**Digital Education**
Advisory Group

# Beyond the Classroom:

# A New Digital Education for Young Australians in the 21st Century

# Contents

**5. The road ahead: a tipping-point strategy**

5.1 Components of the strategy

5.2 Initiatives

5.3 What will success look like?

5.4 Criteria for success

5.5 Indicators of success

**6. Conclusion**

**Attachment A. Proposed Project 1—Building 21st Century Skills in a Global Environment**

**Attachment B. Proposed Project 2—National Virtual Languages Space**

**Appendix 1. Membership of the Digital Education Advisory Group**

**Appendix 2. Panel of Australian Experts on Learning**

**Glossary**

# Chair's Preface

Most parents I know have a Facebook account for the sole purpose of keeping in touch with their children.

Australia's young people are among the 1.2 billion (and growing) Facebook users worldwide. A quarter of those users are aged under ten[1] despite the minimum age requirement of 13 years.

They are among the more than 500 million Twitter users who send 190 million tweets per day.[2]

It is no secret that using social media and digital technology, our children send and receive information in radically different ways to previous generations. The old industrial, "stand and deliver" model of education is long gone.

The walls of the classroom and the home have been expanded by social media, the cloud, wikis, podcasts, video-conferencing etc. These are new learning environments and they are local, national and global and populated by whole communities in addition to family, teachers and friends.

Of course, our understanding of the changes to education brought by digital technology is, in itself, not new.

Over the last couple of decades it has been recognised that as educators, parents and community leaders we have a responsibility to ensure that we provide educational opportunities to our children which build on and extend the ways in which they learn and communicate.

The challenge for us is to embrace, and respond to, not just the technology, but the extraordinary pace of change. We can't underestimate how rapidly things are changing and we need to make sure no opportunity passes us by to improve learning outcomes.

Most importantly, we need a system that caters for differences between learners: those who are racing ahead with new technology and those who are racing to keep up with it; those who have a passion for particular areas; those who are engaged with learning, and those we need to halt disengagement.

We need to harness the transformative potential of digital technology to support new approaches to innovative learning centred around the development of 21st Century Learning skills. These include creativity and innovation; critical thinking, problem solving, decision making; life-long learning; collaboration and communication; ICT literacy; consciousness of being a local and global citizen; and personal and social responsibility. This report focuses on the use of new technologies to support development of those skills - skills that will endure as technology races on.

The Government is to be congratulated for commissioning this work to deliver a blueprint for a new digital education for the 21st Century and beyond.

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[1] www.statisticbrain.com

[2] Ibid.

# Executive summary

Over the past decade Australian governments have invested extensively in digital education, highlighting the growing link between technology and economic prosperity.

The drive to transform teaching and learning through digital education has been supported by the $2.1 billion Digital Education Revolution (DER). Officially launched in 2008, this landmark initiative impacts every aspect of education—from teacher training to school infrastructure, curriculum design, assessment and community engagement.

As well as providing computers for Australian schools, the DER is delivering digital learning resources, online diagnostic tools and professional development for teachers to support the new Australian Curriculum.

Four years on, the rollout of the National Broadband Network (NBN), combined with a new generation of mobile and personal computing devices, is opening new frontiers in digital education.

To ensure Australia continues to build on the foundations of the DER, the Hon Peter Garrett AM MP, Minister for School Education, Early Childhood and Youth established an expert advisory group, the Digital Education Advisory Group (DEAG).

Chaired by the Deputy Vice-Chancellor (Teaching, Learning and Equity) at the University of Technology Sydney, Professor Shirley Alexander, the Advisory Group was asked to assess the achievements in digital education to date, identify what remains to be achieved, establish new priorities and develop a strategy for future developments.

**Key messages and recommendations**

Achieving enhanced education outcomes in Australian schools is increasingly linked to the pace of digital education uptake. Investment in digital education is helping to reshape how students learn and even what they learn through powerful 21st Century tools.  Schools must be encouraged to see the opportunities that such tools provide to support improving learning and teaching.

The Advisory Group identified key areas that need to be addressed via a multi-pronged strategy. The strategy should build on the foundations of the DER and be designed to address systematic challenges facing learners and educators, e.g., the challenges of the so-called 'wicked problems' (poverty, resource shortages, and climate change) as well as equity issues as identified in the PISA 2009 cycle.

The Recommendations developed by the Advisory Group reflect the report's 10 key findings.  The key findings are as follows:

- the 2008 Melbourne Declaration should continue to drive investment in education

- government investment in digital education has achieved widespread change in the experience and content of learning for many students

- rapid uptake of smart devices, combined with declining cost support the move to a 'bring your own device' environment

- pedagogy must drive innovation in digital education

- creating new learning environments demands a systems approach including building teacher capacity and new curriculum design

- digital technologies should be utilised to enhance social inclusion and facilitate student-centred learning

- the private sector has an important role to play in the future of digital education

- the most effective public-private partnerships in education are those that share risk and reward

- digital learning is most successful when it combines formal and informal learning

- while the level of change required in schools is significant, it is best supported in the short to medium term by changing the emphasis of existing curricula and assessment.

The new digital education environment will look and function very differently. In addition to classroom teaching, staff will develop new ways of teaching that embrace digital education, and 'bring your own device' learning models will be integrated into the learning environment. Strong leadership in schools will be needed to support this new environment, to increase teacher capacity and to support the uptake of digital education in schools.

Learning will extend beyond the school to encompass the home, parents and experts located in industry, universities and elsewhere. Social media tools will be increasingly deployed to enrich and extend learning experiences.

To maximise the benefits from digital education, school learning and teaching plans must reflect the nature of digital learning and teaching and reach out to partners in industry and the broader community. Public-private partnerships in education can help make learning more relevant and authentic by involving the community, local businesses and other education sectors. By working with external experts, learners and their teachers can start to see where their learning relates more clearly to their lives and their community, and hence become more motivated and engaged.

