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Department of Education, Science and Training

Australia's Teachers: Australia's Future

Advancing Innovation, Science,
Technology and Mathematics

AGENDA FOR ACTION

COMMITTEE FOR THE REVIEW OF TEACHING AND TEACHER EDUCATION OCTOBER 2003

Backing
Australia's
Ability

The Australian Government's
Commitment to Innovation

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Background

The Review of Teaching and Teacher Education is an initiative under the Australian Government's \$3 billion innovation statement *Backing Australia's Ability*, which was launched by the Prime Minister. The purpose of the Review was to identify strategies which will increase the numbers of talented people who are attracted to teaching as a career, especially in the fields of science, technology and mathematics education, and build a culture of continuous innovation at all levels of schooling in Australia. The Review's Terms of Reference are at Appendix 1.

An independent Committee, with representatives from school, university and industry sectors, was established by the Minister for Education, Science and Training, the Hon. Dr Brendan Nelson MP, on 8 August 2002 to oversee the Review. A broad-based Reference Group—drawn from Deans of education and science, teacher professional associations of science, technology and mathematics, business organisations, parents groups, principals, teachers' unions, teacher education bodies, educational organisations and others—was established to assist the Review Committee. A Review Secretariat drawn from the Department of Education, Science and Training was established to manage the progress of the review. Details of the Review Committee, Reference Group and Review Secretariat, are at Appendices 2 and 3.

The Review Committee released two Discussion Papers, *Strategies to Attract and Retain Teachers of Science, Technology and Mathematics* on 5 September 2002, and *Young People, Schools and Innovation: towards an action plan for the school sector* on 21 March 2003, which were accompanied by national calls for submissions, and provided an opportunity for parents, teachers, educators and all those interested in teaching and schooling to contribute their ideas.

The response to the Discussion Papers was extremely encouraging, and the submissions provided a rich source of ideas and information for consideration by the Review Committee. Submissions came from a wide range of organisations, including government and non-government school education authorities; most universities; teacher professional associations; industry, peak parent, principal, teacher and union bodies; as well as a diverse group of individuals. A total of 241 submissions were received.

In addition to its collective experience, the Committee consulted widely, held meetings and discussions across the country, visited schools already in the vanguard of innovation, reviewed Australian and international experience and research literature, and commissioned a number of papers to inform its work, which are available on the Review website.

On 20 February 2003, the Review Committee released an Interim Report, *Attracting and Retaining Teachers of Science, Technology and Mathematics*.

The Committee's final report is presented in three volumes: an *Agenda for Action*, a *Main Report and Background Data and Analysis*. The *Agenda for Action* presents the Review Committee's main findings and conclusions and a range of actions the Committee believes need to be taken. The *Main Report* presents the reasoning and argument based on evidence from a wide variety of sources that underpin the *Agenda for Action*; and the *Background Data and Analysis* presents much of the data supporting the views formed during the course of the Review.

Further details are available at <www.dest.gov.au/schools/teachingreview>.

Foreword

Throughout our history, generations of Australian teachers have risen to the challenges of the times in educating the nation. Today, their success is demonstrated in a quality of student learning and achievement which generally compares well with the highest international standards.

Over time expectations rise, and educators set more demanding goals and seek new ways to achieve them. As knowledge becomes a staple of the economy and of our social and cultural life, everyone must become better informed and able to apply knowledge and skills in life and in work. A key issue now is Australia's capacity to foster innovation. For this we must mobilise human talent to foster scientific discovery, creativity, inventiveness and the ability to produce needed goods and services, be they material products, services, or practical ideas.

So a central theme of the Review is strengthening science, mathematics and technology education. We need talented people to teach these subjects. But equally, all teachers across all subjects, and all our students should become partners in a learning society that underpins innovation and a high standard of living.

Across Australia, successful schools are showing the way forward as outward-looking learning centres, forming partnerships within the community and drawing on the resources of technology to facilitate learning. But as not all schools have moved in this way, not all students fulfil their potential, and teachers now are called upon to meet ever higher demands and expectations.

Over the next decade Australia's teaching force will be replenished as thousands reach retirement. In this same time, high professional teaching standards are being set, and provision is being made for ongoing professional learning for all teachers. These changes provide opportunities for further significant improvements.

The Review benefited from the support and cooperation of large numbers of individuals and organisations who contributed submissions, and participated in interviews, meetings and visits. Teachers and other leaders in the schools we visited reinforced our sense of a positive future.

It is a pleasure to acknowledge the commitment of organisations represented on the twenty-five member Reference Group, especially but not only in their attending five national meetings.

The Review Committee itself showed dedication across a fourteen month period, meeting formally on ten occasions, as well as participating in school visits and other activities.

The Review Secretariat in the Department of Education, Science and Training provided essential support, coordination, and contributed greatly from their own expert professional knowledge. The leadership of the Secretariat Manager, Ms Di Weddell, was in every way exemplary.

A number of individuals were engaged to undertake commissioned papers. Our thanks go to them, and particularly to Dr John Ainley, Australian Council for Educational Research, for leading the development of the *Background Data and Analysis*. We are indebted also to Emeritus Professor Malcolm Skilbeck and Dr Helen Connell, who brought to the drafting of the *Main Report* a broad international perspective.

I also thank the Minister for Education, Science and Training, the Hon. Dr Brendan Nelson MP, for establishing the Review initiated under *Backing Australia's Ability*, and providing, with his office, ongoing encouragement, support and a quite personal commitment to our shared goals and hopes.



Professor Kwong Lee Dow AM
Review Chair

9 October 2003

Introduction

A well-educated, flexible, creative and self-confident population is a key to achieving economic prosperity and social and civic engagement. Developing greater scientific awareness in the general population, inspiring more young people to take up careers that depend on excellence in science, technology and mathematics and building a culture of innovation in Australia's schools are of the utmost importance if Australia and its people are to be successful in a global world. These messages are imparted by the Australian Government's innovation statement *Backing Australia's Ability*. They provide the rationale for the conduct of the independent Review of Teaching and Teacher Education.

Quality teachers make a difference. They are the single, most important determinant of student achievement, making a significant and lasting impression on all our lives. Most of Australia's young people spend twelve to thirteen years in school gaining skills, values and knowledge for full participation in contemporary Australian society. Increasingly, success in society depends on a core understanding of science, technology and mathematics and the capacity to contribute to innovation and change. Those who undertake the crucial task of nurturing scientific understanding and inquiry and developing an innovative capacity in young people must be talented, knowledgeable, enthusiastic and dedicated. The generational change about to occur within the profession presents an unprecedented opportunity to re-generate teaching and learning, and inject fresh approaches and ideas. This is a great challenge but it is no less an opportunity for teachers and students alike to find new pathways for rewarding and personally fulfilling learning and to share in shaping the future of the country.

The Committee is pleased that the Review's *Interim Report* has contributed to important decisions by the Australian Government. The identification of teaching as one of two national higher education priorities to which the Australian Government proposes to apply a lower Higher Education Contribution Scheme (HECS) rate, is a significant initiative. The higher education reform package, which includes a proposal to increase the Australian Government's funding contribution for teacher education provision in recognition of the costs associated with the practicum, is also significant and welcome. So too is the decision to establish the National Institute for Quality Teaching and School Leadership which will play a major role in supporting quality teaching and leadership nationally.

The Review Committee has identified five broad priority areas for attention. Action is required in each of these areas if Australia is to attract and retain world-class teachers, particularly of science, technology and mathematics, and to initiate and sustain cultures of innovation to achieve high quality learning outcomes for all students. These are:

Energising the sciences and technology, and prioritising innovation in schools: Only by commitment to a shared national vision can this be achieved. This required collaboration by all the stakeholders needs a concerted effort. The target is to promote a broad culture of innovation in all schools and to ensure that all students receive expert teaching in science, technology and mathematics.

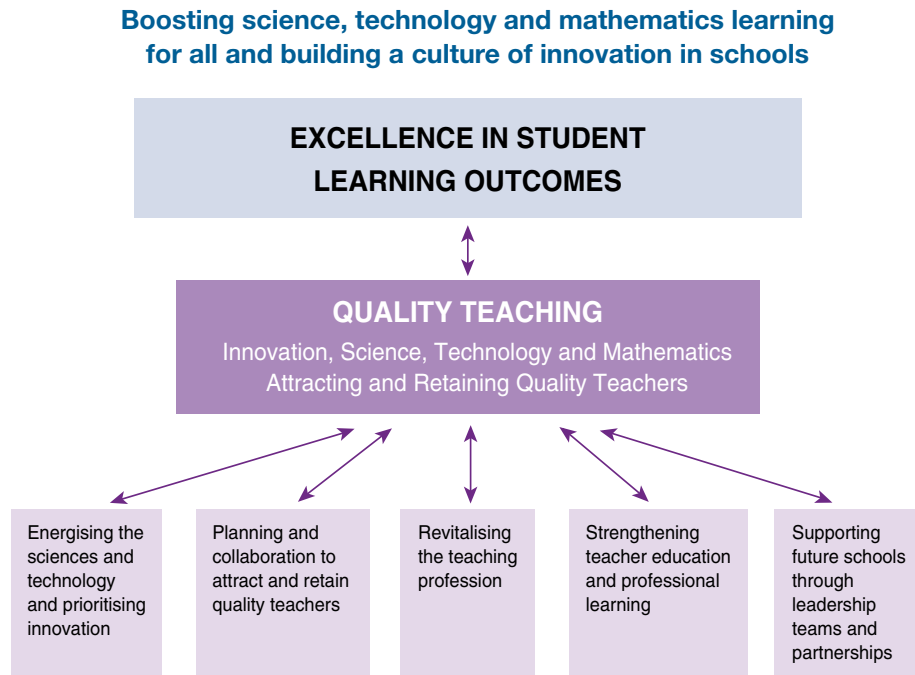
Planning and collaboration to attract and retain quality teachers: For the teaching workforce of the future a sufficient number of talented people must make teaching a career of choice. A shared understanding of workforce needs with targeted incentives and attractive working conditions are essential.

Revitalising the teaching profession: To strengthen the quality and standing of teaching, recognition of flexible career paths and moves to establish teaching as a nationally recognised and mobile profession are required.

Strengthening teacher education and professional learning: Initial teacher education of a very high standard is an essential requirement for an effective, resourceful, diverse teaching profession. It must be built upon through career long professional learning.

Supporting future schools through leadership, teams and partnerships: The key to innovation in schools is giving scope to the inspiration, capability and leadership of teachers themselves. Working together, in wider partnerships with the community, and mobilising a wide array of resources, teachers of the future can transform Australia into a knowledge-based, learning society.

The figure below illustrates the way in which these priorities relate to high quality teaching and excellence in student learning.



The Committee is of the view that concerted and collaborative action by the key players in all priority areas is necessary for Australia to achieve its potential as a highly successful knowledge-based economy and society.

These priority areas frame the discussion throughout this *Agenda for Action* and the *Main Report*.

It is clear to the Committee that action on a number of fronts and by all key stakeholders is necessary if Australia's schools are to meet the challenge of preparing future generations to thrive in and continue to build a knowledge society. Proposals for action have been tested against many stakeholders. Some refer to long standing problems, others reflect the rapid, widespread changes now occurring in society and in schooling. The Committee believes that comprehensive action is needed and this *Agenda for Action* is designed to progress that action over the next decade.

