

## Executive Summary

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### Schooling and innovation

Sustained innovation is the key to future growth and prosperity in a competitive global economy. Building a culture of continuous innovation through education is an essential requirement, parallel to and supporting research and development.

Many areas of knowledge and skills are involved in creating a culture of innovation in addition to science-based research and development (R&D). Strategies are needed for the whole of schooling and all areas of the curriculum. But special emphasis is needed now on improving scientific and mathematical education and technological capability.

Innovation in the knowledge economy is not confined to a small group of specialists. It must be supported by a highly educated workforce and citizenry. Schools have a major role. So too do families, businesses and the wider community.

Teachers are the key to mobilising schools for innovation. System-wide support and leadership both for and within schools is vital. The Review in emphasising these requirements gave attention to ways of improving the attractiveness of teaching, and career-long development. A large turnover of teachers is anticipated during the next decade, due to retirements, so first rate national workforce planning is required to address all fields of teaching, at all levels of schooling.

Australia has a comprehensive and inclusive educational system which performs very well in international comparisons, meeting requirements for a well educated citizenry and workforce. Average standards are high and the best students and schools are among the best anywhere, but there is no cause for complacency.

The strength of democratic institutions and community life, and continuing economic growth, hinge on realising the potential of all children and young people. Increasingly, they will need to show initiative and solve problems and to generate new and better ways of doing things. This innovative capability is needed in a rapidly changing, knowledge-driven, globalising world.

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### Prioritising science, technology and mathematics education

Australia's ability to prosper in this environment depends on high levels of R&D. These in turn require that more young people achieve scientific and technical qualifications with a strong base in the physical and biological sciences and mathematics. By itself, this will not be enough. Policies and strategies are required to ensure a broad base of scientific, mathematical and technological literacy for all students. This means that science, technology and mathematics education must be given high priority nationally, in all education systems and every school.

There is increasing demand in all occupations and in the community generally for well-educated, creative and enterprising people who communicate well, show initiative, work effectively together and demonstrate high levels of competence and responsibility. These and other attributes are identified in Australia's *Adelaide Declaration on National Goals for Schooling in the Twenty-first Century* (National Goals for Schooling). Much remains to be done to translate the goals into effective action and to ensure that *all* children are set firmly on pathways toward lifelong learning. The Review addresses these and related issues but it is clear that they will continue to require attention far beyond the scope of this inquiry.

The Review focuses on issues in science, technology and mathematics education, which are of national concern. They include:

- a declining proportion of students who complete Year 12 studies in physics, chemistry, biology and advanced mathematics;
- insufficient numbers of highly trained teachers in science, technology and mathematics;
- present uncertainty among primary school teachers about how best to teach science, accompanied by primary teachers' relatively low levels of interest and academic attainment in science and mathematics;
- teaching which does too little to stimulate curiosity, problem solving, depth of understanding and continued interest in learning among students, or to thus encourage them to undertake advanced study in science and mathematics at school and beyond; and
- some students who do not do well at school, including too many Indigenous students, and may leave at the minimum permitted age with low attainments and poor motivation for continuing learning.

For all primary teachers there is need to strengthen the content and pedagogical knowledge of science, technology and mathematics in initial teacher education and in professional development programs. For secondary teachers of science there is in addition a need to strengthen further pedagogical knowledge.

The currency of scientific and mathematical knowledge of a generation of teachers who will reach retirement age within the next decade and the nature of professional development opportunities likely to be of most value for these teachers are issues which will continue to require attention over the years ahead.

The Committee visited outstanding, innovative schools where teaching and students' learning was excellent, not only in science, technology and mathematics, but right across the curriculum. Evidence from many sources demonstrates that high quality teaching and successful learning are widespread. But since they are not universal; the Review has addressed ways to disseminate the best ideas, the most effective practice, as widely as possible across all schools.

The concepts of the knowledge society and economy, innovation and a culture of innovation have similar resonance in education as in industry, employment and social affairs in that:

- it is through continuing systematic inquiry, research and well analysed practice that knowledge for practical application is generated;
- it is increasingly through the systematic application of new knowledge and creative ideas that innovations of practical value are generated; and
- it is those 'new knowledge' innovations that will in future underpin employment, economic growth, social development and people's well-being.