**Supporting the new Australian Curriculum**

At the curriculum level, the creation of digital resources to support the Australian Curriculum will complement the development of new infrastructure in schools such as cloud computing. As the pace of technological change accelerates, Australia needs a strategy to embed systemic and holistic cultural change in our expectations of schools, teachers and learners.

Capacity building, teamwork and contemporary pedagogy are powerful drivers of 21st century learning and teaching.  The Advisory Group believes these drivers form a tipping point strategy to drive change that will transform schooling and shape our future.

When it comes to building on the achievements of the DER, it is important that future initiatives support and drive the new Australian Curriculum.

The foundations have already been laid. The National Digital Learning Resources Network (NDLRN) is a collection of over 15,000 digital learning resources including datasets, still and moving images, audio files, assessment items and the like. These resources are directly linked to the Australian Curriculum and accessed either through the online digital curriculum portal Scootle, the national learning environment, or through individual education jurisdictions' websites.

In addition, the development by ESA of a digital language learning space to support the teaching of Mandarin Chinese is currently underway. This new learning space will be a test bed for innovation in the teaching of languages in Australia. The Advisory Group proposes the piloting of a language learning space (Attachment B of the Report), to further expand digital language learning.

**Recommendation 1**

It is recommended that government funding be targeted at the shared procurement, development and distribution of digital resources to support the Australian Curriculum, giving priority to resources that support students' development of 21st century skills and teachers' use of knowledge-building learning strategies with particular focus on inquiry-based learning and design thinking.

## Moving to a 'bring your own device' learning environment

Government investments on infrastructure, learning resources, teacher capability and leadership to date have achieved high levels of access to digital technology in the classroom and significantly improved learning experiences for many students. Access to interactive, online resources, assessments and lessons has been improved. Teachers have benefited from enhanced exposure to the innovative use of digital technology in the classroom.

The NBN rollout will both speed and embed these changes. By making connectivity more affordable, the NBN is enabling a host of technological enhancements in learning. Rapid uptake of smart devices, meanwhile, is reshaping the way we learn to make it more mobile, global and on-demand.

In the very near future it is expected that many students will own a personal smart device. The rapid uptake of smart devices gives rise to a 'bring your own device' (BYOD) environment within schools.

**Recommendation 2**

It is recommended that:

- students and teachers have access to smart devices, where possible, capable of connection to the internet, and

- future infrastructure be targeted to support disadvantaged students in and outside school, enabling broadband access to the internet and fast wireless connectivity.

## Improving learning through enhanced interoperability

A sound knowledge base is vital to achieving change and innovation in learning. This requires data about every student's performance and progress to provide the evidence base for future planning and development. Meaningful data is a precursor to adaptive learning in which teachers respond to learners in a more personalised and agile way. This model of learning has significant potential to improve learning outcomes for all students.

New information technologies make it easy to gather, analyse, distribute and share individual, school and system-based performance data, moving us closer to the ideal of individualised or personalised learning for every student.

**Recommendation 3**

It is recommended that governments ensure the use of interoperable approaches across the education sector to ensure student learning programs can be targeted, shared and individualised through the use of both student data and digital content.

**Strengthening partnerships in education**

There is an important role for public-private partnerships in digital education. These partnerships can take many forms, from supplying vital IT infrastructure to curriculum design and development of resources to support students and teachers.

Partnering with groups or individuals can make learning more relevant and authentic, which in turn can result in more motivated learners. Partnerships that link schools to universities, cultural institutes or industry can bring innovative research closer and give learners access to expertise or information that might not otherwise be available.

Governments and schools should be encouraged to develop partnerships with cultural, non-profit and commercial organisations nationally and internationally to support the delivery of digital education. This will, in turn, accelerate the uptake of digital education and provide students with 21st century skills, particularly in remote and rural areas, and to disadvantaged students.

The untapped resources of the broader community including parents, grandparents and the older community can also be incorporated into school communities with great effect.

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**Recommendation 4**

It is recommended that governments and partners develop and put into operation a range of models for partnerships, particularly those involving industry and the private sector, to disseminate successful uses of digital technologies in education.

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**New approaches for learning**

To support learners' development of 21st century skills as reflected in the general capabilities of the Australian Curriculum[3], we need to create and sustain knowledge-building environments. New technologies such as smart devices (e.g., tablets and smart phones) and personal learning environments can be used in conjunction with contemporary knowledge building strategies, leading to greater innovation in learning.

To support new ways of learning, students need access to appropriate resources and assessment that allows them to demonstrate skills such as reasoning, problem solving and designing.

Teachers will need development and support to deliver these new ways of learning. Enhancing teacher capability is key to accelerating successful digital education in schools.

The Advisory Group proposes a project (Attachment A of the Report)—Building 21st century skills in a global environment—which would provide the way forward to extend the Assessment and Teaching of 21st Century Skills (ACT21S) initiative and provide a platform for the large-scale adoption of contemporary, knowledge building learning strategies.

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**Recommendation 5**

It is recommended that existing efforts to build teacher capacity and enhance school leadership be extended and accelerated as a matter of priority, and that teacher education policies, programs and practices incorporate knowledge gained from OECD countries that achieve high quality/high equity results.

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[3] http://www.acara.edu.au/curriculum/general_capabilities.html

**Encouraging school learning and teaching plans**

It is important to recognise that schools are at different stages in their development of digital capacity and hence have different needs. Accordingly, each school's learning and teaching plan must demonstrate how they will increase the capacity to support students' learning of 21st century skills; support leadership of contemporary pedagogies; build teacher capabilities; connect learning beyond the school and sector; broaden student assessment and reporting; and, improve the provision, accessibility and management of teaching and learning resources.