Accordingly, the actions identified by the Committee to give life to the priority areas are directed at all those with an important role to play in the education of young Australians—governments, government and non-government school education authorities, higher education institutions, schools, teachers, teacher professional associations, parents, science organisations, business and industry.

All stakeholders share the goal and will need to shoulder the responsibility of ensuring that all young Australians are well educated to meet the challenges and take advantage of the opportunities of a society increasingly dependent on knowledge and innovation. In sharing this vision, the Review Committee calls upon all stakeholders to embrace this *Agenda for Action*. Clearly, Australia's future lies in the hands of Australia's teachers. We must do all that is possible to support them.

The Committee commends the *Agenda for Action*, the *Main Report* and the *Background Data and Analysis* to the Australian Government and to all members of Australia's education and science community.

Energising the sciences and technology, and prioritising innovation

1. Schooling and innovation

1.1 Innovation matters

Social and economic progress in Australia, and the strength and vibrancy of our democracy, will increasingly depend on a well-informed and active citizenry with the capacity to solve problems, to create, and to generate new and better ways of doing things.

At all levels, our society will require creative individuals able to communicate well, think originally and critically, adapt to change, work cooperatively, remain motivated when faced with difficult circumstances, who connect with both people and ideas and are capable of finding solutions to problems as they occur—in short, individuals with the array of skills constituting a well-developed capacity for innovation.

Schools and teachers are pivotal to the development of the knowledge and competencies of individuals (often referred to as human capital); and the shared norms, values and understandings that underpin cooperative endeavour in broader society (often referred to as social capital).

Countries that are progressive and successful will increasingly have education systems that develop human and social capital to the fullest possible extent and consistently produce knowledgeable young people with advanced capacities for innovation.

What we aspire to, is beginning to happen....

Reassuringly, the innovation, creativity and excellence that Australia requires can be found now in schools across the country. The Review Committee has seen many schools where inspired educational leadership from principals, teachers, parents, other members of the school community and managers in education authorities has created exceptional and innovative learning environments, and in which teaching and learning in science, technology, mathematics and other key areas is outstanding.

These schools are pointing the way forward. Such schools:

- are open to change and new ideas;
- see challenges as opportunities;
- empower staff and have leaders operating at all levels within the school;
- facilitate professional learning and support the needs of teachers;
- have flexible school structures;
- have a unifying vision and focus;
- meet a diverse range of student needs yet focus on achievement for all;
- focus on students as innovators, problem solvers, communicators, creative team players, to be adaptive, technologically skilled and lifelong learners; and
- place importance on internal and external relationships, with networks and partnerships to enhance the quality and breadth of learning.

The challenge is to spread this excellence to all schools to benefit all students.

In order to build a culture of innovation in Australia, two fundamental goals for the schools sector must be set and achieved—firstly to establish a culture of innovation in all Australian schools; and secondly to develop a capacity and predisposition for innovation in all Australian students.

1.2 A culture of innovation in schools

Schools must themselves be characterised by a climate of innovation, if they are to develop students with a capacity for innovation.

In a culture of innovation, teachers adopt creative approaches, take calculated risks within agreed frameworks, reflect constantly on their teaching and on student outcomes, reach out to share community resources, work together to achieve the best outcomes for students, and embrace technology that enhances their work and students' learning.

The development of a culture of innovation in schools must be built on the teaching and learning of science, technology and mathematics; but not on those areas alone. Societal advances will depend on the complex interdisciplinary understandings students attain and the range of education they experience, from the arts, the humanities and social sciences, and other cultural and ethical domains, as well as science, technology and mathematics.

A culture of innovation is more likely to take hold if it is a culture underpinned by conviction and engagement. This is best achieved in consultation with those who have a stake in the outcomes of innovation. Change that is negotiated and satisfies the diverse interests of those it affects has better prospects than change which is imposed.

Education and research are twin engines of innovation—for economies, for businesses and, no less, for schools. Educational research can help power innovation in schools. It is central to both reflective teaching practice, and informed policy development and decision making. It is imperative that it be bolstered at all levels, from action research in the classroom to national studies in areas as diverse as student achievement and effective pedagogy.

1.3 Developing students' innovative capacities

The capacity and predisposition for innovation gives individuals means to shape their own lives and to better the lives of others.

For students' innovative capacities to be realised, schools and teachers need to cultivate in students—and themselves model—creativity, imagination, original thinking, open-mindedness and critical thinking. Schools and teachers help predispose students to be innovative by motivating them to seek better ways of doing things and helping delineate for them possible forms of exploration and experimentation.

In an already crowded curriculum, the learning experiences needed to foster in students a capacity and predisposition to be innovative cannot simply be added on. These learning experiences must be integrated within, and become a mainstay of, the curriculum. To that end, existing curriculum, school organisation and pedagogy needs to be re-thought and refined to address the ever-changing learning needs of Australia's young people. Teachers' capacities to adapt and innovate need to be harnessed to make changes within the curriculum, rather than to expand the curriculum.

Australia's *Adelaide Declaration on National Goals for Schooling in the Twenty-first Century* identifies the requirement for well educated, creative and enterprising people who communicate well, show initiative, work effectively together and demonstrate high levels of competence and responsibility. Much remains to be done to translate those goals into effective action and to ensure that all young people are set firmly on the path of lifelong learning. The Review has addressed these and related issues, but they will continue to require attention far beyond the scope of this inquiry.

2. Enlivening science, technology and mathematics in schools

2.1 The imperative for science, technology and mathematics learning

Australia's future lies in its potential as a knowledge-based economy and society—one built on the knowledge, intellectual capabilities and creativity of its people. To achieve this potential, it will be necessary to:

- raise the scientific, mathematical and technological literacy and the innovative capacity of students;
- strengthen the education system that provides the platform from which world class scientists and innovators emerge; and
- support the development of a new generation of excellent teachers of science, technology and mathematics.

To achieve these objectives, significant advances must be made in science, technology¹ and mathematics teaching.

Faced in everyday life with ever more complex issues requiring knowledge and understanding of science, technology and mathematics—from the environment, to health, to personal investment, to the purchase of consumer goods—a high level of general community literacy in these fields is increasingly important. All students need scientific, technological and mathematical literacy if they are to make informed choices and contributions, to participate actively in decisions that affect their lives, and to contribute to solving problems facing society.

The achievements of Australia's schools and students in science, technology and mathematics are rightfully a source of pride. But the foundations in these learning areas which have hitherto served students well are rapidly becoming less adequate and appropriate as personal, community, national and international contexts and imperatives are transformed at a breathtaking rate.

¹ While the terms 'science' and 'mathematics' in the context of teaching and learning are well understood, 'technology' is less so. Technology relates to the purposeful application of knowledge, experience and resources to create products and processes that meet human needs. Within schools, it is thus both an area for study and a means of getting things done. As an area for study it embraces, but is much broader than, information and communications technology (ICT), and includes learning areas as diverse as home economics, industrial arts, media, agriculture, design and textiles. The use of ICT in schools and by teachers as a means of getting things done is specifically discussed in Section 10.

In all advanced economies, a shift is occurring toward science and technology-driven innovation. This is creating a requirement for rapid and continuing enhancement of the skills of the workforce. Inquiry, experimentation and the quest for ways to solve problems gain particular expression through studies in science, technology and mathematics. These activities are crucial in all modern nations and require special nurturing in our schools.

Australia's future increasingly will be reliant on new fields of science and technology, such as bioinformatics, biotechnology, laser science, genomics, nanotechnology and microelectronics, which have their basis in physics, chemistry, biology, mathematics and information and communications technology.

By applying additional efforts over a sustained period, Australia has made great strides in reinforcing the literacy and numeracy achievements of its young people. We can and should now build on national efforts and achievements in those areas by next focusing attention in our schools on the sciences and technology.

A community strong in science, technology and mathematics, with sufficient graduates in those fields to support a thriving knowledge economy, requires robust foundations of science, technology and mathematics teaching throughout the early, middle and latter years of schooling. Through more motivating, engaging and relevant learning experiences, more Australian students can and must be excited and rewarded by their studies of science, technology and mathematics.

2.2 The investment required

New and promising approaches to science, technology and mathematics teaching and learning, and to the development of a culture of innovation are urgently required.

Substantial resources must be applied to make possible the range of far-reaching initiatives necessary to release the enormous potential of all young Australians.

A range of practical initiatives on a national scale is called for. Clusters and networks linking schools with one another and with science and other organisations in the wider community broaden and enrich teaching and learning. Strong interdisciplinary links aid students' understanding of real world issues through a multi-faceted approach to teaching and learning, drawing on, and reinforcing, the particular perspectives and knowledge from specific domains. Flexible engagement of specialist expertise in schools—for example, of a marine ecologist to work with teachers and students on a science project, or an actuary to assist students to apply statistical analyses to a class business venture—can make learning resonate. Teacher placements or exchanges in other schools, research organisations and industry, both nationally and internationally, enhance teachers' capacities to bring learning alive through better appreciation of the ways in which knowledge and skills from their field are applied in contemporary workplaces.

For these initiatives to take hold, governments, education authorities, schools and other partners must make a substantial resource and policy commitment.

A number of countries with highly developed economies are already making large funding commitments to foster innovation in their schools, with the aim of boosting the longer term performance of their economies. For example, in Hong Kong a \$5 billion *Quality Education Fund* was established in 1998. Earnings from that investment have supported more than 4,600 projects, often with public and private sector partners, and effectively cultivated a climate of innovation in its schools. Through its *Specialist Schools Trust*, the United Kingdom has promoted specialist, innovative approaches in its secondary schools. As at September 2003, the UK had 1,448 specialist schools (representing 46 per cent of maintained secondary schools), including 497 technology, 14 engineering, 77 mathematics and computing, and 121 science specialist colleges. Singapore's *Thinking Schools, Learning Nation* program commenced in 1997, with the objectives of developing all students into active learners with critical thinking skills and forming a creative and critical thinking culture within schools. Between 1996 and 2002, under the *LUMA* program, Finland set targets for improving mathematics and science education to meet the needs of its knowledge society. Ten major national projects were funded, including a network of pilot schools and institutions, in-service education and teacher education. The outcomes have been impressive.

To become one of the world's leading knowledge economies, Australia has also to commit substantial resources to innovation and science in schools, matching or surpassing the efforts other nations are making. Our goal must be nothing short of that.

Action 1: A national science and innovation education program be established to assist schools and education authorities to introduce exemplary, sustainable and transferable initiatives which are an investment in the development of teachers' and students' science, technology and mathematics knowledge and their capacity to be innovative. A program of this kind would provide funding for many of the actions in this Agenda, including:

- the creation of a national network of local and regional science clusters linking schools and teachers with science organisations, tertiary education institutions and industry organisations (see Action 50);
- limited term teacher placements in science, technology or mathematics-related jobs beyond their schools (see Action 40);
- substantial professional learning opportunities for teachers of science, technology and mathematics (see Action 5);
- the forging of interdisciplinary links among, and multi-disciplinary approaches to, science, mathematics, technology and other learning areas (see Action 46); and
- visits or short exchanges to other schools by highly competent and committed school leaders and teachers capable of acting as agents of change in their own or other schools (see Action 51).

3. Promoting science, technology and mathematics teaching in schools

3.1 Primary schooling

The relative inattention to science teaching and learning in primary schools is inconsistent with aspirations for a scientifically literate society and excellence in Australian scientific achievement.