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### **Australia's teaching profession**

In Australia's nearly ten thousand schools, there are a quarter of a million teachers with responsibility for the learning of three and a quarter million students. Most are either primary or secondary teachers but some boundaries are becoming more permeable and more diverse patterns of schooling are emerging.

In just fifteen years, to 2001, the median age of the teaching population rose from 34 to 43 years, 44 per cent being older than 45 years. In light of this generational change, attracting, recruiting and retaining people to teach will have to become a top national priority.

Teaching now is virtually an all-graduate profession, with teacher education the responsibility of universities and a few other higher education institutions. Australian Government higher education policies and university-wide decision making are two crucial influences on how teachers are educated.

The supply of teachers has been broadly adequate to meet school needs nationally. But recruiting difficulties are apparent for certain secondary specialisationsâ€‘including physics, chemistry, mathematics, technology studies and languages other than English (LOTE)â€‘and in many rural and remote and some metropolitan locations. Targeted policy initiatives, including financial incentives, will be required to attract and retain teachers, especially of science, technology and mathematics. Prospective teachers from Indigenous and other groups at present poorly represented in teaching need to be recruited to achieve a better correspondence with the diversity of students.

A gender bias towards females is pronounced in the teaching profession, especially in the primary sector and in lower secondary schooling. The male teacher cohort is concentrated more heavily in the older age groups and it is mainly older males who teach upper secondary and advanced courses in science and mathematics.

Data limitations and inadequacies make analysis and forecasting supply and demand difficult. However, several priorities stand out:

- ensuring an adequate supply of highly talented, well-educated teachers to meet the need for a more extensive provision of science, technology and mathematics in primary as well as secondary schooling;
- understanding demand by region and specialisation and developing broader strategies to attract, recruit and retain quality teachers of all subjects and at all levels;
- ensuring that all schools regardless of location are well staffed with appropriately qualified teachers; and
- achieving a more diverse population of teachers more representative of the cultural, social and ethnic diversity of the Australian community.

Incentives are needed to attract more talented people to become teachers where shortages are identified. The Australian Governmentâ€™s identification of teaching as one of two national higher education priorities, to which it proposes to apply a lower rate of HECS, is a significant initiative.

However, those qualifying to teach through completion of a Bachelor of Science degree followed by a graduate teacher education award accrue a higher HECS debt than other teachers, but receive the same pay once employed as teachers. Similarly, those teachers who enrol in higher education units in science, technology and mathematics for the purpose of enhancing their professional expertise accrue a higher HECS debt than their colleagues enrolled in units in other disciplines.

The Committee concluded that secondary and primary teachers of science, technology and mathematics should not pay more HECS than their teaching colleagues.

A difficulty in national workforce planning is insufficient data. Moves now under way to strengthen data collection and analysis and research into conditions affecting teacher demand and supply will need to become more intensive to provide a basis for policy development.

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### **Revitalising the teaching profession**

High quality teachers make a significant and lasting contribution to young peopleâ€™s lives. The quality of their initial education and training should be further improved by a greater concentration on

the quality of the school experience components. Difficulties surrounding this issue should be resolved by teacher employers, schools, universities and governments in partnership.

Teacher retention in a highly competitive labour market is a serious challenge with many dimensions. Strategies to retain high quality teachers include sustained improvements to the working conditions of teachers, effective induction programs and mentoring support for beginning teachers, curriculum and pedagogy which engages students, articulated professional standards, flexible workplaces and enhanced career pathways, ongoing opportunities for professional learning, strong school based leadership and team practices.

Professional standards will provide a basis of competence for all teachers. When nationally consistent they will also assist in mutual recognition by different jurisdictions and systems of teacher qualifications and capabilities. They will also improve the public profile and standing of the teaching profession.

Recognising and rewarding teaching excellence and providing opportunities for teachers to further develop their expertise and leadership within the profession will aid quality improvement. The profession itself should play a leading role in steps to achieve these outcomes.

The Review Committee welcomes the Australian Government's establishment in 2004 of a National Institute of Quality Teaching and School Leadership. To be run by and for the profession, the Institute will complement arrangements to support and strengthen teaching and school leadership already in place in various State and Territory school systems and in the non-government sector. The Institute is likely to address professional teaching standards, professional learning for teachers and school leaders, quality assurance, research into teaching and learning, induction, mentoring and succession planning for school leaders, and other ways to improve quality and recognise achievement.