The development of individual plans by schools would provide a structured framework to accelerate the uptake of digital education in schools. The plans could include procedures for collection, analysis and exchange of student data and digital content, and include the schools polices and processes it has or will have in place addressing risk assessment, cyber safety, responsibilities and accountability.

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**Recommendation 6**

It is recommended that schools be encouraged to develop school learning and teaching plans to increase their capacity to:

- support students' learning of 21st century skills
- support leadership of contemporary pedagogies
- build teacher capacity through professional learning
- connect learning beyond the school
- improve student assessment and reporting
- improve the provision, accessibility, and management of teaching and learning resources.

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**Embedding innovation in learning**

Although much has been done already, there is an urgent need to move to a more systematic approach. This necessitates both a large-scale bottom-up approach from education (in particular, individual schools) combined with a top-down approach from governments (e.g. resources, staff support and policies).

Combining top-down and bottom-up drivers of digital education in schools will enable teachers, principals and schools to move to an 'anywhere, anytime' approach to learning. For learners, this offers the best opportunity to achieve high quality outcomes.

The move to a systematic innovation-based approach to digital education will lead to enhanced public-private partnerships and closer engagement of families and communities in this new learning environment.

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**Recommendation 7**

It is recommended that governments support systematic innovation to encourage practices such as:

- teachers managing, assessing and improving individual and group outcomes through teamwork and learning communities
- developing community and industry partnerships

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- managed use of social media tools for learning and teaching

- negotiating relationships with universities, TAFE colleges and professional organisations

- providing learning opportunities for community members in the use of digital resources.

**Strategies for capacity building**

The true legacy of the digital education revolution is its ubiquity. In the future, digital learning will be indistinguishable from traditional learning modalities. We must, therefore, support and enable the whole community to build on the achievements of the digital education revolution.

The internet and digital technology are democratising content, enabling individuals to do many things that were once brokered by third parties (or not available at all). Learners can now research, communicate, transact, connect with others, measure impacts, analyse data and build intelligence, with just the click of a mouse. Skills that once took years or months to acquire can be learned in a fraction of that time.

Our challenge is to enable students and the broader community to build on these skills—and extend their capacity to innovate through digital education. Teachers, too, need the capacity to design and implement new ways of learning and should be supported in the development of innovative teaching practices underpinned by digital technology.

Schools must forge new relationships outside their boundaries and find new ways of delivering digital education, and governments have an important role supporting communities through information and programs for parents and the broader community to gain digital skills to better assist student education.

Students need to be supported to engage in digital education outside school, and for cultural organisations, artists, authors, scientists, not-for-profits, industry and universities to work with schools to enable learning without boundaries.

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**Recommendation 8**

It is recommended that governments develop and disseminate strategies to engage and support the whole community in digital education, including:

- information, programs and support for parents to gain digital skills to better assist their children's education

- support for students to engage in digital education outside school

- support for cultural organisations, artists, authors, scientists, not-for-profits, industry and universities to work with schools.

# 1. Background

Over the past decade Australian governments have invested significantly in digital education, creating a strong base in terms of technological infrastructure, digital resources and support for teachers' practice. At the same time, the Digital Education Revolution (DER) initiative[4] has fostered school leadership in the use of digital technology.

The challenge now facing schools is to build on this capacity, leveraging further improvements by shifting the focus away from the acquisition of new technologies to the use of these new tools as enablers of innovative, challenging and engaging ways of learning and teaching. By moving to the next stage, schools will equip learners and teachers to meet the challenges of a rapidly changing world.

The Australian Government recognises the need to build on the DER to take the Australian education sector through the 21st century and beyond. To this end the Hon Peter Garrett AM MP, Minister for School Education, Early Childhood and Youth, established the Digital Education Advisory Group (DEAG) in July 2011.

DEAG is a group of digital education experts (see Appendix 1) from the fields of education, government, academia and industry. Their task was to assess the achievements in digital education to date, identify what remains to be achieved, establish new priorities and develop a strategy for future developments, including ways of achieving high quality, contemporary learning outcomes from existing investments in digital education.

In writing this report DEAG has examined a wide range of initiatives and research from Australia and around the world. The Advisory Group has taken into consideration outcomes from government initiatives and published data to form a view of how Australian digital education is positioned in relation to global trends, Australian policy direction and community aspirations. This analysis, together with input and advice on high quality learning outcomes provided by a Panel of Australian Experts on Learning (see Appendix 2), helped shape the recommendations.

Included in this final report is a list of recommendations highlighting priorities for improving learning outcomes in the medium term, in the context of Australia's digital economy goals for 2020. The digital economy goals defined in the Government's National Digital Economy Strategy[5] are:

- online participation by Australian households

- online engagement by Australian businesses and not-for-profit organisations

- smart management of our environment and infrastructure

- improved health and aged care

- expanded online education

- increased teleworking

- improved online government service delivery and engagement

- greater digital engagement in regional Australia.

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[4] http://www.deewr.gov.au/Schooling/DigitalEducationRevolution/Pages/default.aspx

[5] http://www.nbn.gov.au/the-vision/digitaleconomystrategy/

The report also recommends two immediate pilot projects for consideration by the Minister to bring about these improvements. These projects were selected as they illustrate ways the recommendations can be taken forward.

# 2. Australian education policy reform context

Education is the cornerstone of Australia's success as an economically strong and socially stable modern democracy. It is also the way in which a modern society contributes to the personal wellbeing of its citizens and provides those members with the capacity to contribute positively to global wellbeing.

Governments invest in, regulate and set goals for educational provision to ensure the country has the skills, knowledge and capacity to be productive and adaptable. Investment in education supports a way of life based on participation, fairness and sustainable growth.