The foundations for the learning of science, technology and mathematics laid in pre-schools and other early childhood settings are also important. Further attention to such learning in the early years of childhood, and to means for ensuring equitable access to education at this time in children's lives, are required.

Science must be given greater emphasis in primary schools and primary teachers effectively prepared and supported to provide exciting and rewarding teaching and learning of science, technology and mathematics.

The development of enthusiasm for and competence in science and mathematics among primary teachers, and of specialist primary teachers and school leaders with expertise in science and mathematics, will require concerted and sustained effort.

Action 2: A cadre of primary science and mathematics specialists, able to support, mentor and guide other primary teachers in science and mathematics teaching, be developed.

Action 3: Primary teacher education programs provide a substantial focus on science, technology and mathematics teaching.

Action 4: Primary teacher education programs offer students opportunities to specialise in science and mathematics teaching, and students be encouraged by teacher education institutions and education authorities to pursue those opportunities.

Primary school teachers who have not been trained in science, whose mathematical attainments and confidence in teaching technology may be low, need assistance and encouragement to extend their capabilities in these areas.

Action 5: Primary teachers be afforded greater opportunities and support to extend their knowledge and professional skills relating to science, technology and mathematics teaching.

3.2 Secondary schooling

Students' enthusiasm for learning, fired in the early years of schooling, is not often enough sustained into the junior secondary years. The expectations students hold of an exciting science curriculum in junior secondary school too often are not fulfilled.

The development of mathematical proficiency and an interest in scientific investigation in the early secondary years powerfully influence the uptake of physical science studies in the upper secondary years, and are key contributors to the number of undergraduates electing to study science, technology and mathematics.

The very good performance of Australian students overall in international assessments in reading, scientific and mathematical literacy is encouraging, but no cause for complacency. The generally high standards attained mask much unevenness. While Australian students perform very well on average and the best students attain high scores, some, including many Indigenous students, perform at much lower levels.

While Australian junior secondary students' achievements by international standards are generally most commendable, it is disappointing that their level of interest in science is lower than the international average. To reinvigorate junior secondary school science, technology and mathematics education, pedagogy and curriculum must be strengthened.

Teachers need to engage and inspire students in these critical years of schooling when strong attitudes and predispositions are being formed. High quality teaching, coupled with deep expertise in specialist fields, is critical to student success. Primary and middle school teachers need opportunities and support to extend their capabilities in the specialist areas.

Action 6: Scholarships and other incentives be offered to primary and middle school teachers to undertake studies to advance their knowledge and skills in science and mathematics teaching.

Connections in science and mathematics education need to be made between clusters of secondary schools and their feeder primary schools, to stimulate science teaching and learning in primary schools, and to ensure that science and mathematics teaching and learning are well articulated between the two sectors.

Action 7: Science and mathematics education coordinators be appointed for clusters of secondary schools and their feeder primary schools to work across schools, stimulating science teaching and learning in primary schools and ensuring that science and mathematics teaching and learning is well articulated between the two sectors.

The absolute numbers of those studying physics and chemistry in Year 12 grew modestly over the last twenty-five years, reflecting strong growth in the number of students continuing to Year 12. However, historical highs were reached in the late 1980s and early 1990s, and since then there have been overall declines in the absolute numbers of students studying physics, chemistry and biology in Year 12. Declines in the *proportions* of Year 12 students who complete studies in physics, chemistry and, to a greater extent, biology have been even more pronounced.

While substantial increases in participation in mathematics among Year 12 students occurred during the 1990s, this was largely in 'fundamental' mathematics, with a modest decline in participation in 'advanced' mathematics. Participation in technical and information and communication technology studies did, however, rise dramatically over the last decade.

School participation rates and student performance in science, technology and mathematics are indicators of Australia's preparedness to meet the imperatives of the knowledge society and economy. The picture is uneven. There are undoubted strengths, but higher rates of participation in these learning areas and improved levels of student performance are required.

The dramatic and commendable growth over the last twenty-five years in the number of students continuing to Year 12 has been achieved in part by secondary schools providing a much wider range of learning experiences to cater for an expanded spectrum of student interests and abilities. A consequence of the greater choice now available to senior secondary students is that many who may previously have opted to study science or mathematics are now choosing subjects, such as business studies, psychology or computing, which they perceive to be more relevant, interesting or to have greater potential to lead to desired careers. The challenge is to endow science and mathematics learning with the kind of relevance and stimulus that will appeal to all students in the primary and lower secondary years and encourage more of them to continue to advanced levels in upper secondary.

Actions are required to build that appeal. Industry and science organisations must assume a shared responsibility with schools and families for raising young people’s awareness of the range and vitality of careers in the fields of science, technology and mathematics.

Traditional learning pathways in the sciences and mathematics are tremendously important. They are not, however, the only means by which valuable student learning in these domains can or should occur. Over recent years, enhanced opportunities have emerged for students to pursue occupationally-oriented studies in science and technology-related fields—such as computer science, building and construction, and community health—through vocational education and training courses, an increasing number of which are offered in schools. These too are important pathways and means for building our society’s scientific and technological capacity.

It is vital that teachers of these domains keep abreast of the continuing exponential growth in scientific and technological knowledge by regularly undertaking professional learning. Advanced studies (including at postgraduate level) for current teachers of science, technology and mathematics therefore should be encouraged and supported.

Action 8: Scholarships and/or other incentives be provided to selected teachers to undertake advanced (including postgraduate) studies in science, technology and mathematics.

Insufficient numbers of students are enrolling in tertiary education courses in science and mathematics. Declines since 1997 in higher education commencements in the physical and natural sciences, and to a lesser extent engineering, compromise Australia’s potential to be at the forefront of global scientific and technological development. The level of graduates from science, engineering and health in Australia stands around the middle of the field of OECD countries, well below the leaders, Sweden and Finland.

To broaden the appeal of school science teaching and learning, undergraduate and postgraduate science students and science researchers could be paid to contribute to school science lessons and projects, and to act as mentors to students. This would have the additional benefit for the undergraduate and postgraduate students of assisting them to develop the kinds of communication and teaching skills that are well-regarded in a range of science and other settings. Furthermore, as the Western Australian STAR program has demonstrated, opportunities for university students to tutor or assist in schools alongside teachers can help encourage suitable people to consider teaching as a long- or short-term career.

Action 9: Undergraduate science students and science researchers be engaged to assist school students and teachers.

Planning and collaboration to attract and retain quality teachers

4. Australia's teachers

4.1 Profile of Australia's teachers

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 may be classified as primary or secondary teachers, but those partitions are beginning to break down, especially through the emergence of middle school structures and programs.

A large-scale generational change in the profession resulting from expected retirements at unprecedented rates is likely in the next few years. In just fifteen years to 2001, the median age of the teaching population rose appreciably—from 34 to 43 years—with 44 per cent being older than 45 years. Male teachers are concentrated much more heavily in the older age groups. These trends are set to continue.

A gender bias towards females, most pronounced in primary schools, has been growing over the past 40 years. Male teachers are more represented in secondary schools, in the learning areas of science, technology and mathematics, and in promotion positions. The role messages these phenomena may be sending to students are concerning, as are the possible effects of a profession unrepresentative of the composition of broader society.

It is therefore desirable that the number of male teachers, especially in primary schools, increase in coming years. It is also desirable that more females become teachers of science, technology and mathematics, and more female teachers aspire to, and obtain, formal positions of leadership within the profession.

Australia is one of the most ethnically and culturally diverse countries in the world, but that diversity is not fully reflected in the composition of the teaching profession. Education is an inclusive activity. That inclusivity must be reflected within the teaching profession. The profession therefore needs to become more representative of the cultural and social diversity of the Australian community.

4.2 Supply and demand

Over recent years, the supply of teachers has been broadly adequate to meet school needs across the country. Recruiting difficulties are, however, apparent for certain secondary specialisations—including physics, chemistry, mathematics, technology and languages other than English (LOTE) studies—and in rural, remote and some metropolitan locations.

Like Australia, many advanced countries are facing shortages of teachers of science, technology and mathematics, exacerbated by the imminent retirement of large numbers of experienced teachers.

The significant losses of teachers through retirement that Australia will face over the next few years, with an anticipated peak around 2006 to 2008, will most acutely affect the secondary level. The generational change that will occur within the profession presents an unprecedented opportunity to regenerate teaching and learning, injecting fresh ideas to underpin a culture of innovation in Australia's schools.

The Ministerial Council on Education, Employment, Training and Youth Affairs' (MCEETYA) 2003 report on teacher supply and demand estimated that, depending on the success of policy initiatives to attract and retain teachers, shortages of up to 20 000 to 30 000 teachers may occur later in the decade.

Notwithstanding the recent information base on supply and demand gathered for MCEETYA, teacher workforce planning across Australia does not match the complexities of and requirements for the contemporary profession, and is frustrated by the inadequacy of available data.

While there are reasonably consistent data for teacher supply and demand overall across the major jurisdictions (the six State and two Territory education departments, and their counterparts in Catholic Education Offices and in independent schools), the data at the level of subject specialisation, are less comprehensive.

Nonetheless, nearly all jurisdictions refer to shortages of mathematics and technology teachers, and to shortages of physics and chemistry teachers, and these occur especially in rural and regional locations, and in some parts of capital cities. Any future shortages are expected to vary between States and Territories, due to differential population growth and projected student enrolment trends.

Now and for the future, it is essential that all schools, regardless of location, are well staffed with high quality teachers. Attracting, deploying and retaining, teachers, especially of science (physics and chemistry), technology and mathematics is a top priority.

A vital factor in workforce planning for the future will be to support and retain as many quality teachers currently employed as possible, particularly those in the earlier years of their careers. Induction and mentoring programs, sustained improvements to the working conditions of teachers, articulated professional standards, flexible workplaces and enhanced career pathways, opportunities for professional learning, strong school based leadership and team practices are all important features of the solution to better retain teachers in Australian schools. Initial teacher preparation and the schools where teachers start their careers are closely related elements that influence teachers about their careers and are of demonstrable significance for retention. Many of these measures are the subject of discussion and actions throughout the remainder of this *Agenda for Action*.

4.3 Teacher workforce planning

Workforce planning can be improved and more progress made. There are two main sources of prospective teachers available to fill vacancies that occur: those who are newly qualifying as teachers through teacher education programs (who typically comprise around 70 per cent of newly recruited teachers), and the pool of qualified teachers on employment lists for ongoing teaching jobs (estimated to be around 31 000 in 2002) or available for relief or casual teaching. Beyond these two main sources, other qualified teachers (estimated at 117 000 in 2001) are working in all sorts of other jobs. Any attempt to recruit significantly from this third source will be a major challenge for employing authorities.

Effective planning depends on a better understanding of the interests and needs of the existing workforce together with the conditions in which teachers can most effectively work.

Building on the teacher supply and demand information gathered by MCEETYA, greatly improved national data collection and analysis, including for specific fields of teaching and geographic areas, are required. Comprehensive statistics relating to teachers and teacher workforce trends generally, and for specific fields of teaching, teacher motivations and teacher education needs to be consistently, reliably and regularly collected on a national and collaborative basis. Studies of teacher aspirations and working conditions are essential.

Action 10: Comprehensive statistics relating to teachers, teacher workforce trends and teacher education be consistently, reliably and regularly collected on a national and collaborative basis.

More information and research is urgently required into building the longer-term capacity of the teacher profession. For instance, more needs to be known about existing and future education and skills needs for the teacher workforce, and more needs to be known about the intentions and motivations of those likely to leave, and those likely to enter, the profession. Such data need to find their way more systematically to teachers, educational leaders, teacher educators and policy makers alike.