Several factors underpin teacher satisfaction and retention. Among them are: improved remuneration; physical conditions within schools; availability and quality of curriculum resources; teaching loads; class sizes; access to and use of technology; appropriate in-service training and the opportunity for study leave and professional development. These need to be kept under constant review and wherever possible improvements should be made.

Consideration should be given to rethinking career progression according to teaching performance. Recognising and refining strategies to support quality teaching and educational leadership will be important. Teacher salary advancement should be based on teaching performance and career structures, with better recognition points for proficient teachers and highly accomplished teachers. Diverse roles teachers perform to complement class teaching, including mentoring, community leadership, cluster support and other leadership roles within the school, need to be recognised.

Progressively, teaching career and salary advancement should come to be based on merit and teaching performance rather than length of service, with accomplished teachers rewarded at higher rates. While starting rates for teachers' salaries are comparable with other professions, ceilings reached eight to eleven years after entering the profession and lack of rewards for outstanding quality of teaching disadvantage teachers.

The Committee noted among submissions and in its visits and meetings a concern over the standing of teaching and the general community regard for education. More has to be done to make teaching once more a career of choice and not, as it has been for too many, a fallback option.

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### **Preparing to teach**

Teaching has become a graduate profession based on not less than four years of higher education. The many different pathways into teaching fall mainly into either four year education degrees, four year double degrees, or degrees in other subjects followed by one to two years of professional training. Mature-age students are being attracted to teaching, often bringing rich experience from other careers

and adult life. They require flexible pathways and recognition of what may be heavy personal and family responsibilities. While selection for admission to teacher education courses must be stringent and high entry standards maintained at all times, there is scope for recognising the wide variety of prior learning and competencies that many prospective students bring.

Universities and other higher education institutions can do much to equip prospective teachers with the skills and knowledge needed to develop an innovative capacity in students. They can value, encourage, and model creativity, initiative, enterprise and diverse ways of applying and using knowledge. There are many innovative programs and approaches in teacher education, notably those with close links to schools, including organisation of students' practical experience of schools and classrooms. Linkages can be further strengthened between initial teacher education, induction, mentoring and continued professional learning. Additional funding the Australian Government has proposed for the practicum under the *Backing Australia's Future* package should be used to improve the workplace learning component of initial teacher education.

Teacher employers, education faculties and professional bodies representing teachers will need to collaborate so that all beginning teachers receive well structured induction programs, mentoring and time to reflect on their practice.

Academic staff involved in the planning and delivery of teacher education courses are often directly involved in schools in various roles. More academic staff need such experience to maintain the currency of their practical knowledge and to build up greater collegiality between schools and universities. Experienced, practising teachers have much to offer teacher education programs. There is scope for conjoint appointments and close working partnerships between school and universities in the design and delivery of teacher education. Overcoming impediments to moving further in this direction will require greater collaboration among universities, schools and employing authorities.

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### **The professional learning continuum**

The overall professional preparation of teachers should be strengthened through seeing initial teacher education, practical experience, internships, induction and ongoing professional learning as a continuum.

More extended professional learning is essential for the vitality of the profession. Teachers will be better placed to foster students' innovative capabilities, or respond adequately to students' diverse learning needs if they continue their own professional learning. Professional learning needs to become a central feature of career development – planned, systematic, regular and relevant.

Access by all teachers, regardless of location and specialisation, to high quality, professional learning has several purposes: to facilitate and enable career advancement; to motivate, rejuvenate and retain good teachers; and to provide the knowledge and competence schools need in pursuing their goals and priorities.

Initial and professional development programs are needed to prepare primary science specialists with sufficient knowledge, confidence and experience to support and advise other teachers when and where needed.

It is necessary to take a wide, career-focused approach to professional learning. Teachers change schools, they move into different areas of specialisation, they may move in and out of the education profession. In addition to professional learning focused on the requirements of the individual teacher's current school, approaches are needed which recognise the changing nature of the teaching career and the directions being taken by education authorities as they develop new priorities and re-position themselves in response to wider jurisdictional and national needs.

Upgrading disciplinary and pedagogical knowledge will be at the core of professional learning, especially in the sciences and technology where there are rapid changes in knowledge and techniques.

It is a feature of all subject areas that research, scholarship and practical experience are constantly reshaping both the surface features of the domain and its structure and foundations. The message for teacher professional learning is that it be current and vital and that it connect with both teachers' present responsibilities and their evolving career profiles.