## 2.1 Council of Australian Governments

On 5 December 2008 the Council of Australian Governments (COAG) released the Melbourne Declaration on Educational Goals for Young Australians (Melbourne Declaration) that connects the goals of equity and excellence. The Melbourne Declaration commits all Australian governments to pursuing not only equality of opportunity but also more equitable outcomes. It clearly links the effective use of information and communications technologies (ICT) in schools with young Australians becoming successful learners, confident and creative individuals and active and informed citizens.

Under the National Education Agreement signed by all states and territories and the Commonwealth in 2008, governments are pursuing a reform agenda to meet the Melbourne Declaration goals. To this end, there are national agreements to lift Year 12 or equivalent attainment to 90 per cent by 2015, to close the gap on Indigenous disadvantage in reading, writing and numeracy and Year 12 attainment, and to achieve universal access to quality early childhood education for all children in the year before school.

COAG's current five key priorities for Australian education are that:

- all children are engaged in and benefiting from school

- young people are meeting basic literacy and numeracy standards, and overall levels of literacy and numeracy are improving

- Australian students excel by international standards

- young people make the successful transition from school to work and further study

- schooling promotes social inclusion and reduces the educational disadvantage of children, especially Indigenous children.

The COAG framework agreements are particularly important because they represent a consensus about Australia's educational direction, and the shifts and actions required of all governments to build a national economy driven by competitive advantage, a more sustainable and liveable Australia and a long-term strategy for economic and social participation, including for Indigenous Australians.

| **DEAG Finding 1** | The priorities and goals of the 2008 Melbourne Declaration, namely to create learning environments that foster students becoming successful learners, confident and creative individuals, and active and informed citizens, should continue to drive investments in digital education. |
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## 2.2 The Australian Government's education agenda

In addition to the education reform agenda delivered through COAG agreements, the Australian Government's investment in the DER and the National Digital Economy Strategy (NDES) is driving accelerated change in the educational use of ICT.

### 2.2.1 The Digital Education Revolution
The Australian Government's five year, $2.1 billion suite of DER initiatives has engaged all governments and educational sectors in targeted reform, and built a strong foundation for enabling a new, future-directed vision for education in Australia.

It forms part of a strategy for achieving the vision for the use of ICT in schools articulated in May 2008, when Ministers issued the third Joint Ministerial Statement on ICT in Australian education and training: 2008–2011. This statement informed the Melbourne Declaration and specifically acknowledged that ICT is 'enabling the transformation of the curriculum and changing the way learners and educators operate, learn and interact'.

### 2.2.2 The National Digital Economy Strategy
The NDES provides the strategic framework though which Australia seeks to achieve its aim of being a world-leading digital economy by 2020. One of the eight digital economy goals is expanded online education such that 'by 2020, Australian schools, TAFEs, universities and higher education institutions will have the connectivity to develop and collaborate on innovative and flexible educational services and resources to extend online learning resources to the home and workplace; and the facilities to offer students and learners, who cannot access courses via traditional means, the opportunity for online virtual learning'.[6]

### 2.2.3 The National Plan for School Improvement
DEAG has also considered the National Plan for School Improvement proposed in the context of the Australian Government's response to the Report of the Review of Funding for Schooling chaired by David Gonski (the Gonski Review). The Review identified three themes as directly relevant to achieving high quality contemporary learning outcomes:

- the need for innovation in teaching and learning

- the need to build learner capacity

- reduction of the impact of disadvantage.

Of particular relevance to this report is the acknowledged need to refocus effort onto the student and her/his outcomes, rather than just assuming the use of new digital devices will provide instant success:

> In response to the world becoming a more integrated, technological and global community, students must not only master the core skills, but also develop a capacity for problem solving and decision making; creative thinking; collaboration, communication and negotiation; and technology and innovation.[7]

### 2.2.4 Australia in the Asian Century
Finally, the Australia in the Asian Century White Paper[8] released in October 2012 recognises there is much more to be done to build Asian cultural literacy in Australia, including proficiency in Asian languages, specifically Mandarin Chinese, Hindi, Indonesia and Japanese. Digital technologies, in

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[6] *National Digital Economy Strategy*, 2011. Department of Broadband, Communications and the Digital Economy p. 5.

[7] Gonski, D, Boston, K, Greiner, K, Lawrence, C, Scales, B and Tannock, P 2001, *Review of Funding for Schools*, p. 33.

[8] http://asiancentury.dpmc.gov.au/white-paper

particular collaborative tools, can assist both in the development of cultural literacy and the teaching of languages where there are teacher shortages. These themes and the related findings have informed the proposed projects recommended in this report.

## 2.3 Achievements to date

Under the DER and other initiatives, Australian Government investment in ICT in education has centred around four pillars:

- infrastructure

- learning resources

- teacher capability

- leadership.

In addition, state and territory governments and the non-government school sector have made significant progress towards engaging with the reform potential of digital education through their own investments in ICT in the classroom, teacher practice and digital content. The sections below touch only on the achievements that are nationally supported and available, and not the many achievements that have been, or are being, implemented locally at the school and system level.

A recent report ranks Australian students second among the 19 participating countries in relation to digital literacy.[9] This achievement confirms the value of the concentrated effort and investment of all Australian governments over the past decade. The report also identified a number of equity issues that need to be addressed.

### 2.3.1 Infrastructure
Access to computing devices and broadband connectivity is key to realising the benefits of digital technologies in education. Prior to the DER approximately 200,000 computers were available across all schools. Today, as a result of the DER over 957,000 computers are installed in Australian secondary schools, and every Australian student in Years 9 to 12 has ready access to a computer at school.