Action 11: Research be undertaken on the working lives of teachers, their professional aspirations and ways in which changed conditions of schooling and employment might enhance the attractiveness of careers in teaching.

Across the country, arrangements for workforce planning are varied and often uncoordinated. While all education authorities have developed forms of teacher workforce planning, in some States and Territories and for some education authorities, projected teacher workforce needs do not formally inform teacher education enrolment targets in programs run by higher education institutions.

In this regard, the Committee welcomes the decision of State and Territory Ministers to work with the Australian Government in developing the proposed Commonwealth Grants Scheme (CGS), under which universities will be required to enter into a funding agreement with the Australian Government specifying both the number of places and the discipline mix, in part based on labour market needs.

Teacher education places should be allocated by number and discipline mix in order to meet future workforce needs. Specifically, the allocation of places will need to take account of the shift in demand from primary to secondary, for specialist fields, particularly physics, chemistry, technology, mathematics and LOTE, and for specific geographic regions.

Action 12: High quality teacher education programs and sufficient teacher education places, particularly in science (especially physics and chemistry), technology, mathematics and LOTE, be provided to meet the future teaching workforce needs and circumstances of all metropolitan, regional and remote communities.

State and Territory education authorities will be shaping and re-shaping their teacher workforce in anticipation of current and future directions and needs. Through flexible and responsive planning processes, they can capitalise on existing teacher capabilities through better understanding of teacher motivations and intentions, recruit and retain high quality teachers with requisite skills and expertise, and intervene rapidly and strategically in response to changing needs. The range of incentives offered by education authorities to attract, recruit, deploy and retain teachers must be strengthened, become more widespread, and be targeted at areas of greatest need.

5. Attracting and retaining high quality teachers

5.1 A career of choice

Teaching must be a career of choice, drawing to it many more of the country's best and brightest. Too few people currently are embarking on careers as teachers of science, technology or mathematics.

Coordinated actions by governments, employers, higher education institutions and the profession itself are required to ensure that Australia's young people are taught by well motivated and highly capable people.

Strategies to attract and retain teachers need to be built on high quality teacher education, effective and targeted recruitment, the prospect of fulfilling work which makes a real social contribution, attractive employment conditions, professional standards and mobility, and community valuing.

In recent years, scholarships, arrangements to pay students' accumulated Higher Education Contribution Scheme (HECS) debts, assurances of employment (often in country areas), and other incentives offered by education authorities have proved successful in drawing suitable people to teaching. Such initiatives must be strengthened, become more widespread, and be targeted at areas of greatest need. As a consequence, the interactions between scholarships, taxation and income support will need refining to ensure recipients gain maximum benefit from the financial incentives that are applied.

Between 80 and 90 per cent of those qualifying to teach senior secondary chemistry and physics, and around 75 per cent of those qualifying to teach advanced mathematics, do so through a graduate teacher education course following completion of an undergraduate degree.

But the proportion of those completing an undergraduate degree in one of those specialisations, who are immediately drawn to teaching, is low. Only around one in twenty-five of those who graduate in the general life sciences or mathematics, and one in fifty of those who graduate in the physical sciences, undertake teacher education in the year after graduation.

The predominant labour market destinations for graduates in these fields, however, are not, as might be expected, the domains of professional practice in their areas of science. The most common professional field in which these graduates (other than graduates in chemistry and geology) were employed in 2001 was in fact education, including teaching. At that time, around one in ten science and mathematics graduates were employed as education professionals, suggesting that a significant proportion of those people make their way into teaching a number of years after completing their undergraduate award.

Attracting a greater proportion of science and mathematics graduates to teaching and to teacher education, whether soon or some longer time after graduation, is the big challenge to be confronted if the anticipated shortages of teachers in these areas are not to become pronounced. Incentives are needed to encourage highly able people to become teachers of science, technology and mathematics.

Action 13: Prospective teachers of science, technology and mathematics be offered incentives, including payment of their HECS debt, housing assistance, scholarships, and/or paid internships, to qualify as teachers in those fields and to take up teaching appointments.

It is of the utmost importance that Australia produces sufficient high calibre teachers of science, technology and mathematics, able to move in and out of teaching during their working lives. At a time when expertise in science, technology and mathematics is in great demand, and shortages of science, technology and mathematics teachers are anticipated, it is imperative to send a clear signal that the teaching of science, technology and mathematics matters.

The Australian Government'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. The great majority of newly qualifying science and mathematics teachers are in this category. A number of submissions to the Review commented that the higher HECS liability faced by teachers of science, technology and mathematics, combined with teacher pay rates that do not distinguish between specialist areas such as science and mathematics, acts as a disincentive for graduates in those fields to take up teaching.

There are a number of higher order factors which students take into consideration when choosing teaching as a career—most notably the intrinsic rewards of teaching, salary and conditions, and career prospects. However, the extent to which the higher HECS liability for science, technology and mathematics units in university courses may act as a disincentive to prospective teachers needs to be investigated.

New secondary and primary teachers of science, technology and mathematics should not pay more HECS than teaching colleagues. Similarly, those teachers who enrol in higher education units in science, technology and mathematics for the purpose of enhancing their professional expertise should not pay more HECS than colleagues enrolled in units in other disciplines.

Action 14: Teachers of science, technology and mathematics not pay more HECS than other teachers.

Opportunities for students within science, technology and mathematics-related non-teaching degrees to undertake teacher education units could usefully be negotiated between the respective faculties in higher education institutions. These would provide students with an early taste of, and the chance to make an informed choice about, teaching.

Action 15: Close collaboration be developed between education and other (particularly science, agriculture and engineering) faculties at higher education institutions, with arrangements established for students in science, technology and mathematics-related non-teacher education programs to undertake teacher education units within their course packages.

5.2 Attracting more Indigenous teachers

Schooling is not fully effective when specific groups of students perform at a significantly lower level than the general school population. While some Indigenous students are achieving good results, the Programme for International Student Assessment (PISA) results testify that too many have relatively low scores in mathematical and scientific literacy. In the primary years, Australia's Year 5 Indigenous numeracy benchmark results are approximately 26 percentage points lower than the results of all Year 5 students. This large gap in performance is a serious problem and must be addressed in many ways, including through the committed efforts of teachers and principals working together with Indigenous communities.

The education of Indigenous students should be seen as a mainstream responsibility. All teachers need to be able to meet the challenge of delivering quality outcomes to Indigenous students through knowledge and understanding of Indigenous cultures. And all schools require leadership to support innovation and excellence.

Action 16: All initial teacher education programs promote as a core competency in qualifying teachers, an understanding of the diversity of students and their communities—most especially in relation to Indigenous students—and provide in-school experiences in a range of settings, including rural communities.

Prospective Indigenous teachers need to be attracted to the profession in greater numbers. Such teachers serve as role models, infuse a broader range of cultural perspectives into schools, and bring a capacity for closer rapport and identification with students from Indigenous backgrounds.

Action 17: Prospective Indigenous teachers be offered special incentives, including scholarships and payment of their HECS debt, to qualify as teachers and to take up teaching appointments.

Action 18: Prospective teachers of Indigenous students be offered assistance to undertake practical experience in schools with significant cohorts of Indigenous students and be offered incentives to take up teaching appointments in schools with predominantly Indigenous enrolments.

The outstanding work of Aboriginal and Islander Education Workers (AIEWs), in community liaison and teacher assistant roles, warrants further support. AIEWs are integral to the delivery of education to Indigenous students, and in developing networks with communities. Greater encouragement and practical assistance ought to be applied to enable many more of these highly regarded paraprofessionals to qualify fully as teachers.

Action 19: The continuing professional learning of Indigenous education workers, including study to qualify as teachers, be encouraged and supported.

5.3 Facilitating career change entry to teaching

More people with experience in other occupations and professions should be and are beginning to be attracted to teaching, bringing with them a richness of wider world experience. For example, engineers, agricultural scientists, health professionals, statisticians, and others with appropriate qualifications and experience in government and industry, are becoming teachers. Career change professionals have much to offer as teachers, including in school vocational education and training courses.

However, high personal and family costs are faced by those who wish to make a career change move to teaching. Flexible, innovative but rigorous means of recognising and crediting prior learning and expertise must be developed. Crucially, teacher education institutions must recognise prior learning if additional sources of teaching talent are to be tapped and those working in other professions attracted to teaching.

Action 20: Actively recognise and credit the knowledge, capabilities and experience of prospective teachers now engaged in other professions, and implement recognition of prior learning arrangements in ways that reinforce high standards for the teaching profession.

Internships, offering part-time paid support teaching work have been underused in Australia, but have great potential for attracting additional suitable people to teaching and for strengthening the relevance and immediacy of teacher education. These should be offered as part of programs of teacher education.

Action 21: Financial incentives, including scholarships and payment of their HECS debt, and internships be offered to high calibre prospective teachers of science, technology and mathematics from other professions to qualify as teachers and to take up teaching appointments.

To attract career change entrants to teaching, innovative, including online, courses, and programs offering paid internships in schools, should be designed, delivered and evaluated.

Action 22: A range of new, flexible, cross-faculty, intensive and accelerated teacher education pathways be established for those seeking to enter science, technology and mathematics teaching from other relevant professions.

Action 23: Financial assistance be provided for the start-up and piloting of new, flexible, cross-faculty and innovative science, technology and mathematics teacher education programs targeted at entrants from other professions.

5.4 Raising awareness and appreciation of teaching

Public awareness and appreciation of teaching as a profession has to be raised. The Review Committee commends those governments, education authorities and teacher organisations that have recently run campaigns to raise awareness among prospective teachers and the general community of the critical social importance and attractions of teaching. Opportunities to coordinate and extend future such efforts ought to be considered.

Means of raising the awareness of senior secondary students (from whose ranks the next generation of teachers will largely be drawn) of the real responsibilities and rewards of teaching need to be developed. Realistic and positive advice about teaching as a career needs to be offered through careers advisers and teachers themselves in all secondary schools.

All schools ought to provide secondary students with opportunities to help younger students with their learning. In addition to its recognised two-way educational value, such opportunities help older students form early, informed judgements about their interest in and suitability for teaching.

5.5 Towards better retention

The actions proposed in the preceding sections address the challenge of attracting highly able people to teaching. Equally pressing is the need to retain such people in the profession. Raising the retention of high quality teachers clearly hinges on a range of measures across the realm of professional experience. Many of these measures are the subject of actions in later sections of this *Agenda for Action*.

Teacher retention in a highly competitive labour market is a challenge with many dimensions. In a survey conducted for MCEETYA, teachers themselves nominated, in order of importance, the following factors in retaining teachers:

- improved remuneration;
- increased resources/reduced workload;
- improved employment conditions other than remuneration;
- improved professional standing in the community;
- reduced class sizes; and
- improved student behaviour.

School and system-based support is crucial to retaining teachers; particularly the coming generation, which has new and different expectations about work and careers. That new generation is pursuing varied and flexible career paths, which may for many include a period of teaching. Younger workers in all fields are typically seeking employment flexibility, to move into different roles and organisations, and to accommodate the demands at various stages of family and other life beyond work.

Movement between jobs in schools and jobs in other organisations is a positive feature of the contemporary Australian labour market and should be encouraged. The wealth of experiences shared can only enrich schools and lead to better appreciations in the wider community of the importance and challenges of teaching.

