

Education and Skills for the Smart State

Prepared by a working group of the **Smart State Council**

November 2006



Dear Premier

Please find attached the Smart State Council working group report on *Education and Skills for the Smart State*.

In forwarding this report, I note that the Standing Committee of the Smart State Council has asked me to convey their unanimous view that the quality of our education system is the single most important factor underpinning the development of the Smart State, and that the quality of our teachers is the single most important factor underpinning our education system.

The report outlines ways to elevate the status of the teaching profession, develop relevant and engaging curricula, enhance science and technology education and increase community awareness and engagement in education.

I commend it to you.

Professor Peter Andrews
Queensland Chief Scientist and
Chair, Standing Committee
Smart State Council

November 2006

This paper was prepared by an independent working group for the Smart State Council. The views expressed in this paper are those of the group and do not represent Queensland Government policy.

Copies of this publication can be obtained at www.smartstate.qld.gov.au

WORKING GROUP

Chair

Professor John Mattick, Chair, Reference Group; Chair QSA

Members

Dr Cherrell Hirst, Deputy Chair, Queensland Biocapital Funds

Dr Jane Wilson, Chair, Institute for Molecular Bioscience; Director, Protagonist Ltd

Professor John Dewar, Chair, QCT; Pro Vice Chancellor (Academic), Griffith University

Professor Gabrielle Matters, Principal Research Fellow; Manager, ACER, Brisbane

Professor Richard Smith, Executive Dean, CQU Faculty of Arts; Humanities and Education Chair, MACER

Mr Robert Wilson, Assistant Director, Education and Training, Queensland Resources Council

SMART STATE COUNCIL

The Smart State Council was established in June 2005 as a central advisory body to provide high level advice to the Queensland Government on emerging Smart State issues and trends, and to propose measures to position Queensland to respond to challenges and opportunities.

The Smart State Council is chaired by the Premier of Queensland and comprises Government Ministers, the Queensland Chief Scientist and representatives from Queensland's business and research communities.

EXECUTIVE SUMMARY

Education is critical to a modern economy as well as to an informed citizenry. The Smart State Council Report, *Smart Regions: Characteristics of Globally Successful Regions and Implications for Queensland*¹ found that the world's smart regions have a strategic focus on improving general education attainment levels. In particular, modern economies are increasingly dependent on science and technology education for the preparation of researchers, technologists and the community at large.

Queensland must position itself at the competitive edge at all levels of education to meet demand in science, engineering and technology (SET) industries, creative industries and other technical areas in a knowledge-based economy. If education is the mechanism for Queensland to be the Smart State where smarter learning occurs, four fundamentals require immediate attention:

1. **Elevation of the status of the teaching profession** through the attraction and retention of a highly-qualified **teaching workforce** committed to ongoing personal learning and professionalism.
2. **Construction of a relevant and engaging curriculum that details core content that is standard across the state**, allowing a degree of local and personal specialisation, and **reformation of the senior syllabus landscape to provide a balanced education and flexible enabling platform** for students to pursue varied careers and choices that will serve industry demands and create the opportunities that will drive the Smart State.
3. **Provision of a quality science and technology education** to ensure that Queensland has **the researchers and the technologists to drive the knowledge-intensive society** of the future, and **a community with the scientific understanding** to participate in the ongoing evolution of that society.
4. **Encouragement of an involved community that values education** as the passport to the future for all students, **particularly those from disadvantaged backgrounds**, and understands the importance of the opportunities and rewards of careers, particularly in science, engineering and technology.

