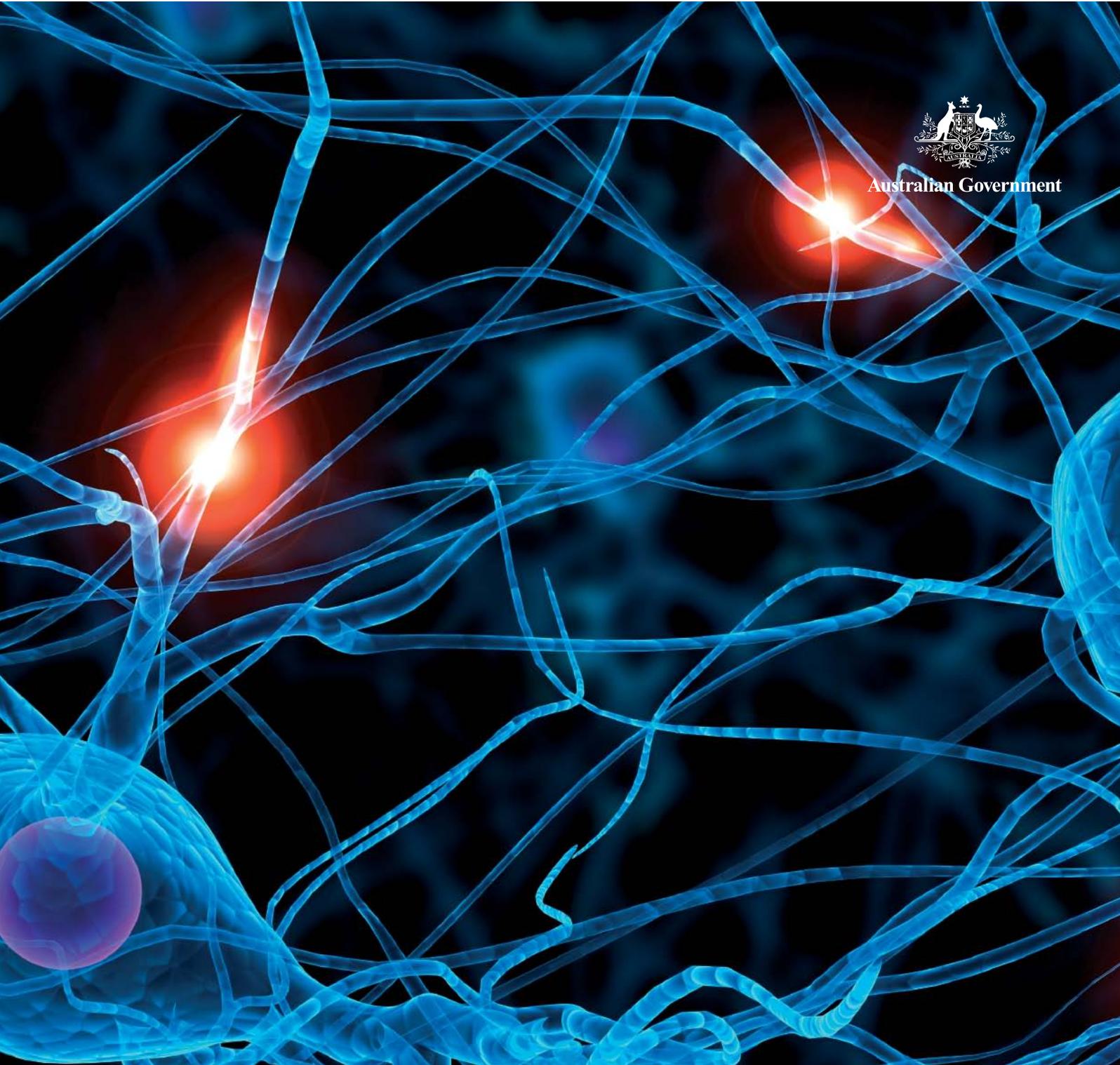




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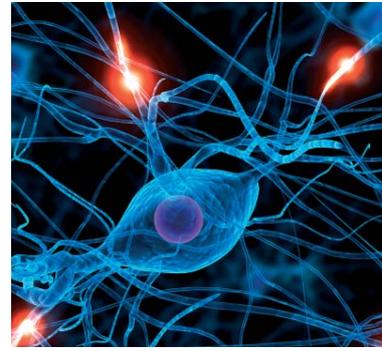
Transforming Learning  
and the Transmission of Knowledge