As part of this investment there has also been significant expenditure on wired and wireless networks, power upgrades, electronic whiteboards, digital cameras, software, suitable furniture and redesign of learning spaces. In 2008 approximately 47 per cent of Australian schools had broadband fibre connections. Now more than 60 per cent of Australian schools now have internet connections delivered by fibre.[10] Most are capable of sustaining video links to deliver or receive services remotely in real, or close to real time, extending their capacity into the community, the home or other points of expertise and demand.

As the National Broadband Network (NBN) is rolled out, students will have access to similar bandwidth capabilities at home and at school. Remote learners, teachers and principals will be notable beneficiaries. By making connectivity more affordable, the NBN will enable virtual classrooms and other innovative approaches, which in turn increase equity for learners and communities who have been historically underserved.

[9] http://www.acer.edu.au/documents/PISA2009_PreparingAustralianStudentsForTheDigitalWorld.pdf

[10] http://www.deewr.gov.au/Schooling/DigitalEducationRevolution/Documents/2010SurveySchoolConnectivity.pdf

The sustainability of these initiatives needs to be reconsidered in light of the rapid advances in technology such as the ubiquity, proliferation and mobility of internet access devices.[11] In the short to medium term a majority of learners will have access to personal smart devices (e.g. smart phones and tablets). This will result in a shift away from the expenditure needed to continually replace computers in schools to the reality of a 'bring your own device' (BYOD) environment.

Such a transformative change will inevitably cause conceptual challenges. Assurances on issues such as security of student data will need to be addressed. However the reality is that students' learning can and does take place anywhere, and school is an essential part of this environment.

Sustaining a BYOD environment in schools does require technical support services underpinned by government commitment to a range of interoperability, technical and ethical standards. But as many of these services will be cloud based, the technical support costs will be shared.

An important but often overlooked component of infrastructure investment has been in the agreements and standards needed to provide interoperability of ICT systems. To this end, the Australian Government, together with the states and territories, has supported the National Schools Interoperability Program (NSIP), which also includes representatives of the Catholic and Independent school systems. NSIP also works closely with Education Services Australia (ESA), the national education services provider owned jointly by all education ministers.

### Smart devices – changing the game

Some schools are breaking traditional boundaries by using smart devices to reinvent the classroom for students and teachers.

Portable and multifunctional, smart devices that students own for their personal use are increasingly important learning tools in Australian classrooms in a BYOD environment.

For example, year 10 history students studying the Vietnam War at a school in Hobart this year collaborated on a project which included video interviews with veterans. They used their personal devices to record interviews and then, using mobile video applications, created video clips. These were incorporated into a joint presentation that included still images from the period drawing on primary source documents. To consolidate and share their learning, their teacher arranged a web-conference with an historian from the Australian War Memorial. The teacher recorded the web conference and made it available for students that were away from school on the day, to review from home.

Image Source Page: http://cpdmoodle.ccsd.net/pathway/

*2.3.2 Learning and teaching resources*
The National Digital Learning Resource Network (NDLRN) has been developed with the support of the Australian Government and all state and territory governments. Managed by ESA, the NDLRN is a collection of over 15,000 digital learning resources including datasets, still and moving images, audio files, assessment items and the like. These resources are directly linked to the Australian Curriculum and accessed either through the online digital curriculum portal Scootle, the national learning environment, or through individual education jurisdictions' websites.

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[11] Johnson, L, Adams, S and Cummins, M, 2012. *NMC Horizon Report: 2012 K-12 Edition,* The New Media Consortium, Austin, Texas.

Over a third of all teachers employed in schools in Australia are registered users of Scootle and between them have created and contributed over 220,000 learning pathways and 7,000 collaborative activities, which in turn are being used and improved upon by other teachers. The Scootle site had over 220,000 unique visits from September 2001 to August 2012 and over 25 million page views. In the first six months of 2012 there were over 750,000 resources accessed, an indication that the use of digital learning resources linked to the Australian Curriculum is becoming embedded in teaching and learning in Australia.

Through DER funding the NDLRN is being expanded to provide further coverage of the subject areas and cross-curriculum priorities of the Australian Curriculum. Of particular note is the development by ESA of a digital language learning space to support the teaching of Mandarin Chinese. This new learning space will be a test bed for innovation in the teaching of Asian languages in Australia. DEAG recommends the Australian Government support the accelerated expansion of language teaching as one of two proposed projects.

Additional steps to help future-proof the NDLRN include development of an access and identity management system, a metadata review and a national cloud computing strategy. Cloud services are already transforming the way learning and teaching takes place in schools. Schools can now outsource many of the technology applications they used to manage in-house (e.g. email, learning platforms, data storage), saving costs on technical staff and infrastructure. This enables schools to focus on their core business of teaching and learning.

Achieving excellence and equity for all young people requires reliable data about every student's performance and progress. New technologies make it easy to gather, analyse, provide immediate feedback and make available students' performance data, moving us closer to the ideal of individualised or personalised learning for every student. As students learn online, it is possible to collect information about their progress and enable teachers to respond to their needs in a more personalised way. Whilst in its infancy, the ability to provide relevant and timely feedback in the form of adaptive learning has significant potential to improve learning outcomes for all students.

ESA's Improve online formative assessment tool for numeracy, literacy and science has been linked to learning resources in the NDLRN. The Australian Government has committed over $54 million through the Online Diagnostic Tools initiative[12] to deliver additional online support for teachers and parents.

### 2.3.3 Teacher capability
Improving student learning outcomes requires teachers and school leaders to have a deep understanding of the context, content and pedagogy of a rapidly increasing range of enabling technologies. They also need to understand the interplay between these factors. For example, the fact that technologies do not, of themselves, improve learning. Rather, it is the design of the learning experiences, making use of particular technologies, that leads to improved learning outcomes.

To this end, governments have worked with the profession, education academics, industry and business to further develop and embed innovative and effective pedagogic practices that integrate digital technologies in schools across Australia.