Table of Contents

EXECUTIVE SUMMARY	3
EDUCATION FOR THE 21 ST CENTURY	5
Science, Engineering and Technology Skills.....	6
1. TEACHERS, TEACHERS, TEACHERS.....	6
1.1 Professionalism	8
1.2 SET Teaching.....	9
2. CURRICULUM LANDSCAPE	10
2.1 Transformed Curriculum – Motivating Students.....	10
2.2 Core Disciplines and Content.....	12
3. AWARENESS AND ENGAGEMENT	13
3.1 Family and Community Support.....	13
3.2 Career Awareness.....	14
Conclusion	15
References.....	16

EDUCATION FOR THE 21ST CENTURY

The world has moved from an agricultural to industrial to knowledge revolution with the transition to the knowledge economy being the most painful and confusing because it is faster than any previous revolution.²

*'In a knowledge age, education will undergo radical change since the needs of a knowledge society are fundamentally different from the needs of societies of the past. A society organised around knowledge generation is a society organised around an unlimited resource – one that is entirely renewable.'*³

'Knowledge economies are stimulated and driven by creativity and ingenuity. Knowledge schools have to create these qualities.'⁴ Integral to a knowledge-based economy in Queensland is a transformation of the educators, curriculum and learning environments so that there is relevance for students, today and in the future, as they prepare for an ever-changing world. This includes an increased knowledge of science and technology as well as creative and communication skills. To embed the transformation in education will require a significant culture shift for many educators and will involve ensuring students and their parents and caregivers are well informed about career pathways and options.

In 2003, an Organisation for Economic Co-operation and Development (OECD) report⁵ on *Networks of Innovation* stressed the need for governments to ensure that education was a high priority, politically, socially and economically. Research by Andy Hargreaves⁴, Warner⁶, David Hargreaves², and Schleicher⁷ concurs that countries that invest heavily in education and skills benefit economically and socially.

The demand in Science, Engineering and Technology (SET), creative industries and other technical areas places pressure on systems to:

- ensure that there are sufficient qualified educators across all sectors to motivate young people to enter the 'in demand' industry areas;
- construct curriculum that is relevant, coherent, rigorous, flexible, and focussed on lifelong learning for a knowledge economy;
- promote within the community the value of the pivotal role that education plays in a knowledge economy; and
- provide places for learning that are vibrant, innovative and motivating, for tomorrow's knowledge workers and the wider community.

The Queensland Government has made a commitment through the *Queensland Smart State Strategy 2005-2015*⁸ to place long-term investments in people and places to shape a society that uses knowledge, creativity, innovation and skills to stimulate enduring economic growth. The education initiatives of the Strategy, *Smarter Learning, Smarter Classrooms and Smart Academies*, have been the catalyst required to stimulate investment in knowledge and skills for an innovative society. The challenges of the 21st century have

only begun. The full impact is yet to be embraced by all educators and learning institutions across the state to effectively engage in the required change. Queensland can take national leadership in addressing education and skills issues, and thus making it unarguably the 'Smart State' in which smarter learning occurs, if all educators accept these challenges.

Science, Engineering and Technology Skills

Skills in SET are globally acknowledged as vital to the development of the industry and research sectors and to growth in a country's economy. The 2006 Australian Government audit of SET skills⁹ found the adequacy of skill supply in these areas is an ongoing concern for industry, governments and the scientific research community. This concern is shared by many OECD countries that are experiencing not only lower enrolments in SET areas in higher education, but a decline in youth interest in study and careers in SET.

The demand in SET has grown at almost twice the rate of the workforce as a whole. Projections by the Queensland Chief Scientist¹⁰, indicate that there is a need for a significant increase in university-qualified people in SET if we are to compete with knowledge-intensive countries such as Finland. It is time to address what science academics at the University of Queensland see as the '*Flight from Science – Fright of Science*' dilemma.

The *Skills for Jobs and Growth*¹¹ indicates a skills shortage in Queensland technical areas as an outcome of the diversification of the industry base beyond the traditional primary and resource-based industries. Knowledge-based industries cannot exist without the technically and commercially qualified individuals that drive them and will not thrive in the absence of a scientifically literate society. In the future, "*virtually all quality jobs in the knowledge economy will require certain scientific and mathematical skills.*"¹²

Research conducted during the Audit of SET Skills in Australia⁹ identified three factors influencing the fall off in engagement in science, mathematics and technology in Australian schools:

- the implemented curricula can differ from the intended;
- lack of inspirational, high quality teachers especially in primary; and
- level of awareness of parents and the general community of the SET careers opportunities and benefits.