**PMSEIC**

Transforming Learning  
and the Transmission of Knowledge  
Preparing a learning society for the future

Report of the PMSEIC Expert Working Group

2 December 2009



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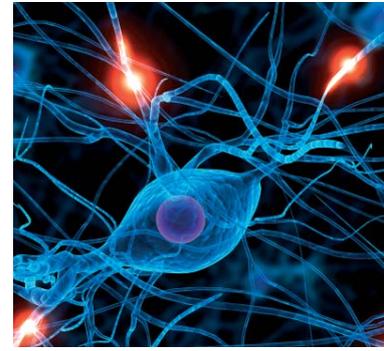
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A report for the Prime Minister's Science, Engineering and Innovation Council (PMSEIC)

This report has been prepared by the independent PMSEIC Expert Working Group on Transforming Learning and the Transmission of Knowledge. The views expressed in this report are those of the Expert Working Group and not necessarily those of the Australian Government.

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## Foreword from the Chair

Now is an exciting time to be addressing the issue of transforming learning and the transfer of knowledge due to the many recent breakthroughs in our understanding of the fundamental science of learning, and the ever increasing need to better equip both our young and lifelong learners to address the increasing complexity of a world requiring innovative solutions.

The Transforming Learning and the Transmission of Knowledge Expert Working Group comprised a multidisciplinary group of researchers and educators, creating a powerful intellectual dynamic to address the complexities of learning and learners. As the least expert of this group of experts, it was interesting to watch the group veer away from questions around technology and the massive amount of information available via the internet, to focus on fundamental questions that influence our ability to learn. The multidisciplinary approach, and the involvement of both researchers and practitioners, proposed many innovative solutions that in themselves demonstrated the potential of bringing together such groups to address the science of learning in a more structured and sustained program.

The Expert Working Group came together for only two months, a much shorter time than is usual for PMSEIC working groups, and had, therefore, to limit the scope of what could be covered in that time.

In particular, we recognised the importance of, but were unable to cover in depth, a number of areas including:

- the transmission of knowledge, a topic only briefly touched on in the report owing to its broad nature and rapidly developing Government activity in this sphere;
- ICT infrastructure needs – the potential to use ICT to enhance learning, and the need to support use of ICT by teachers, was considered rather than the physical infrastructure itself;
- early childhood intervention, although it is well understood that there is a strong correlation between educational outcomes and influences in early childhood. Given that it has been some time since there has been a PMSEIC report on this critical subject (i.e. *Developmental Health and Wellbeing: Australia's Future*, PMSEIC June 2001), this may be an area for further work;
- science teaching per se, instead we focussed on learning in general; and
- cognitive issues associated with ageing.

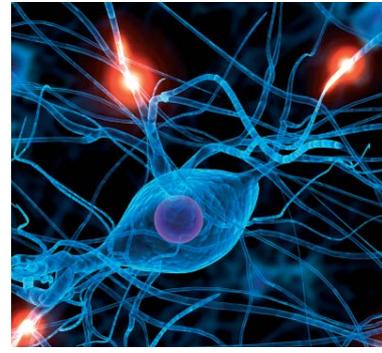
We were, or became, aware of many important and outstanding examples of programs to enhance learning, support teachers and promote learning being conducted by Departments of Education, researchers and other educational groups across Australia, but had insufficient time to complete a full evaluation or stock take of these.

Finally, the practitioners in our group frequently drew us back to the realities of classrooms, the need to address some of the most basic requirements of education (e.g. the lack of trained teachers and even chairs in classrooms in some remote communities), and the need to value and support the teachers who are central to all aspects of formal learning.