Most teachers in Australia have expanded opportunity to improve their skills in relation to the use of digital technologies, whether through school programs or their professional networks. Other groups aiding the expansion of digital skills acquisition to support the Australian Curriculum online include Principals Australia, Teacher Education Centres of Excellence and the Australian Institute of School Leadership (AITSL), as well as the ICT Innovation Fund.

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[12] http://www.deewr.gov.au/schooling/Pages/OnlineDiagnosticTools.aspx

Working in consultation with the profession and supported by all Australian governments and the non-government school sector, AITSL has developed standards, professional learning programs, resources, illustrations of practice and a draft performance and development framework. This work is designed to assist Australian teachers and school leaders in developing and evaluating their good practice, and aiming for the highest levels of effectiveness in a digital environment.

Helping to drive these initiatives is the Improving Teacher Quality National Partnership (ITQNP), a joint initiative of all Australian governments to support teachers and school leaders to reflect on their capabilities and enhance their skills.

### 2.3.4 Leadership

To foster leadership at the school level, national standards have been developed for principals. Significant support has also been provided through national, system and local professional learning. Around the country, exemplar schools in which pedagogical change and high quality contemporary learning outcomes are well understood and pursued, have been recognised.

Leaders in these schools are taking charge of professional learning, driving pedagogical change and improving teaching and learning practice. They are supplementing in-school learning through digitally focused classroom partnerships, engaging experts online for services such as speech therapy, music coaching, supporting students with special needs and providing choices and pathways not otherwise available to groups or individuals.

| DEAG Finding 2 | Government investments to date on infrastructure, learning resources, teacher capability and leadership have achieved: <ul><li>high levels of access to digital technology in the classroom</li><li>significantly improved learning experiences for many students</li><li>access to interactive, online resources, assessments and lesson sequences</li><li>increased exposure by teachers to the innovative use of digital technology in the classroom.</li></ul> |
|---|---|
| DEAG Finding 3 | The decline in the cost of personal devices such as smart phones and tablets, combined with their rapid uptake, means that student learning can now be supported anywhere, anytime. <br><br> This move to a 'bring your own device' (BYOD) environment will require support to enable students, particularly disadvantaged students, to access smart devices. |

### 2.3.5    Private sector partnerships

In addition to the inter-government agreements through COAG and commercial outsourcing and contractual arrangements entered into by jurisdictions and schools, important and productive public-private partnerships have played a significant role in achieving digital education change across Australian schools.

Through the NDLRN, ESA has facilitated a wide range of productive partnerships with cultural, non-profit and commercial organisations, inside and outside Australia. A partnership between the Australian Broadcasting Corporation (ABC) and ESA is developing a free, public, online education portal that will be accessed over the NBN's high-speed broadband connection. Once live, the portal will link to the Australian Curriculum through the NDLRN.

In Victoria, New South Wales, Queensland and South Australia, public-private partnerships have been used to build and maintain schools (and components of schools). It remains to be tested whether this model has wide application to digital infrastructure and services.

A number of global corporations have education partnership initiatives that extend to Australia:

- Microsoft has partnered with three state government education authorities as part of the company's global Partners in Learning program.

- Cisco's Networking Academy, which helps students prepare for entry-level ICT jobs and pursue additional training or education, has 140 academies in Australia.

- Pearson Learning Studio is an example of a partnership in the Higher Education sector through which Pearson recruits students for a selected range of courses and then uses its Learning Studio platform to track at-risk students and devise intervention strategies designed to increase retention and course completion rates.

An alternative and effective model is the Partnerships for Success program of the Graham (Polly) Farmer Foundation. Based in Perth, the Foundation has 15 projects operating across Western Australia, the Northern Territory, South Australia and New South Wales. Each project involves local Indigenous communities, private and government partners and the Foundation working together in partnerships to introduce and manage projects to improve the educational outcomes of Indigenous students.

# 3. Change and innovation in teaching and learning

The impetus for change and innovation in Australian schools is shifting from a reliance on top-down external drivers such as government policy imperatives and industry practices, to a combination of top-down and bottom-up approaches. This new model is evident in every learning space and in interactions between teachers and learners at the school level. The combination of top-down initiatives and school-based bottom-up activities will help ensure innovative learning and continuous improvement.

Few would argue that change and innovation, supported by enabling technologies, are the foundations of next generation schools. For too long, innovation has been imposed on schools, often resulting in inertia and resistance. In a dynamic Web 2.0 world, innovation is driven by the experiences gained from learning and teaching.[13]

## 3.1 The need

The coming together of several historical factors highlights the urgent need to engage in a step-change in education by developing new paradigms for learning and supporting these in a systematic way. The first, most widely acknowledged factor is the significant level of change occurring in the world, including:

- the shift from industrial to information-based knowledge economies

- the globalisation of products, markets and companies

- changing patterns of life, including greater life expectancy

- significant advances in technologies requiring new kinds of literacy.

Each of these forces is having a significant impact on the lives of Australians, requiring us to work in different ways, both locally and as global citizens.

A second factor is the changing nature of work. The shift towards technology-rich workplace environments requires multidisciplinary teamwork and greater levels of innovation and creativity. Manual labour and routine skills are increasingly being automated or sent offshore. As Prime Minister Gillard said in a recent speech, 'We've said for years, for decades, that given a choice between competing on quality or competing on price, we'd compete on quality....'.[14] Australia needs a future workforce that is competitive on the world stage and hence greater capacity for creativity and innovation are needed.

Thirdly, new strategies are required to tackle endemic challenges—so-called 'wicked problems'—such as poverty, food security, energy shortage and climate change. Existing strategies have so far been unsuccessful, highlighting the need for new problem solving approaches and skills.