1. TEACHERS, TEACHERS, TEACHERS

*"Teaching is increasingly complex work. It requires the highest standards of professional practice in order to perform it well. Teaching is the core profession, the key agent of change in today's knowledge society."*⁴

Teachers are distinguished from other professions by their knowledge of the science of learning and cognitive processes. This expertise must be valued and trusted¹³ so that teachers can prepare students for a society and an economy in which students will expect to be self-directed learners and motivated to keep learning.¹⁴ Quality professional teachers^{3,15,16} are vital if the educational challenges of this century are to be met. Skilbeck et al¹⁷ research in Queensland regarding teaching careers found that:

“The quality of teaching has a decisive impact in student learning. Teacher policies directed at quality teachers and teaching will play a key role in determining the extent to which the strategic goals of the Smart State are achieved.challenges... the state’s capacity to attract, educate, deploy and retain a high quality teaching force.”¹⁷

Many OECD countries share a concern about having enough teachers with the necessary skills and knowledge to meet the challenges of the 21st century. Finland, which ranks highly in the OECD Programs for International Student Assessment (PISA) results places a particularly high degree of importance on the quality of teachers that are recruited to the profession. Excellent teachers in Queensland schools are vital if SET and other demands are to be met and the attitudes of Queensland students to science and mathematics, as evidenced in the 2003 PISA¹⁸ results, are to improve.

A greater emphasis on teacher quality could see teachers’ work being redefined to focus more on the professional and knowledge-based components and teachers being paid substantially more to attract and retain the best possible candidates. It has long been the desire of teachers to be able to concentrate on doing what they obviously entered the profession to do and that is to teach. Over time, teachers have been expected to take on responsibilities that fall outside the realm of their professional work as teachers. Such responsibilities have contributed to their workload and at times detracted from their professional role.

Currently, there is no formal recognition or a culture of valuing the additional qualifications and professional skills and knowledge that teachers develop during their careers which places them in direct contrast to how other professions operate. The lock step, one size fits all approach to remuneration for teaching is a ‘hangover’ from an industrial time. New models must be investigated. Warner⁶ and the MACER¹⁹ report suggest that recognition and remuneration of teachers should be about ‘what they do’ not ‘who they are’. It is critical to have a sustained campaign to improve the status, stature and capability of the teaching profession, and to attract gifted and highly qualified individuals who are committed to ongoing personal learning and professionalism and capable of motivating students to be ambitious and to enter ‘in-demand’ industries.

The 2004 DEST¹⁶ report suggests that recognising outstanding teachers will strengthen the status and quality of the profession. Recently at the national level, it has been suggested that performance-based pay should be introduced to attract and retain excellent teachers to the profession and to raise the esteem of the profession. Skilbeck et al¹⁷ suggest that teaching is insufficiently structured as a career and work should be undertaken to investigate how other professions recognise and reward quality so that outstanding teacher quality can be rewarded.

1.1 Professionalism

Caldwell²⁰ in commenting on knowledge management in schools calls for a:

'new professionalism in which teachers' work is increasingly research-based, outcomes oriented, data driven and team focused with lifelong professional learning as important in education as it is in medicine.'

To position Queensland at the leading edge it is suggested that:

- all secondary teachers should have a tertiary qualification in the core areas in which they teach;
- pre-service courses for primary teachers should have a stronger focus on subjects in the core areas of literacy, numeracy and science; and
- all teachers should demonstrate a commitment to ongoing professional learning.

Teachers as knowledge workers must learn to work with colleagues and students in knowledge producing and knowledge sharing.¹⁹ As knowledge workers in the modern world, there is the need for continuous education among professionals.¹⁴ The trend for teachers to become lifelong learners and to model this learning for students with whom they work needs to gain momentum and be a priority.