The Review Committee acknowledges and welcomes the increasing trend for people to move in and out of teaching over their working lives. However, too many high calibre teachers leave teaching in the first five years of their teaching careers. Some education authorities anecdotally report high rates of separation early in teachers' careers. Possibly up to 25 per cent of new teachers leave teaching during that early period. Effective induction, mentoring and support must be found to ensure the highest possible number of very able teachers are retained in the profession (see Action 36).

The frequent use by school employing authorities of short fixed-term contracts for beginning teachers induces a level of uncertainty among teachers engaged in that way, and can undermine their longer-term commitment to the profession. Research suggests that permanency or ongoing tenure positively influence teacher retention.

A core of experienced and committed teachers able to team and work with others is needed to support a more flexible and varied workforce.

Teachers tend to retire earlier than the population generally, often because their superannuation entitlements provide a disincentive to continuing their career. It is clearly desirable to retain highly experienced teachers who wish to continue in the profession for longer, including in roles as classroom teachers and as mentors to beginning teachers. A number of relatively low-cost measures could be used by education authorities to induce larger numbers of experienced teachers to remain in the profession beyond age 55. These might include: a guarantee that those eligible for an advantageous resignation benefit (typically at age 54 and 11 months) will receive a benefit on retirement after age 55 that at least equals the resignation benefit; continue to base final average salary for superannuation purposes on a teacher's previous salary should they opt from teaching full time to teaching part time or move to a lower level position with fewer responsibilities later in their career; or provide a bonus payment at, say, age 60 to any teacher still in employment who has achieved their maximum retirement benefit at age 55.

Action 24: Superannuation arrangements be investigated and applied to enable teachers who wish to remain longer in the profession to do so without financial detriment.

The initiatives required to attract and retain highly able teachers are closely aligned to those required to promote innovation in schools.

Positive school environments, in which teachers feel valued and respected, are essential to effective teaching and learning, and crucial to teacher retention. The physical conditions within schools, the availability and quality of curriculum materials, teaching loads, class sizes, access to and use of technology, and opportunities for study leave and professional learning affect teacher satisfaction and therefore retention. These are also channels through which innovation in schools can be encouraged and stimulated.

An effective means of improving teacher retention is through schools that are lively and in which students are engaged. Schools that promote a strong sense of purpose and a joy in learning shared between teachers and students are places where good teachers want to remain and in which a climate of innovation will thrive.

Commensurate with teachers' professional responsibilities, sustained improvements to the environments and general working conditions, including staff rooms, of schools need to be made.

Revitalising the teaching profession

6. A national profession of teaching

6.1 Standards

Teaching is a profession that requires highly committed, knowledgeable, enthusiastic and able people. High quality teachers make a significant and lasting contribution to young peoples' lives. It is a matter of the utmost importance to Australia's future as a knowledge economy and society that sufficient numbers of such people are attracted to, and retained in, the teaching profession.

There is wide acceptance that high standards for teaching should be set by and for the profession, and that an open dialogue is required about what these standards should be and how they should be assessed and recognised.

The identification of professional teaching standards is well advanced. The further development, promulgation and assessment of those, as well as standards for school leadership, will encourage consistently high quality teaching. It will also promote public recognition of the demanding role of the profession, and the celebration and rewarding of excellence in teaching and school leadership. The profession itself needs to take charge of these initiatives.

There is a need nationally to build on existing and emerging statements of professional teaching standards—especially those being developed by a number of States, science and mathematics teacher associations and the MCEETYA Teacher Quality and Educational Leadership Taskforce—to enhance the profession, and encourage a nationally consistent approach to recognising teacher quality.

The *National Framework for Professional Standards for Teaching* agreed by MCEETYA in July 2003 is intended to provide the basis for agreement on and consistency around what constitutes quality teaching, and to facilitate the articulation of the knowledge, understandings, skills and values expected of teachers through development of standards at the local level.

Similarly, the 2003 *National Statement from the Teaching Profession on Teaching Standards, Quality and Professionalism*, which was developed by a range of national professional associations, teacher unions and others, will inform further work on standards.

Standards will assist in defining quality outcomes, but need not prescribe the means by which those outcomes are achieved.

It is important that any profession define the standards to be met for entry. The feasibility of developing nationally aligned entry-level standards for beginning teachers is being investigated. Such standards should be developed to guide initial teacher education, as well as provide the basis nationally for teacher registration, accreditation and portability of teaching qualifications. They should be based on the things beginning teachers need to know and be able to do, rather than on particular inputs to their teacher education, such as length of course or number of days of practical teaching experience.

Action 25: National professional standards for beginning teachers be developed and adopted, and guide initial teacher education as well as provide the basis nationally for teacher registration and accreditation, and portability of teaching qualifications.

National professional standards should also be developed by the profession for specified career and performance stages beyond the beginning stage. Generic standards applying to all teachers and specific standards applying to teachers in particular fields can each help guide and advance professional practice.

Action 26: National generic and learning area specific professional standards that specify teachers' capabilities, performance and knowledge at different career stages continue to be developed and adopted by the teaching profession.

Of themselves, standards have value in directing professional learning and guiding and inspiring teachers to levels of proficiency acknowledged across the profession. However, without reliable and respected means of determining whether standards have been met, the mere setting of standards falls somewhat short. The profession should consider developing means of assessing the standards which define levels of professional practice.

Action 27: A national, credible, transparent and consistent approach to assessing teaching standards be developed and implemented by the teaching profession, with support from governments.

A new form of teacher professionalism must also incorporate strong ethical standards, forms of public accountability, and conduct that is appropriate for a culturally diverse society.

6.2 Portability of professional standing and teacher mobility

Teachers ought to be able to move readily between education authorities and State and Territory jurisdictions without losing salary, other work entitlements or standing.

It is increasingly recognised by education authorities that inflexibilities and barriers to national teacher mobility should be minimised or eliminated. The *Mutual Recognition Act 1992*, and the emergence over recent years of State teacher registration bodies, increase the scope for mutual recognition in the teaching profession.

One of the attractive features of teaching, particularly among those choosing to undertake teacher education, is that it is perceived as highly mobile. The potential of this factor in attracting new entrants is undermined by limited national portability and diverse employment requirements. There is an urgent need to make teaching qualifications and experience more portable to allow teachers to be mobile without losing salary, length of service conditions, career advancement status, superannuation or any other entitlements. Portability is a fundamental feature of most professions.

Renewing and extending the profession through development of uniform registration and accreditation arrangements and portability of entitlements will serve to improve perceptions of the profession both from within the profession and from the community as a whole. The Committee strongly endorses the notion of a national profession of teaching, and of the 'Australian teacher'.

6.3 Quality teaching and school leadership

A coordinated and collaborative national approach to the advancement of the teaching profession needs to be established.

The Review Committee is pleased that its work has helped inform the Australian Government's welcome decision to establish in 2004 a National Institute for Quality Teaching and School Leadership. The Institute will complement the arrangements to support teaching and school leadership in the various State and Territory school systems. It should play a central role in developing a coordinated and collaborative national framework for the advancement of the teaching profession. Its role should embrace professional teaching standards, teacher and school leader professional learning, quality assurance and research into teaching and learning. The Institute should focus on building cultures of innovation underpinning the teaching profession.

Action 28: The National Institute for Quality Teaching and School Leadership be run by and for the teaching profession, and work to enhance the profession and improve teaching practice and school leadership by:

- developing and supporting current and potential school leaders;
- supporting the work of teacher professional associations;
- supporting the development and assessment of national professional standards;
- providing and facilitating advanced professional learning;
- recognising highly effective schools and facilitating teacher and school leader visits and exchanges to and from such schools;
- undertaking or sponsoring research and data collection;
- providing a physical and virtual clearinghouse of research and materials to inform teaching and school leadership;
- promoting collaboration and partnerships among schools, education authorities, governments, teacher associations, parents, education and other faculties of higher education institutions and other organisations; and
- quality assuring courses for teachers and school leaders.

A range of national and other bodies undertake work to support teaching and teacher education in Australia. It is important that the work of the National Institute for Quality Teaching and School Leadership, State and Territory bodies with related responsibilities, Curriculum Corporation, the Australian Council for Educational Research (ACER), *education.au limited* and other relevant players be undertaken in complementary ways. Regular and substantive dialogue among all relevant organisations must be established to ensure this happens.

6.4 Recognition and remuneration

Those drawn to teaching are primarily motivated by an enjoyment of teaching young people, and the satisfaction they derive from contributing something of significance to others' lives. However, many potentially fine teachers are dissuaded from joining the profession by perceptions of low status and relatively poor remuneration. Too many excellent teachers leave the profession for much the same reasons.

Labour market realities, domestically and internationally, cause many highly able people to look beyond teaching to exercise greater earning power elsewhere.

Exacerbating the difficulties for the profession in Australia, the international labour market for English speaking teachers, especially of science, technology and mathematics, has greatly expanded, creating short- and long-term opportunities for significant numbers of Australian teachers in schools overseas. Each year an estimated 4 000 to 6 000 Australian teachers go on an overseas 'stint'.

While beginning salaries for teachers are comparable to those attained by graduates in other fields, the rate of teachers' salary progression thereafter does not compare favourably. Furthermore, the plateau teachers' salaries reach eight to eleven years after entering the profession generates considerable dissatisfaction among experienced teachers.

Highly accomplished teachers are disadvantaged by comparison with those in other professions by their inability to access pay commensurate with their performance. Improved remuneration for accomplished teachers is critical to the attraction and retention of the high quality teachers now required in Australian schools.

Ways for recognising and rewarding teachers who meet and exceed specified work levels and performance standards should be investigated and adopted.

Performance as a teaching professional—fairly and objectively assessed against specified and accepted work levels and standards—should determine teachers' career progression and remuneration. Progressively teacher career and salary advancement should be based on merit and teaching performance rather than length of service.

Action 29: Teacher career progression and salary advancement reflect objectively assessed performance as a teaching professional.

Action 30: Recognition, including remuneration, for accomplished teachers who perform at advanced professional standards and work levels be increased significantly.

As well as more appropriately rewarding performance and making teaching a generally more attractive profession, such changes would have two further positive effects. Flexible pay structures could make teaching more attractive for prospective entrants from other professions who may bring with them deep knowledge of their discipline area. They would also allow teachers to move in and out of teaching over a career without financial penalty, making the profession a much more permeable one able to draw on a wider pool of talent and experience.

Strengthening teacher education and professional learning

7. Teacher education and career-long professional learning

7.1 Teacher education

High quality teacher education, and the high quality teaching it enables, are directly and strongly linked to student achievement.

Teacher education is provided through hundreds of courses delivered by almost all of Australia's universities and a number of other higher education institutions. In 2001, these courses produced over 11 000 new, qualified primary and secondary teachers through two main pathways: a four-year undergraduate teacher education degree (most commonly a Bachelor of Education); and a one- or two-year teacher education diploma or degree (most commonly a Graduate Diploma of Education), following completion of an undergraduate degree in a non-teaching area, such as science or arts.

The numbers in teacher education have increased since 1995. More recent years have seen an increase in both commencing and completing teacher education students, and these have been higher in primary than in secondary programs. Data suggest there has been a decline in the proportion of science and mathematics graduates entering initial teacher education courses.

The gender bias in the teaching workforce is replicated in teacher education, with the proportion of males enrolled in teacher education dropping from 34 per cent in 1983 to 24 per cent in 2000.