Finally, as noted above, there is an urgent need to redress equity issues identified in the PISA 2009 cycle and highlighted in the recent Gonski Review. This extends to identifying new ways of engaging and supporting learners who experience educational disadvantage by reason of their socio-economic status, Indigenous background, level of English language proficiency, disability and remoteness.

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[13] See, for example, TED and the new TEDEd (http://ed.ted.com/), where flip technologies created and developed by teachers are reshaping learning experiences for all learners.

[14] Gillard, J, 2012. *Building a New Australian Economy Together*, speech delivered at the Australia-Israel Chamber of Commerce, 1 February 2012, Melbourne.

These challenges require an immediate response via the development of innovative approaches to the ways in which teaching and learning is supported and prepares students to meet them.

It is important to note, however, that new and emerging technologies such as cloud services, quantum technologies, augmented reality and a semantic web leading to artificial intelligence, will not of themselves carry 21st century schooling into a bright future. Rather, we are at the beginning of a whole new set of possibilities enabled by these rapid technological developments.

The Melbourne Declaration identifies essential approaches and skills for 21st century learners in literacy, numeracy, ICT, thinking, creativity, teamwork and communication. These are designed to develop individuals who can manage their own wellbeing, relate well to others, make informed decisions about their lives, become citizens who behave with ethical integrity, relate to and communicate across cultures, work for the common good and act with responsibility at local, regional and global levels.

The general capabilities of the Australian Curriculum encompass the knowledge, skills, behaviours and dispositions that, together with curriculum content in each learning area and the cross-curriculum priorities, will assist students to live and work successfully in the 21st century.

| DEAG Finding 4 | The development of successful learners, confident and creative individuals, and active and informed citizens requires the deployment of new learning paradigms. Featuring innovative learning environments designed to support students' development of 21st century capabilities, the new learning paradigm builds capacity to: <br><br> • adapt to a rapidly changing world <br><br> • operate successfully in changing work environments <br><br> • work towards solving difficult, ill-defined problems/develop a proactive approach to solving ill-defined problems <br><br> • be creative and innovative <br><br> • learn and work collaboratively <br><br> • develop local and global citizenship responsibilities <br><br> • create and publish content. <br><br> The adoption of new pedagogies to transform practice at scale requires connections between pedagogy and technology, underpinned by knowledge of how to bring about change. |
|---|---|

## 3.2 The nature of schooling

After remaining largely unchanged for more than 50 years, the nature of schooling in Australia has only recently begun to be transformed. Under the industrial model of schooling, students enrolled in a formal system in which they:

- engage with a curriculum determined by state (and more recently national) authorities

- are taught by a single teacher who was the major source of the content of learning and who had the professional freedom to determine how best to organise learning

- are grouped into classes according to their age

- learn an age-appropriate curriculum divided into discrete subjects.

This system worked well during a time in which there was a great deal of stability and confidence about the knowledge and skills students needed to learn to equip them for life. It also worked well for students whose particular interests, talents and development were roughly similar to others of their age group, and for those who were allocated experienced and knowledgeable teachers.

The triggers for the significant changes to schooling now being witnessed began almost 20 years ago when the internet became available to those who could afford connections. Around the same time, the price of personal connected devices (computers, laptops, tablets and more recently smart phones) began to decline sharply, making individual devices affordable for many and paving the way for a BYOD environment.

The combination of these two developments has resulted in new learning opportunities. Much of the content of learning is now accessible from a rich range of sources globally in a variety of media. These resources can be used at a time and place of the learner's choosing. Thus learning opportunities are becoming available inside and outside the formal classroom. These developments have led to an important shift in the nature and purpose of teaching and learning—from content delivery to building student capacity.

Educational research has highlighted ways of providing a more individualised and personalised learning experience for students within a single classroom. There is research evidence to show there is little or no effect in student learning outcomes when students are grouped across multiple ages[15], e.g., making it possible for students to learn in groups where there is common interest in a particular phenomena, rather than the same chronological age. Research has reported the identification of multiple levels of development within a single classroom as more useful than normative grades.[16] This identification of multiple levels of reading competency means that teaching and learning strategies can be deployed which acknowledge these differences, rather than the same strategy for every student.

While there are moves toward more 'integrated studies'—e.g., breaking down divisions between subjects—these changes are not systematic or widespread. Consequently, more needs to be done to achieve the step-change in digital education required to deliver 21st century capabilities to all young Australians.

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[15] Hattie, J, 2009. *Visible learning: a synthesis of over 800 meta-analyses relating to achievement*. Routledge, London; New York.

[16] Griffin, P, 2007.  The Comfort of Competence and the Uncertainty of Assessment.  *Studies in Education Evaluation in Memory of Arieh Lewy*. Vol. 33, No. 1 pp 87-99.

# 4. Issues, gaps and opportunities

Four years into the Digital Education Revolution much has been achieved, and much has changed in the way students and teachers use digital technologies. The overarching challenge now is to maintain momentum and ensure that digital technologies are used more systematically to improve the quality of education provision and learning outcomes for all students.

The high uptake of new digital technologies is creating changes in what students learn, as a result of the change in how they learn. They afford new opportunities and provide different learning experiences resulting in high quality learning outcomes.

Much has been written about what makes a difference to student learning outcomes. It is clear that there is no single factor, but rather a system that influences quality learning outcomes. A 2009 study, for example, identified the following factors as influencing student achievement:

- student ability (50 per cent)

- teachers (30 per cent)

- influence of parents and home (5 – 10 per cent)

- resources of the schools (5–10 per cent)

- peer effects (5 – 10 per cent).[17]

The systems nature of learning improvement has also been suggested in US studies of the effectiveness of 1:1 ratio (student to computer) environments.

