information, contact compass@sa.gov.au.

World view: A world view, or '*Weltanschauung*', refers to the framework of ideas and beliefs through which an individual, a group of people or a culture interpret and interact with their world.

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