It is vitally important that those admitted to teacher education programs are highly capable and suited to teaching. Student selection for admission to teacher education should therefore be both stringent and reflective of the skills and qualities required of teachers in today's and tomorrow's schools.

In addition to academic attainments, the requirements for entry to teacher education programs should take account of a range of personal, experiential and other criteria relevant to the practice of teaching. Those requirements should be set at exacting levels, consistent with the importance of teaching, and not be reduced at times of current or anticipated teacher shortage to facilitate easier entry. Lowering entry standards to fill teacher education places, and allowing lower calibre students to qualify as teachers, short-changes school students and diminishes the profession.

Losses of prospective teachers occur at every point along the pathway to becoming a teacher. A 2002 report for the Victorian Institute of Teachers concluded that, for every 100 applicants for a place in a teacher education course, 56 received an offer, 41 enrolled, 31 would be expected to graduate, 23 would be available for full-time employment, and 15 would ultimately be employed as teachers in schools. As far as practicable, these losses need to be reduced and a higher rate of conversion of enrolments in teacher education to professional practice as a teacher achieved.

More stringent entry standards and a better matching of entrants to the qualities required of a professional teacher would go some way to raising the rates of course completion and entry to the profession.

Teacher education faculties have shown great determination in shaping teacher education programs to provide the necessary foundations for entry into the modern profession of teaching. More remains to be done to build partnerships between teacher education faculties, education authorities and schools to ensure a close alignment between what is taught in teacher education programs and the skills and knowledge that now are needed by teachers in Australian schools.

There is no single model of teacher education that is clearly the most effective way of preparing teachers. As standards for beginning teachers are developed, articulated and expressed through registration requirements, the outcomes of initial teacher education programs will be reviewed and courses reshaped.

There are, however, some indications of the direction in which effective teacher education is evolving. Numerous innovative teacher education programs, many recognising prior experience and non-formal learning, have been introduced in recent years. These tend to have in common the following themes:

- an emphasis on the role of the teacher as an expert knowledge manager and guide of students' learning;
- pedagogy based around inquiry methods and problem-based learning;
- developing skills for collaboration in teams and through partnerships;
- reflective and adaptive teaching practice based on evidence and grounded in practical experience;
- enhancing diversity within the teaching profession through non-standard entry pathways;
- redefinition and linking of teaching levels, notably primary to secondary; and
- stronger partnerships between universities, schools, employing authorities and unions.

Teacher preparation must give new teachers a rich knowledge of how students learn, as well as an understanding of both the content they will teach, and of ways to teach well to a range of students.

To equip teachers with the skills and knowledge needed to develop an innovative capacity in students, teacher education faculties themselves must value, encourage and model innovation.

All those undertaking teacher education must acquire familiarity and confidence in the use of knowledge management appropriate for their future teaching and other school roles. Teachers need to be technology aware and alive to the opportunities that technology presents for learning and innovation. Advanced information and communication technology should be ubiquitous in schools, and ease with its use as an educational tool part of the professional repertoire of all teachers.

Action 31: All teacher education programs prepare prospective teachers for the digital age where ICT is an important tool in information and knowledge management and integral to student learning.

Teacher education must be firmly connected to the life and culture of schools. The overriding imperative is for qualifying teachers to develop familiarity and ease with students, teachers and school communities. Teacher education programs must equip new teachers with a full range of skills and strategies needed to function proficiently from the commencement of their careers—including in relation to behaviour management, reporting to parents, and involvement in the wider life of the school. Theoretical understandings of education are also important to inform the development of qualifying teachers' practical skills.

More than ever, in-school experience and the application and development of practical professional skills are the central plinth of teacher education. Early and continuing in-school experience should become the norm for teacher education students.

Close and continuing collaboration between teacher education faculties, education authorities and schools must underpin the specification of required skill sets and the development of appropriate in-school programs to enable qualifying teachers to acquire the necessary skills.

Action 32: All initial teacher education programs link strongly to schools, including through internships, and equip students with a full range of practical skills required to commence teaching as a competent professional.

It follows, therefore, that prospective teachers need substantial and high quality pre-service experience in schools. The earlier that experience comes—giving students who are planning to teach the earliest possible opportunity to apply a ‘reality check’ to their aspirations—the better. Desirably, that pre-service experience should be with a diversity of students and in a number of different settings, including rural communities. Teacher education students should also spend time in schools which, and with teachers who, have introduced successful, innovative approaches to teaching and learning.

Internships have been introduced by many universities as an important part of teacher preparation and entry to the profession. Internships can serve to close the gap between school and university perceptions and expectations of teaching.

Similarly, there is growing support for treating the practical teaching experience and the induction period as a single stage in the initial professional learning of teachers. Close collaboration and partnerships between teacher education faculties and schools is a feature of good practice in many teacher education programs.

The increased funding contribution for teacher education, which recognises the significant costs associated with the practical teaching experience component is a welcome element of the Australian Government’s proposed 2003 higher education reform package. Further consideration should be given by key stakeholders at the national level to the funding and structuring effective and broad-ranging practical teaching experience.

Action 33: Different models for funding and structuring the practical teaching experience, based on the contemporary and expected skills needs of beginning teachers, be investigated, considered and adopted.

Academic staff involved in the delivery of teacher education courses should have an ongoing, direct and substantial involvement in schools. Conjoint employment of such staff by education faculties and education authorities should become widespread. Universities, schools and education authorities will need to collaborate to make this possible.

Action 34: Teacher educators have continuing direct involvement in schools—including as part-time teachers, as mentors to beginning teachers, and as experts conducting or guiding action research—and education faculties and education authorities conjointly employ significant proportions of those staff.

Teacher educators must be able to apply a range of technologies to their own work, and primary teacher educators especially must be confident and expert in science, technology and mathematics.

In 2002, 78 per cent of academic staff engaged in teacher education in Australian universities were aged 45 years or above. With the expected retirement of large numbers of these people over the next decade, the recruitment and retention of sufficient high calibre teacher educators will be challenging and vital. Judicious appointments to these roles of outstanding professionals able to promote teaching excellence will need to be made by education faculties in consultation and collaboration with education authorities and schools.

Action 35: Numbers of highly accomplished teachers and school leaders be placed in education faculties as teacher educators for specified durations, under joint arrangements between education authorities and universities.

7.2 Beginning to teach

Stronger connections need to be made between initial teacher preparation, beginning teacher practice and ongoing teacher professional learning. In particular, beginning teachers need effective induction and mentoring support to help them in the early, challenging years of their careers, and to ensure that the highest possible number of very able beginning teachers are retained in the profession.

Action 36: Beginning teachers receive appropriate professional support, including thorough-going induction and mentoring, and time to reflect on their practice.

Support for beginning teachers must be predicated on a climate of collegiality, and reinforced through internal and external collaborations and partnerships integral to each school's operations. It is desirable that both teacher education institutions and schools play lead roles in support through this early period of professional practice.

Action 37: Partnerships between education authorities, schools and teacher education faculties be established to support jointly the transition to teaching of beginning teachers—and this additional responsibility for teacher education faculties and schools be formally recognised and resourced.

Many of the above actions require an integrated and collaborative approach. Given the national importance of quality teacher education and the range of stakeholders with interests in quality teacher education, a national forum should be convened to progress the issues.

Action 38: A national forum on teacher education be convened, bringing together the key stakeholders to set future directions and develop agreed common principles and protocols for teacher preparation including effective recognition of prior learning arrangements, course structure, content and delivery arrangements, practical teaching experience, quality assurance and flexible pathways into teaching.

7.3 Career-long professional learning

Changes in the knowledge base of all disciplines, and in the understanding of teaching and learning, require the continual renewal by teachers of their own knowledge and understanding.

Teachers change schools, move into different localities, and may move in and out of the profession. In addition to professional learning focused on the requirements of the individual teacher's current school and students, approaches are needed which recognise the changing nature of teaching and the new directions being taken by schools and school systems.

Teachers need space and guidance to reflect on their own practice, and should be supported to take time for professional learning and the examination of good practice elsewhere.

Continuing professional learning which builds on teachers' existing skills, enabling them more effectively to foster students' learning outcomes in a constantly changing world, is fundamentally important. Professional learning must be current and vital, and connect with both teachers' present responsibilities and their evolving career profiles.

The professional learning of teachers should be viewed as a continuum which begins with initial teacher education. The knowledge, skills and values developed during initial teacher education are a foundation which will not suffice for a lifetime or even extended periods in a teaching career. Sustained professional learning for teachers has to be a central feature of careers in education. Such learning should be directed to the acquisition of advanced teaching competence and to improving student learning outcomes. Professional learning is most effective when it also relates directly to the particular needs of the teacher's school and its students, and the teacher's assessment of his or her own professional learning requirements.

Action 39: The professional learning opportunities provided by employers of teachers, higher education institutions and teacher professional associations be directed to the achievement of the standards to be established for advanced teaching competence and improved student learning outcomes, relate to the situational needs of schools and their students, and reflect the expressed professional learning needs of teachers.

It follows that professional learning must be planned, systematic and regular.

A more coherent, national approach to professional learning is desirable in order to ensure consistency and opportunity for all teachers, regardless of location and situation, and to promote improved learning experiences and outcomes for students wherever they may be. A framework incorporating existing provisions and aligned to professional standards also has potential to enhance public perceptions of teaching as a high status profession.

High quality and pertinent professional learning and development opportunities will rejuvenate, motivate and retain good teachers. Providing teachers opportunities to gain work-relevant experience in research and industry can reinvigorate and add new dimensions to teaching skills.

Action 40: Opportunities be created through professional leave or other arrangements for teachers, especially of science, technology and mathematics, to gain relevant work experience in research and industry.

The upgrading of disciplinary knowledge and pedagogy will be at the core of professional learning, but teachers also need to further strengthen their capacities for the leadership, mentoring, curriculum development, knowledge management, planning, marketing, community relations, workplace health and safety and other roles they assume in schools.

Teachers need continually to update their expertise in the use of ICT as an indispensable tool for their professional roles and to ensure they keep abreast of the full range of learning opportunities for their students.

Action 41: Opportunities continue to be created for teachers to upgrade and update ICT knowledge and skills relevant to their professional roles.

Responsibility for professional learning is necessarily shared between teachers and employers. Governments, professional associations and others also make important contributions. While the teacher and his or her commitment as a professional lie at the heart of professional learning, the benefits and obligations associated with it are diverse.

7.4 Upgrading or acquiring new professional expertise

To complement the flows of new teachers through teacher education courses, teachers in disciplines and at levels where there is a sufficient supply of teachers ought to be encouraged to acquire new skills and knowledge for teaching science, technology and mathematics. Teachers with a developing interest in these learning areas should be supported to make the transition to new disciplines. For example, primary teachers who already have advanced pedagogical skills could undertake courses to enable them to become specialist science, technology or mathematics teachers in secondary schools.

Action 42: Specially tailored courses be provided to enable selected teachers not currently qualified to teach in science, technology or mathematics and who wish to teach in those areas, to acquire the professional expertise needed.

While a case can be advanced that, overall, the formal qualifications of teachers of science, technology and mathematics are better today than ever before, there is also evidence that a significant proportion of teachers in those fields have qualifications which fall short of the standards that the profession itself is beginning to set for teaching mathematics and specialist science and technology in secondary schools.

Teachers who need further qualifications in specialist areas need to be offered opportunities, support and incentives to upgrade and update their expertise.