Responsibility for professional learning should be shared among teachers, schools, education authorities and the various providing bodies. Increasingly, the value for professional learning of structured experience in industry and both public and voluntary services is being recognised, but it is yet to develop to the point where it is a common experience for practising teachers (or those preparing to teach).

Two requirements to meet for a fully functioning system of professional learning for Australia's teachers are:

- recognition and reward for teachers who demonstrate advanced competencies and continued professional development; and
- greatly improved teacher access to and use of new knowledge and the communication and information technologies pertinent to teaching and learning.

Educational research is vital, but its diffusion and use in solving practical problems in education are constrained when, in both content and form, quality data, evidence, critical evaluation and other products of research and inquiry are not accessible. Teachers require timely and ready access to new knowledge. New technologies have immense potential as vehicles for providing this access and for developing the networks through which professional practice thrives.

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### **Future schooling**

Among the key factors in bringing about school improvement are:

- outstanding leadership, from formally designated staff, notably the school principal, and from the teaching staff and students;
- a clear vision and sense of purpose together with the capability to manage and orchestrate institutional change;
- a commitment by the whole school community, including parents, to this vision and to sustain it in all facets of school life;
- highly competent teachers dedicated to achieving excellent learning outcomes for all students and to maintaining the highest standards of professionalism and professional learning; and
- strong system and employer-led strategic planning, resourcing and support.

These need to be complemented by greater school autonomy in combination with system-wide strategic steering and resourcing, targeted professional learning and flexible career pathways.

Science and mathematics education coordinators should be appointed for clusters of secondary schools and their feeder primary schools to stimulate science teaching and learning in primary schools and ensure that the teaching and learning of science and mathematics are well articulated between the two sectors. Primary school science specialists will boost science in primary schools.

Teachers need a rich understanding of the changing world of children's experience, of youth culture and the lives of students, irrespective of the subjects they teach. Effective teaching requires that teachers are sensitive to and connect with this culture and build upon it. Learning is strongest and most meaningful when it engages students actively, connects with their own knowledge and understanding and relates to their interests and experience. To meet these challenges teachers need a great deal of support in the often difficult conditions of the contemporary school.

Greater consistency is needed in educational outcomes. When schools have been provided with the necessary resources and fully supported, they should be held to account for avoidable weaknesses and shortcomings in student learning. This is a demanding criterion which reflects the fundamental importance of high quality learning for all students.

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### **Energising schools for innovation**

Schools are not working individually and in isolation; teams, external partnerships, clusters and networks are connecting teachers and schools with one another and with the wider community. These can be extended and teaching made a more collaborative enterprise. The potential role of communication and information technology in this respect is yet to be fully realised but many schools are well down the track. More flexible working spaces in schools, to enable a wider array of teaching and learning approaches to be used, are being provided through adaptations of older buildings and the design of new ones. But too many schools lack high quality spaces and resources for learning that are needed.

Flexible teaching and learning spaces and communication and information technology provide the means for more creative teaching and better learning outcomes. These are particularly needed to overcome such problems as student disengagement in the middle years of schooling and to motivate and support those students whose learning outcomes have been weak or poor. As shown in the international comparisons of student performance in reading, scientific and mathematical literacy, while Australian students perform very well on average and the best students attain high scores, too many do not do well, so there is room for considerable improvement. The foundations have to be laid in high quality early childhood education and care.

New vocational pathways in secondary education are being developed, and should assist in improving retention rates and in developing pathways into post-secondary vocational training and skilled employment. Learning pathways and forms of assessment, especially at senior secondary level, will require further attention: to test their consistency with the objective of successful schooling for all; and to meet changing knowledge and skill requirements in both the tertiary sector and the labour market.

In order to energise schooling for innovation, a very high quality of educational leadership is required. Competent leaders who have a strong, clear vision, are determined and have a capacity to inspire and move things forward will be in great demand. They need freedom and authority to steer, manage and orchestrate what are very often large, complex organisations.

The exemplary teaching and learning practices that daily occur in Australia's schools are too often submerged beneath highly publicised problems. An investment in the dissemination of good practice and more systematic recognition of outstanding achievement would benefit all schools and give the community a better understanding of how schools are changing.

Schooling in Australia is on the verge of transformation to drive forward policies and strategies to reach new national standards of educational quality and relevance.

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