To achieve this position may take some years and will require a reassessment of teacher salaries to bring them into line with other professionals with similar qualifications. To invest in this change and to create the incentives for excellent, professionally prepared and professionally remunerated teachers will require a cultural shift by many educators. Teachers who gain additional qualifications and/or demonstrate a professional commitment through engaging in ongoing professional activities in their own time should be recognised and rewarded accordingly.

It is vital that teachers maintain skills through professional learning as school environments, social and economic conditions change and the innovations in technology impact on teaching practices and subsequently student learning.^{16,21} The times are gone when teachers could be dependent on the 'system' to provide top down professional development to ensure currency within the profession. Teachers and employers need to accept joint responsibility for continued professional learning.

*"In many professions, reaccreditation and/or renewal of registration are dependent on continued professional learning. Community expectations of members of a profession relate to standards of conduct, competence, knowledge, skill, judgement and care, and aspirants are admitted to a profession after they have satisfied rigorous entry requirements....."*²²

It is acknowledged that at times, schools face many conflicting challenges which places enormous demands on teachers to undertake professional development and thus puts a strain on budgets and priorities. As Watson²³ and the Senate Inquiry²⁴ recognised, many of the arrangements for teacher professional development are 'piecemeal' or 'ad hoc' and

may turn teachers off engaging. The plethora of professional learning opportunities and resources for educators are frequently ignored because there is a 'hit and miss' approach to how they receive and access information. They are bombarded from all sides and often make ill-informed decisions about what is suitable and/or available to enhance personal and professional learning. A unified approach that provides a 'one-stop place' for educators to access current information regarding opportunities for ongoing formal and informal learning pathways would assist individuals and schools in their planning.

It is also vital that our community recover high respect and strong support for teaching as one of, if not the, most important professions that will determine the opportunities for the next generation of Queenslanders and a prosperous and civil society as a whole.

1.2 SET Teaching

There are often gaps in teaching expertise in defined subject areas in the secondary years as teacher supply tries to match demand. Common across education systems in Australia is the need for more highly trained teachers in the science, technology and mathematics fields to ensure that students are encouraged and motivated to meet the growing demands in these career areas. To address the ongoing and urgent need for more qualified and motivated teachers of maths and science, recruitment strategies, recognition and incentives are required to attract and retain suitable people. In addition, these teachers need to be the ones who inspire and motivate students to engage in learning pathways that take them into tertiary study and technical roles in which scientific literacy is an imperative.

Many primary teachers struggle with the teaching of science and mathematics as a result of low confidence and interest in these subjects. This is reflected in the weekly time allocated, particularly to science teaching. It is acknowledged that Queensland will be addressing this situation in the primary sector with the introduction of the 'Primary Connections' program being developed by the Australian Academy of Science. At the secondary levels of education, there is often concern regarding the currency of knowledge of teachers who may not have engaged in relevant professional learning for many years in these subjects and are the manner in which their teaching occurs.

The situation described by Goodrum et al²⁵ in 2000 still prevails today:

"The actual picture of science teaching and learning is one of great variability ... the picture is disappointing.some primary schools, often science is not taught at all.....move to high school, many experience disappointment, because the science they are taught is neither relevant nor engaging and does not connect with their interests or experience. Disenchantment with science is reflected in the declining numbers of students who take science subjects in post-compulsory years of schooling."

2. CURRICULUM LANDSCAPE

In 2004, a study of international curriculum and assessment frameworks²⁶ revealed that some of the few countries lacking a national curriculum were Australia, USA and Canada. In countries with a core curriculum, discretionary responsibility is generally placed at the local level for schools/teachers to interpret the curriculum to match the local context and needs. These are mainly countries that lead OECD ratings in terms of scientific, mathematical and literacy ability. In Finland, the Netherlands and Sweden, educational objectives and core subjects are centrally defined but schools are given comparatively greater freedom to set the actual learning content.²⁷ The New Zealand curriculum²⁸ sets the national direction for students, although each school designs and implements its own curriculum to meet needs of its students.