Action 43: Specially tailored courses be provided to enable teachers of science, technology and mathematics who need to upgrade their subject knowledge or qualifications in those areas to do so.

In many schools teachers are being required or choosing to teach 'out-of-field'. For example, in 2002, 18 per cent of teachers whose first main qualification was in studies of society or the environment, 17 per cent of teachers whose first main qualification was in English, 12 per cent of teachers whose first main qualification was in mathematics, and 7 per cent of teachers whose first main qualification was in science were not teaching that as their first or second main discipline.

The significance of out-of-field teaching varies. For example, there are sometimes different priority needs between a Year 12 class where the teacher's depth of subject knowledge is vital, and a Year 8 class where encouraging student interest may be the prime objective.

There are both positive and negative aspects to out-of-field teaching. Teaching out-of-field is a way for many teachers to extend their professional expertise and re-energise their teaching by taking on a new challenge. However, to the extent that teachers are being required to teach in disciplines for which they have inadequate expertise, out-of-field teaching is problematic, and can mask the nature and extent of specialist teacher shortages.

Teachers regularly teaching in areas in which they lack adequate background must therefore be offered opportunities, support and incentives to acquire appropriate expertise.

Action 44: Specially tailored courses be provided to enable those regularly teaching science, technology and mathematics 'out-of-field' to gain the specialist expertise required to teach in those learning areas.

7.5 Accessing new knowledge about teaching

Education research is vital to ensuring that teaching practice is informed by quality data, evidence and evaluation. Teachers require timely and easy access to new knowledge to improve their pedagogical practice and to be at the forefront of innovation. The profession itself also needs to generate and disseminate new knowledge. Evidence-based and data-driven approaches to teaching and learning must, to a greater degree, become a routine feature of professional practice.

New technologies are one very important vehicle for providing access to, and disseminating, new knowledge and for fostering the networks through which professional practice thrives. A number of internet-based data banks have already been established within professional learning networks. The 'virtual clearinghouse' role the Review proposes for the National Institute for Quality Teaching and School Leadership opens a range of exciting professional learning and support possibilities. These would build on existing initiatives, including *education.au limited* and the ACER's Australian Education Index, and be guided by the work of the MCEETYA ICT in Schools Taskforce. Through such an initiative, online materials, learning technologies and programs, and coaching and mentoring might be made available for all teachers.

Importantly, too, a virtual clearinghouse should make education research and new knowledge readily accessible to policy makers, and wider research communities as well as parents and other interested members of the public, who play a part in improving schools.

Action 45: A 'virtual clearinghouse' be established to make available online to teachers, school leaders, researchers, policy makers and the wider public the findings of research about and materials for Australian schools, school leaders and teachers.

Supporting future schools through leadership, teams and partnerships

8. Future schooling

8.1 Schools of the future

The highly positive, engaging and effective learning climate that exists in some schools needs to exist in all Australia's schools.

The exemplary and innovative schools visited by the Review Committee demonstrate that inspirational leadership, a culture of excellence and innovation, and the energy and goodwill of teachers, students, parents and their communities, are of paramount importance. Schools have proved to be one of the most enduring and successful of all society's institutions, and will continue to be so.

There is an inexorable momentum building, albeit unevenly, toward the scope and scale of change in schools for which many educational and other leaders have been calling. Examples are the innovative restructuring of the curriculum and the multidisciplinary approaches to teaching and learning which are being developed in a number of jurisdictions. These are promising initiatives which should be carefully studied, evaluated and built on over coming years.

Innovative multidisciplinary approaches to teaching and learning that have the potential to advance pedagogic understanding and practice across the country warrant support.

Action 46: Resources be provided for the piloting of innovative multidisciplinary approaches especially with a focus on science, technology and/or mathematics teaching and learning.

Technology is pervasive, but it is the human dimensions of schooling and especially the relations between students and their teachers in the joint venture of learning that are vital.

Increasingly, teachers will be managers of an array of learning experiences for their students beyond the confines of traditional schooling.

Forms of assessment, especially at the senior secondary level, will operate in ways which support the development of students' innovative capacities and the objective of successful schooling for all. Technologies present means for improving the relevance and effectiveness of assessment.

Schools of the future will be universal centres of learning, adapting to the remarkable rate of change in students' worlds. They will be focal points for the educative society, networked and closely linked to other forms and means of learning.

8.2 Engaging students

Learning is strongest and most meaningful when it engages students and connects with their own knowledge and relates to their own interests, experiences and motivations.

All schools and teachers must strive to make learning relevant, engaging, rewarding and enjoyable for all students. All students need to develop a responsibility for their own continuing learning. To meet these considerable challenges in the often difficult conditions of the contemporary school, teachers need a great deal of support.

There is widespread evidence of student disengagement in the middle years of schooling. This is a serious issue which must be targeted through teaching and learning which is relevant, challenging and fun, and school environments which are friendly, encouraging and respectful.

Engagement in the life of the school and the classroom, and the improved learning outcomes and retention rates which follow, must be achieved for those students for whom these indicators have hitherto been weak or poor. This goal is imperative for reasons of social, economic and personal well-being.

Successful innovation demands the valuing of difference and the use of the opportunities difference presents.

Highly capable teachers have a rich understanding of youth cultures and the lives of students, irrespective of the discipline areas in which they teach. Effective teaching requires that teachers are sensitive to and connect with these cultures and build upon them. Too much teaching has been and remains insufficiently mindful of the challenges and difficulties students experience in learning.

Learning is most effective when students:

- know about, understand and actively participate in setting the goals and purposes, and feel ownership of, the process of learning;
- are helped to analyse and understand their own ways of learning and ways in which they can become better learners;
- are enabled and encouraged to analyse their experience, to construct their own meanings and understandings, and to evaluate their performance;
- experience pleasure, satisfaction and a sense of achievement in their learning; and
- are immersed in a whole school climate which fosters learning.

Action 47: The nature and processes of learning become the focal concerns of initial teacher education and continuing professional development.

It needs to become commonplace for teachers collaboratively to plan the learning groupings and teaching approaches which best engage students for particular units of work, adapting those as circumstances change. Likewise, learning spaces and community and school facilities will need to be used flexibly and imaginatively.

There needs to be an accompanying commitment to enhance learning spaces in all schools progressively, to enable a wider, more creative and more engaging array of teaching and learning approaches to be utilised. Across-school ICT connectivity can help extend the flexible use of school spaces.

9. School leadership, teams and partnerships

9.1 Leadership and school autonomy

Substantive school regeneration will be built on:

- outstanding school leadership;
- a clear vision and sense of purpose;
- a commitment by the whole school community to achieving that vision;
- highly competent teachers committed to excellent student learning outcomes; and
- strong system support, planning and resourcing.

Educational leadership is a driver of innovation and excellence in schools. Leadership does not only arise from positional authority vested in the principal and his or her executive team. Nor is leadership the sole domain of the teacher professionals in the school. All those within a school community may in various ways and at different times assume leadership roles.

Leadership should be widely dispersed and distributed so that it pervades the school and its community. Leadership which promotes participative decision making nurtures a culture of innovation.

The styles of leadership exercised by those in positional authority have a profound influence on the motivation and effectiveness of teachers, and on teacher retention.

As a fundamental part of their roles, educational leaders, especially principals, must promote school climates that are lively, welcoming and supportive, in which both teachers and students feel valued and respected, and where a spirit of active learning pervades the school.

Leaders must be people of vision and determination, have a capacity to understand what needs to be changed and an appreciation of things which need to be preserved, and have a pronounced ability to move things forward. School leaders must be supportive of student and teacher initiatives. Effective school leaders will encourage the exploration of new ideas and approaches.

The Review Committee proposes for the new Institute for Quality Teaching and School Leadership a pivotal role nationally; not only in developing the skills required for these forms of leadership more consistently to emerge but, equally importantly, in promoting expectations in school and wider communities about the kinds of leadership Australia's schools and students deserve.

Capacity for innovation is supported and enhanced by strong leadership, agreed and clearly articulated beliefs and goals, professional learning, regular review and reflection, and professional trust.

School leaders, particularly principals, need regularly to be refreshed and challenged anew in their roles in order to maintain their motivation and effectiveness. Principals should not be expected to remain in a single role for the balance of their careers. Periodic time away from their schools to undertake research, to guide processes of change in other schools, to become teacher educators within faculties of education, or to take on positions in government or industry, for example, would do much to ensure that principals continue to provide the dynamic leadership and enthusiasm on which their effectiveness depends.

Action 48: School leaders, and especially principals, be given periodic opportunities to take on new, professionally relevant challenges in a range of different settings.

As was confirmed for the Review Committee in its visits to a number of exemplary schools, the work of schools and teachers is energised and rendered more effective through greater autonomy, responsibility and decision-making power at the school leadership level and with strengthened and localised school governance arrangements involving the wider school community.

Anecdotal evidence of a decline in interest in advertised principal positions is concerning. This problem might in part be remedied by the greater autonomy for schools and school leaders advocated by the Review.

Reasonable risk taking within agreed parameters has to be encouraged in learning organisations for innovation and excellence to thrive. Governments and education authorities need to nurture a climate of trust and support for school leaders and teachers, and of responsible problem solving and risk taking.

Schools need strengthened autonomy over and responsibility for their education program, staffing, budget and other aspects of their operations to give them the flexibility to respond effectively to the particular challenges and opportunities they face. This was a clear characteristic of the outstanding schools the Review Committee visited.

Within school systems, strengthened school governance and autonomy needs to be complemented by a supportive framework of broad policies providing certain safeguards. These include ensuring equitable access to teaching and other resources, and public accountability for expenditures.

Action 49: Schools and their governing bodies be given strengthened autonomy over and responsibility for their education programs, staffing, budget and other aspects of their operations; as necessary within a supportive framework of broad systemic policies.

9.2 Teams and partnerships

Schools have never worked in isolation from their communities, and there has always been collaboration and shared responsibility. What is different now are the enlarged opportunities and greater realisation of what can and should be delivered to students.

In schools of the future, teaching will to a much greater extent be a team-based profession, with teachers working together and with outside experts and agencies to foster, orchestrate and manage learning. Teams, partnerships and networks of various kinds are now essential to take advantage of the resources, and to meet the challenges, of the knowledge society.

Schools will increasingly be characterised by sets of interdependent teams working across educational levels and areas. Team approaches to teaching will promote the further development of interdisciplinary learning. Teams, partnerships and networks of various kinds are now essential to take advantage of the resources, and to meet the challenges, of the knowledge society.

Schools and teachers on their own can no longer deliver all that students require from their schooling. In addition to system support, forging and strengthening partnerships with parents, business and industry, other schools, community groups and other educational institutions are required to enrich the experiences and opportunities of students and teachers.

Innovative connections must continue to be made to enable teachers and students to utilise the rich resources that lie beyond schools. For example, the CSIRO, Questacon and centres such as the Scitech Discovery Centre in Western Australia deliver captivating science presentations to schools throughout the country. Zoos, botanic gardens, museums, national parks, factories, farms and studios likewise are community resources which can help bring the teaching of science, technology, mathematics and other areas of learning alive.

Governments can and should provide practical support to encourage schools and teachers to develop collaborative partnerships and connections with the wider world—to open schools to new ideas and to give them access to broad sources of expertise and support. Increasingly, schools will need to be taken into the community and the community brought into schools.