I commend this report to the Prime Minister, Cabinet, the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) and the wider Australian community, and in so doing, thank the Expert Working Group for the quality and intensity of their efforts of the past two months.



Margaret Sheil  
Chair, PMSEIC Expert Working Group on Transforming Learning and the Transmission of Knowledge



line' paradigm designed for mass schooling and delivering education in large schools and universities with large classrooms. Under this model, there is an assumption that individuals of the same age are more or less equally ready for the same curriculum (Darling-Hammond, 2004).

However, under this paradigm, many achievement gaps remain as large as they have ever been. For example, differences have been observed in the average achievements of boys and girls, Indigenous and non-Indigenous students, and students from lower and higher socioeconomic backgrounds. Educators have often concluded that special education programs for boys, or for Indigenous students, or for students from low socioeconomic backgrounds, are the solution.

The hope has been that ways can be found to ensure that all children in a year level master the curriculum designed for that year level, and move ahead at the same rate. Systems like 'mastery learning' have had this as an objective. But in practice, this has not been achieved on any significant scale, with the variability in student achievement observed in Australia is similar to that observed internationally (Masters, 2009).

Research shows that in any year of primary school, the gap between the top 10% of students and the bottom 10% of students in reading and mathematics is the equivalent of at least five years of school. When the slower average rates of progress in the secondary school years are taken into account, gaps between the highest and lowest achievers become even greater (Masters, 2009).

Results such as these are not surprising in light of the evidence presented in *Chapter 2* which shows that learning is influenced by prior knowledge in long-term memory and motivational states, and that students of the same age are often at different starting points in terms of knowledge and motivation. These differences in starting points that may be amplified by differences in support and access to other forms of guidance, can lead to quite different trajectories through a standardised curriculum. As a result, instead of producing a common level of mastery, the standardised curriculum delivered through the traditional schooling model can produce wider gaps in performance over time.

### Case study 1

## QuickSmart Numeracy and Literacy Programs

*QuickSmart* programs have successfully addressed the need to improve the basic academic skills of lower-achieving middle school students in order to narrow the achievement gap. Based on information processing theory (e.g. Bratina and Krudwig, 2003; Ketterlin-Geller et al, 2008), *QuickSmart* aims to improve students' information retrieval times to free up working memory capacity and improve fluency related to tasks such as basic mathematical facts and word recognition. More cognitive resources are then available for the important tasks of problem solving and comprehension. Pairs of students selected from participating schools attend three half-hour lessons a week for 30 weeks during class time. Structured lessons with many opportunities for feedback and success, delivered most often by educational paraprofessionals, are supported by a program of professional development for principals, teacher coordinators, and instructors.

Since 2001, independent (state-wide or standardised tests) assessment results gathered from over 2,000 *QuickSmart* and average achieving students, mostly from New South Wales and the Northern Territory, have consistently demonstrated student growth of two to four years' improvement as measured by effect size statistics. Interviews and surveys of students, parents, teachers, and principals have also yielded consistently positive qualitative data, with many comments indicating generalised improvements for the *QuickSmart* students not only in class, but also in their attitudes to school, their attendance rates and their levels of confidence both inside and outside the classroom (e.g. Graham et al, 2007a; Graham et al, 2007b; Pegg et al, 2007).

A considerable body of research shows that learning is most likely to occur when an individual is presented with challenges just beyond their current level of attainment, in what Vygotsky referred to as the 'zone of proximal development', the region of 'just manageable difficulties' where students can succeed, but often only with the support of others (Vygotsky, 1978).

Ensuring that every individual is presented with such optimally challenging learning opportunities can be difficult in a class of 25 to 30 students of mixed abilities. Many teachers begin classes each school year with only a general understanding of what individuals know and can do, hindering their ability to know what will challenge each individual.

With the wide variation typically found in mixed-ability classes, teachers often teach to the middle of the class. The consequence is that the highest-achieving students are often not challenged, and the lowest-achieving students remain or fall further behind with each year of school.