At the national level, Queensland has agreed to incorporate the national Statements of Learning²⁹ developed through the Commonwealth Ministerial Council on Education, Employment, Training and Youth Affairs which is endeavouring to introduce more consistency in curriculum and years of schooling across the states and territories in Australia so that the education of the increasing number of mobile students is less compromised.

There is increasing criticism locally and nationally of current school syllabuses, from which Queensland has not been immune. There is a case that current Queensland Studies Authority (QSA) syllabuses are vague and content poor. The current practice of school-based curriculum development, whilst in principle empowering schools and teachers, also has several weaknesses and disadvantages. These anomalies can be addressed through:

- closer collaboration between learning institutions;
- clearer curriculum specification and expectations; and
- the monitoring of outcomes.

2.1 Transformed Curriculum – Motivating Students

Transformation, by definition, suggests deep organisational change that is for the long-term, sustainable and significant. The transformation suggested for the curriculum in Queensland is for a future that will ultimately see learning places that are quite unlike what they are at present.

Queensland is currently at a crucial stage in the development of the curriculum across all levels of schooling. In the development of the Queensland Curriculum, Assessment and Reporting (QCAR) Framework and the review of the Senior Phase of Learning Syllabuses, it is important that the QSA respond to evidence from high achieving OECD countries and be futures-oriented if Queensland school graduates are to effectively participate in, and contribute to, the knowledge economy.

A transformed curriculum in Queensland needs to:

- ensure all students achieve positive outcomes commensurate with their abilities;
- encourage students into areas of need (eg science and technology);
- create greater consistency within and across subjects;
- create greater consistency in assessment strategies;
- provide a broad-based education with degrees of specialisation;
- provide a degree of flexibility to match contexts;
- ensure needs of employers are met; and
- attain Smart State aspirations.

Ongoing collaboration between educators, employers and other stakeholders will shape and reshape the qualities required of Year 12 students to enable them to graduate as lifelong learners in a creative, knowledge-based and innovative Queensland environment.

Students graduating from Queensland schooling need to be:

- literate and numerate;
- competent in defined core academic areas;
- globally aware;
- skilled for employability;
- critical thinkers and problem solvers;
- confident and self-managing;
- creative and productive users of technologies;
- good communicators;
- team players and collaborators;
- lifelong learners, able to learn, unlearn, relearn;
- accountable and adaptable;
- planners and organisers; and
- ethical, loyal, motivated and positive.

Mobility is an increasing feature of modern economies. For students and professionals to be mobile, they must have an education and training environment that provides a strong generic platform of knowledge and skills, and is reasonably consistent with national and international standards. Queensland's syllabus landscape needs to be transformed to permit both better structure and a more robust and flexible platform for career development.

2.2 Core Disciplines and Content

All countries grapple with the issues of content in syllabuses be it core, extension, specialised or combinations. The European Union and the United States^{7,30} acknowledge that there is a need to follow the lead of high achieving OECD countries if they are to 'pick up' the long tail of their low achieving students as evidenced in the 2003 PISA results. In New Zealand, a high-achiever in PISA results, a new core curriculum has been drafted to reflect the changing needs and priorities within society.

The *Smarter Learning* initiative within the *Smart State Strategy 2005-2015*⁸ suggests that there needs to be a sharp focus on the fundamentals in core subjects to give students deeper knowledge. A review of Year 11 and 12 syllabuses has highlighted the need for breadth and depth, learning for the 21st century, flexibility, valuing of different kinds of learning and knowledge and sustainable systems for quality and consistency. The planning and reviewing of these syllabuses need to be linked to the pace of change within these disciplines. Queensland students need to be provided with maximum flexibility for future choice of professional and educational pathways - which paradoxically means limiting, but not eliminating, choice at school level.