In seeking to harness the resources available in the community to promote the learning of science, technology and mathematics, many schools have established successful partnerships with the scientific community. Likewise, many science organisations in Australia have made valuable connections with schools. All schools need to become more systematically linked with science and industry organisations to provide students with rich and relevant exposure to science and technology in local settings.

Vibrant partnerships need to be built to assist the work of schools and teachers—between education, science and other faculties within universities; teacher education institutions and schools; schools and other schools; schools and the general community, business and industry, and scientific and technological organisations; and teacher education institutions, school systems and governments, among others.

Action 50: A national network of local and regional science clusters linking schools and teachers with science organisations, tertiary education institutions and industry organisations be created.

9.3 Networking and sharing

The exemplary teaching and learning practices that daily occur in Australia's schools need to be recognised and shared. An investment in the dissemination and adoption of outstanding practice must be made. Sharing ideas among schools in Australia and internationally needs to be fostered, with highly competent and committed principals and teachers, capable of acting as agents of change in their own or other schools, supported to make visits to or to undertake short teaching appointments in other schools.

Action 51: Outstanding school leaders and teachers be funded to undertake visits or exchanges to other schools, in Australia or overseas, in order to exchange ideas and champion improvements in school and teaching practice, especially but not only in the fields of science, technology and mathematics.

Teacher professional networks are destined to become key instruments of change and innovation within the profession.

Networking has become a staple of knowledge capital, from informal, flexible and trust-based to more formal forms. For schools, as for businesses, networks—and especially ICT-assisted networks—offer unprecedented scope and reach of activities, flexibility, adaptability, accessibility and immediacy.

9.4 Assistance for teachers

The current organisation of work in schools results in most teachers' performing a wide and full range of both teaching and administrative tasks. To enable teachers to concentrate more fully on their professional roles, thereby making best use of their expertise and increasing their job satisfaction, other suitably trained school staff need to be appointed in sufficient numbers to provide effective paraprofessional support. Schools therefore need maximum flexibility in managing and deploying their human resources. For example, schools need the flexibility to engage a range of additional specialist expertise, such as network managers, instructional designers and laboratory technicians.

Action 52: Sufficient suitably trained paraprofessional staff be deployed in schools to support teachers in school-based non-teaching work.

10. Information and communications technology

Schools need modern, flexible, user-friendly, inter-operable technology systems, such as intranets, to link teaching and administrative functions and allow teachers to focus on their specialist teaching roles.

For reasons of cost, location and practicability it is not always possible for teachers to take an active part in face-to-face partnerships beyond the school. However, through the rapid changes occurring in ICT, new kinds of networks are being created. Schools and teachers from all systems and sectors can now much more readily share their experiences and ideas, and acquire the skills and knowledge to promote change.

The intellectual and knowledge resources of tomorrow's schools will be well managed and used to achieve high levels of student learning. Knowledge management will be an integral part of the pre-service and in-service education of teachers and school leaders. As the technological experience and capability of students, teacher education and practising teachers further develops, school learning will in future be highly technology dependent.

The power and accessibility of contemporary information and communication technologies make it feasible already for schools to create learning opportunities for students impossible a generation ago. Great strides have been made in introducing these technologies to schools, but the realisation of their educational potential remains a distance off for too many schools.

It is unrealistic to expect that each school will itself develop the advanced technological capacity and expertise which is increasingly desirable. Schools and education authorities will therefore need to forge effective alliances with organisations and individuals who can provide impetus towards that end. Advances in the introduction of ICT platforms, software and services must continue apace.

Action 53: High speed bandwidth internet access, leading edge connectivity and computing technologies, digital educational content, and appropriate software and ICT services be accessible for all Australian schools.

School intranets have enormous potential for promoting the ready and immediate sharing of information and resources among teachers, parents and students. The Review Committee visited schools where, for example, course outlines and assessment requirements were available online to students and parents, where teaching resources were shared and accessible to the teaching staff online, where student reports could be downloaded by authorised students, parents and teachers, and where professional learning opportunities were electronically posted. Such information sharing contributes greatly to the sense of common purpose and commitment which characterise highly successful school communities.

Action 54: A national project to identify and distil excellent policy and practice in the use of school intranets (including in providing useful and immediate information to students, teachers, parents and education authority managers), and to disseminate and promote those policies and practices, be undertaken.

Conclusion

The Review Committee's investigations and deliberations have led to the conclusion that immediate, vigorous and coordinated action by a range of stakeholders is required in the following broad areas:

- energising the sciences and technology and prioritising innovation in schools;
- planning and collaboration to attract and retain quality teachers;
- revitalising the teaching profession;
- strengthening teacher education and professional learning; and
- supporting future schools through leadership, teams and partnerships.

If Australia is to regenerate schooling and to realise its potential as a scientifically and technologically sophisticated nation advancing on the creative and innovative capacity of its people, decisive action in these areas must be taken.

From the many soundings it has taken and the very large number of submissions it received, the Review Committee believes that the responses to its calls by governments, school systems, schools, the teaching profession, higher education institutions and other key players will be strong and positive. Actions by all of the stakeholders including the wider community will do much to determine the kind of society Australia becomes and the potential we realise as a nation in the decades ahead. The responsibility is heavy. The time for action is now.

Australian schools have at hand many thousands of outstanding teachers, enormous student potential still to be fully realised, and a vast reservoir of resources in the wider community. Making the most of these, Australia's schools are poised to become the vibrant centres of learning needed for the well-being and prosperity of our society and its citizens.

Education authorities, schools and teachers in Australia have a record of providing rich learning experiences to develop the range of students' potentials. Comparative international research affirms the high standards achieved by our schools and students.

These qualities lie at the heart of the schools we envisage for the future.

Drawing on the qualities they have always shown, assisted by the actions outlined above, Australia's teachers and schools, so successful for so long, can and will evolve into places that consistently excite learning and prepare all students for rewarding lives in the twenty-first century.

Appendices

Appendix 1

Terms of Reference

Review of Teaching and Teacher Education

The Prime Minister in launching the Government's Innovation Statement *Backing Australia's Ability* in January 2001 announced a range of measures to pursue excellence in research, science and technology and to build an even more highly skilled workforce. In this statement the Prime Minister announced a number of initiatives for immediate implementation and a number of strategies for longer-term implementation. One of the major long-term strategies announced was to:

... ensure that talented people are attracted to teaching as a career, especially in the fields of science and technology education, teaching and teacher education will be reviewed, in consultation with State and Territory Governments.

To implement this strategy, a Review Committee will be established to conduct a review of teaching and teacher education. Particular emphasis will be placed on the fields of science, technology and mathematics. The review will focus on teacher work force needs in these areas in the short term and skills teachers need to build a culture of continuous innovation in Australia's Schools in the longer term (2012).

The review will:

1. build upon comprehensive work that analysed teacher supply and demand undertaken by the then Commonwealth Department of Education Training and Youth Affairs (DETYA) under the auspices of MCEETYA;
2. draw upon recent literature and initiatives to describe the teaching skills needed to develop a culture of lifelong learning and innovation in Australia's school students;
3. explore the impact of innovative pre-service and in-service education programs on the development of teachers' pedagogic practices to enhance their students' appreciation and capacity for learning, creativity and innovation, with particular emphasis on the fields of science, technology and mathematics;

4. map current skills and propose strategies for equipping teachers with the knowledge and skills to create an innovative learning culture amongst their students;
5. examine leadership practices that attract and retain teachers, especially in the areas of science, technology and mathematics;
6. produce an interim report, by end 2002, on strategies to attract and retain science, technology and mathematics teachers in Australia's schools; and
7. produce an innovation action plan for the school sector, by mid-2003. This action plan will encapsulate a shared understanding of the school exit outcomes necessary to equip school graduates for the knowledge economy and society. The action plan will consider the current situation and future scenarios.

Appendix 2

Review Committee

Professor Kwong Lee Dow AM—Chair
Deputy Vice-Chancellor (Students & Staff)
The University of Melbourne

Ms Elizabeth O’Leary
Executive Director
Catch 22 Asia Pacific

Dr Peter Tannock
Vice Chancellor
University of Notre Dame

Ms Helen Paphitis
Principal
Salisbury High School

Mr Ken Rowe
Retired Principal
Frankston High School

Professor Anne Edwards
Vice Chancellor
Flinders University

Dr Ian Paterson AM
Retired Headmaster
Knox Grammar School

Professor Janet Greeley
Executive Dean
James Cook University

Mrs Jill Healey
Principal
Flinders Christian Community College

Professor Steve Dinham
Chair of Teacher Education, Pedagogy
and Professional Development
University of New England

Mr Phillip Kiely
Executive Director
Net Return Pty Ltd

Mrs Marianne Nicholas
Science Teacher, Walkerville Primary
School and Recipient, Prime Minister’s
2002 Prize for Excellence in Science
Teaching in Primary Schools

Mr Stuart Hamilton AO
Secretary, Department of Education
and Training Victoria
(Committee Member:
August – December 2002)

Dr Martyn Forrest
Secretary
Department of Education, Tasmania
(Committee Member from April 2003)

Review Secretariat – Department of Education, Science and Training

Ms Di Weddell—Manager

Ms Susan Smith

Dr Shannon Smith

Ms Marie Hird

Mr Scott Lambert

Ms Renae Houston

Ms Millennia Pullen

Ms Margaret Carruthers

Emeritus Professor Malcolm Skilbeck and Dr Helen Connell

Dr John Ainley and Ms Catherine Underwood

Appendix 3

Reference Group

Ambassador, National Indigenous English Literacy & Numeracy Strategy	Ms Naomi McCoy
Australian Association of Mathematics Teachers Inc.	Mr Steve Thornton
Australian Chamber of Commerce & Industry	Mr Joe Moore
Australian College of Educators	Mr Jim Cumming
Australian Council for Computers in Education	Ms Cathy Crook
Australian Council for Education Through Technology	Mr Brian Webberley
Australian Council of Deans of Education	Professor Terence Lovat
Australian Council of Deans of Science	Professor David Finlay
Australian Council of State Schools Organisations Inc.	Ms Julian Golby
Australian Curriculum Studies Association	Professor Alan Reid
Australian Education Union	Mr Roy Martin
Australian Parents Council Inc.	Ms Josephine Lonergan
Australian Principals' Associations' Professional Development Council	Mr Don Zoellner
Australian Science Teachers Association	Mr Peter Russo
Australian Society for Educational Technology	Mr Ian Thomas
Business Council of Australia	Ms Maria Tarrant
Federation of Australian Scientific and Technological Societies	Ms Jan Thomas
Independent Education Union of Australia	Mr Patrick Lee
IT Skills Hub	Ms Deirdre Mason
Mathematics Education Research Group of Australia Inc.	Ms Judy Mousley
MCEETYA Teacher Quality & Educational Leadership Taskforce	Mr Paul Leitch
MCEETYA Teacher Quality & Educational Leadership Taskforce	Dr John Roulston
National Catholic Education Commission	Dr Michael Gaffney
National Council of Independent Schools' Associations	Ms Audrey Jackson
Technology Education Federation of Australia	Mr Ralph Leonard

PRINCIPALS
TEACHERS
UNIVERSITIES
PARENTS
TEACHER ASSOCIATIONS
STUDENTS
SCHOOLS
TECHNOLOGY
EDUCATION AUTHORITIES
INDUSTRY
SCIENCE
EDUCATION
MATHEMATICS
INNOVATION
TEACHER EDUCATION
PARENTS
TEACHER ASSOCIATIONS