The approved Queensland senior syllabuses have grown in an ad hoc way and comprise many overly specialised and narrow subjects. There are over 70 separate QSA-approved subjects in Years 11 and 12 in Queensland, which is far too many. The end result is that it is currently difficult, if not impossible, for our senior students to obtain a broad education and a flexible but reliable platform of knowledge and skills for their future lives as citizens and for the development of their careers. Specialisation at a time when students may not have a clear sense of their ultimate choices or preferences constrains their opportunities and those choices, the very opposite of what they and society need to prosper in a rapidly developing world.

In general it is suggested that a system of structured flexibility around coherent themes be developed by reorganising the senior syllabus landscape in two interrelated ways:

- define core and discretionary subjects, and core and discretionary components within these subjects; and
- cluster narrow subjects into broader spectrum courses.

This structure would provide a stable yet flexible platform for students, schools, employers and tertiary educational institutions to work with and from. A number of the issues outlined above are currently being considered by the QSA, but could benefit from government leadership and clear direction.

The inclusion of science and technology across year levels will support the growing demand and concern in SET and other employment streams for these necessary skills. The 2004 DEST report on science teaching and learning²⁵ maintains relevance today.

"The ideal science education will provide an appropriate school experience for all students to achieve a level of scientific literacy, and also provide a suitable background for those (perhaps 20%) who wish to become scientists or pursue other

*science-related careers. Clearly, no one curriculum can prepare students for science study beyond school, meet the specialised vocational purposes of others and provide a general level of scientific literacy for all.*²⁵

3. AWARENESS AND ENGAGEMENT

*"What happens today in education profoundly influences the lives of individuals and the health of whole communities for decades to come. Yet, educational decision-making is mostly dealing with pressing immediate issues or seeking more efficient ways of maintaining established practice, rather than about shaping the long term."*³¹

Apart from the interest and support of the family, there is no more important factor in a good education than the teacher, especially the enthusiastic teacher. Indeed the teaching profession is, or at least should be, regarded as one of the most important and prestigious in our society. It is obvious that, whatever a student's innate abilities may be, the major influences on his/her education and life choices, including professional choices, are the support and engagement of their family and the enthusiasm of their teachers. Aspirational families and societies place their highest value on, and their major investments in, education, as their passport to the future. However, sadly, it appears that significant sections of our community do not accept this fact, or at least do not support their children in their education. The 2006 New Zealand draft curriculum clearly recognises that, *"Quality education is a shared responsibility of the state, the community, the family and the individual."* Culture is everything. More needs to be done to develop an educationally-committed culture in Queensland, and to promote the importance of education for individual and community advancement.

The status of the teaching profession and perceptions of the general community have considerable impact on the importance placed on education in Queensland and indeed Australia. There is little doubt that teachers value teaching and their profession, but one must question if the community similarly values it. In surveying early career teachers, Skilbeck et al.¹⁷ revealed that 63% of primary and 48% of secondary teachers in the early phases of their careers expected recognition from the community for their role.

Through the State's Education and Training Reforms for the Future (ETRF) agenda, Queensland schools are already engaging with parents, industry, universities and the wider community to share the responsibility for education. Of particular note are the partnerships established between schools and industry in Gladstone, Mt Isa and Stanthorpe, to name a few. But more could be done.

3.1 Family and Community Support

It appears self-evident that an important factor in the educational achievement of students is the strong interest and support of their family and community. Sadly, such interest and support is not always present. This support is particularly important for children that may be located in disadvantaged communities, as education is the key to their emancipation and opportunities. It is therefore important to do what we can to improve this support and to

have all of our parents and carers appreciate that, along with the nurture of emotional and physical well-being, a good education is the most important life gift that our children can receive.

3.2 Career Awareness

A focus of the *Smart State Strategy*⁸ relates to ensuring that '*people have the skills and knowledge to exercise choice about what they do and how they choose to engage in the economy/society*'. This can be achieved at the school level if well-informed advice, managed by suitable experts, is provided to students and their parents/carers in order for informed choices to be made. Currently, Guidance Officers, teachers and various other educators are required to provide advice and guidance to students and their parents/carers regarding further education and career pathways in addition to the other responsibilities that they have. As the options for students are undergoing continual change, it would be preferable to have suitably qualified career advisors available to provide advice at appropriate points across the years of schooling. Students should be exposed from an early age to potential careers through interactions in the wider school community and appropriate, relevant information.

At the same time, industries of all kinds need to become more involved in ensuring that education providers are aware of their needs and the opportunities that they can provide to support education of Queensland students. Commentaries on desirable education for a knowledge economy^{2,32-34} place an emphasis on, the need for and importance of, enduring partnerships between schools, industry, community, business and researchers in order to create career pathways for students.

Finally, places of learning must be vibrant, innovative, exciting and motivating. Industry and the wider community need to actively engage with students and schools, to provide role models and glimpses into exciting worlds beyond the classroom, particularly those that feed into advanced industries and will drive the development of the Smart State.

Conclusion

There is nothing more important to Queensland's future than education. A quality education will determine the opportunities for our young people, especially those from disadvantaged communities to which we have a particular responsibility, to realise their potential and their dreams, whatever their particular interests and talents may be. It is also the fundamental base of both a knowledge economy and a prosperous, civil and just society. Education in and appreciation of science and technology, and its importance in our lives and potential for the future, is important, but does not stop there. Smart systems will improve all aspects of our lives, including resource management, healthcare delivery and learning itself. Creativity and communication skills are also critical, as is an understanding that learning is fun and that its applications are exciting.

The ambition of Queensland as a *Smart State* will only be realised if we take decisive steps to improve the quality of the teaching profession and the value that is placed on education by all sections of our community, as well as to develop modern curricula with the balance and content of learning that best equips students for their future and empowers their choices in a world where knowledge and its creative applications are the most important currency.

References

- (1) *Smart Regions: Characteristics of globally successfully regions and implications for Queensland*, Smart State Council, an initiative of the Queensland Government, 2006.
- (2) Hargreaves, D. In *Forum of OECD Education Ministers; Developing New Tools for Education Policy-Making* Copenhagen, Denmark, 2000.
- (3) Dellit, J. *Restructuring Education for the Knowledge Society*; Unicorn Online Refereed Article No 4 2001.
- (4) Hargreaves, A. *Teaching in the Knowledge Society: Education in the age of insecurity*; Open University Press: Maidenhead, Philadelphia, 2003.
- (5) *Networks of Innovation: Towards New Models for Managing Schools and Systems*, Organisation for Economic Cooperation and Development (OECD) (<http://www.oecd.org/>), 2003.
- (6) Warner, D. *Schooling for the Knowledge Era*; ACER Press: Victoria, 2006.
- (7) Schleicher, A. *The economics of knowledge: Why education is key for Europe's success*, The Lisbon Council: Policy Brief, 2006.
- (8) *Smart Queensland Smart State Strategy 2005-2015*, Queensland Government (<http://www.smartstate.qld.gov.au/>), 2005.
- (9) *Audit of Science, Engineering and Technology Skills - Summary Report*, Department of Education Science and Training, Australian Government (<http://www.dest.gov.au/>), Canberra, 2006.
- (10) Andrews, P. *Building brain-based industries? First, find the brains*, Office of the Queensland Chief Scientist, Queensland Government (<http://www.chiefscientist.qld.gov.au/>), 2004.
- (11) *Skills for Jobs and Growth*, Department of Employment and Training, Queensland Government, Brisbane, 2006.
- (12) *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, National Academy of Sciences, National Academy of Engineering, Institute of Medicine (<http://www.nap.edu>), 2005.
- (13) Bruniges, M. *An Evidence-based Approach to Teaching and Learning*; ACER Research Conference: Melbourne, Australia, 2005.
- (14) *Teachers Matter: Attracting, Developing and Retaining Effective Teachers*, Organisation for Economic Cooperation and Development (OECD) (<http://www.oecd.org/>), 2005.
- (15) *Understanding the Brain: Towards the New Learning Science*, Organisation for Economic Cooperation and Development (OECD) (<http://www.oecd.org/>), 2002.
- (16) *Taking Schools to the Next Level - The National Education Framework for Schools*, Department of Education, Science and Training, Australian Government (www.dest.gov.au/nef/schools), Canberra, 2004.
- (17) Skilbeck, M.; Bonser, S.; Connell, H. *Teaching Careers in Queensland: The First ten Years*, 2004.
- (18) Thomson, S.; Cresswell, J.; De Bortoli, L. *PISA in Brief from Australia's perspective Highlights from the full Australian Report*, ACER, Melbourne, 2003.
- (19) *A Creative Workforce for a Smart State - Professional Development for Teachers in an Era of Innovation*, Ministerial Advisory Committee for Educational Renewal, Department of Education and the Arts, Queensland Government (<http://education.qld.gov.au/>), Brisbane, 2004.
- (20) Caldwell, B. *Re-imagining Educational Leadership*; ACER Publishing: Melbourne, 2006.
- (21) Skilbeck, M.; Connell, H. *Teachers for the Future - The Changing Nature of Society and the Related Issues for the Teaching Workforce*, Ministerial Council on Education, Employment, Training and Youth Affairs (<http://www.mceetya.edu.au/mceetya/>), 2004.
- (22) McMeniman, M. *Review of the Powers and Functions of the Board of Teacher Registration*, Department of Education and the Arts, Queensland Government (<http://education.qld.gov.au/>), Brisbane, 2004.
- (23) Watson, L. *Quality Teaching and School Leadership A Scan of research findings*, Teaching Australia - Australian Institute for Teaching and School Leadership, 2005.
- (24) *A Class Act: Inquiry into the status of the teaching profession*, Senate Employment, Education and Training References Committee Inquiry, Canberra, 1998.
- (25) Goodrum, D.; Hadley, M.; Rennie, L. *Status and Quality of Teaching and Learning of Science in Australian Schools*, Department of Education Science and Training, Australian Government (<http://www.dest.gov.au/>), Canberra, 2000.
- (26) O'Donnell, S. *International Review of Curriculum and Assessment Frameworks: Comparative tables and factual summaries - 2004*, Qualifications and Curriculum Authority and National Foundation for Educational Research (<http://www.inca.org.uk/>), 2004.

- (27) *What Make School Systems Perform? Seeing School Systems through the Prism of PISA*, Organisation for Economic Cooperation and Development (OECD) (<http://www.oecd.org/>), 2004.
- (28) *The New Zealand Curriculum Draft for Consultation 2006*, Ministry of Education, New Zealand Government (<http://www.tki.org.nz/r/nzcurriculum/>), Wellington, 2006.
- (29) *The Statements of Learning*, Ministerial Council on Education, Employment, Training and Youth Affairs (<http://www.mceetya.edu.au/mceetya/default.asp?id=11893>), accessed September 2006.
- (30) *Learning for the 21st Century*, Partnership for 21st Century Skills (www.21stcenturyskills.org), 2006.
- (31) *Think Scenarios, Rethink Education*, Organisation for Economic Cooperation and Development (OECD) (<http://www.oecd.org/>), 2006.
- (32) Lynch, D.; Smith, R. *Australian Schooling: What Future?* Unicorn Online Refereed Article No 17, Australian College of Educators 2002.
- (33) *Knowledge Management in the Learning Society*, Organisation for Economic Cooperation and Development (OECD) (<http://www.oecd.org/>), 2000.
- (34) *Results that Matter - 21st Century Skills and High School Reform*, Partnership for 21st Century Skills (www.21stcenturyskills.org), 2006.