A 2008 US research study found that 33 per cent of 1:1 ratio school districts, reported significant academic improvement as a result of the use of new technologies.[18] Project Red, a follow up study of nearly 1000 schools, examined those districts reporting improvement by evaluating their use of 1:1 ratio. It identified nine key factors as influencing student achievement:

- intervention classes – technology is integrated into every intervention class period

- change management leadership by principal – leaders provide time for teacher professional learning and collaboration at least monthly

- online collaboration – students use technology daily for online collaboration

- core subjects – technology is integrated into the core curriculum weekly or more frequently

- online formative assessments – assessments are done at least weekly

- lower student-computer ratio – lower ratios improve outcomes

- virtual field trips – with more frequent use, virtual trips are more powerful; the best schools do these at least monthly

- students use search engines daily

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[17] Hattie, J,. 2003. *Teachers Make a Difference: What is the research evidence*?
   http://research.acer.edu.au/research_conference_2003/4

[18] Greaves, T and Hayes, J, 2008. *America's Digital Schools*, MDR, 2008.

- principal training – principals are trained in teacher buy-in, best practices, and technology-transformed learning.[19]

| DEAG Finding 5 | Creating new learning environments requires a systems approach which, in addition to supporting the use of new pedagogies, includes:<br><br>• the development of appropriate student and teacher resources<br><br>• building teacher capacity<br><br>• expanding the number of teachers involved in school leadership<br><br>• focused work on curriculum and assessment design relevant to the needs of today's society. |
|---|---|

## 4.1 Improved learning outcomes from high quality learning environments

Although there is evidence of significant integration of digital technologies in the classroom (as demonstrated by the uptake of Scootle cited above), they are still regarded as optional in many cases. Implementation of the Australian Curriculum, which is fully digital and is the only curriculum in the world available online in a flexible, dynamic format, directly linked to digital resources, will help drive recognition that digital technologies are core tools in the modern education system. Better articulation of how digital technologies can support improved learning outcomes is also required. In establishing DEAG and tasking it with identifying ways of achieving high quality learning outcomes from existing investments in digital education, the Minister recognised this challenge.

To better inform itself about authoritative, contemporary views, DEAG consulted a panel of Australian experts in the field of learning (see Appendix 2). These consultations resulted in the descriptions of high quality learning outcomes—and the learning strategies to achieve them—listed in Table 1. DEAG proposes digital technologies that are relevant to each.

| Learning outcome | Learning strategy | Digital technologies |
|---|---|---|
| Committing to key concepts, procedures and problem solving strategies that will help build new knowledge into long-term memory | Worked examples based on cognitive load theory<br><br>Predict, observe, explain | Open content textbooks<br><br>Open content e-books<br><br>Curriculum based digital content mapped to the Australian Curriculum<br><br>Drill and practice online content<br><br>Assessment banks for testing understanding and skills<br><br>Data capture technologies<br><br>Simulations |

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[19] Greaves, T, Hayes, J, Wilson, L, Gielniak, M and Peterson, R, 2010. *The technology factor: Nine keys to student achievement and cost-effectiveness.* MDR, 2010, 12. Available at http://www.pearsonfoundation.org/

| | | |
|---|---|---|
| Transactive memory to know where and how to find new information and understanding that not all information has to be stored in personal memory | Problem solving | Semantic web<br><br>Search engines |
| High level of collaborative skills such as the capacity to contribute knowledge, experience and expertise in a constructive way as part of a group | Scaffolded group learning experiences<br><br>Role plays and simulations<br><br>Debrief | Communication technologies including:<br>• mobile devices<br>• virtual worlds<br>• webinar tools<br>• global strategy games<br>• collaborative tools for sharing information<br>• collaborative planning tools<br>• participation in global projects using technology for communication, capture and sharing<br>• assessment tools<br>• video conferencing<br>• text and audio based collaboration tools<br>• wikis |
| Cognitive skills such as understanding of the structure and procedure involved in resolving problems | Meaningful, authentic activities | Digital video and camera for visual recording<br><br>Audio capture and editing technologies<br><br>Project management technologies<br><br>Brainstorming tools<br><br>Authoring tools<br><br>Large-scale global games<br><br>Virtual learning environments for building knowledge |
| Understanding how best to use technologies for learning | Scaffolded integration into all curricula and learning activities | Digital media development tools, video and image recording and editing software, blogging tools<br><br>Search engines<br><br>Digital maps for local and global tasks<br><br>Collaborative authoring tools |

| | | Use of websites for tasks (e.g. travel, history, news, events) |
|---|---|---|
| | | Search and retrieval tools |
| | | Collaborative sharing organisational tools |
| | | Social media networks |
| Development of generic problem solving skills and strategies that can be applied in different contexts | Inquiry-based learning  Design thinking | Problem-based learning activities (complex problems drawing on multiple discipline activities) |
| | | Digital tools for inference, deduction and predicting |
| | | Digital problem solving tools |
| | | Assessment banks for testing skills and learning |
| Metacognitive skills that include the capacity to define learning goals, and self-awareness of the way in which learners have approached a learning task, coupled with the ability to critique it and modify their approach | Self-directed learning | Virtual Learning Environment or e-portfolio to document achievement, goals and future aspirations |
| | | Project management tools |
| | | Game design and development tools for behaviour modification |
| | | Programmatic and web design tools |
| | | Tools for career development |
| | | Blogs |
| | | Video conferencing |
| | | Social media |
| | | Semantic web search |

Table 1. High Quality Outcomes and the Learning Strategies that achieve them.

*4.1.1 Principles of quality learning environments*
Improved learning outcomes require high quality learning environments. We have identified three general principles about high quality learning environments, all of which can be enhanced through the good use of digital technologies.

**Principle 1.** *There is a direct relationship between what students learn and how they learn*
Students are more likely to achieve high quality learning outcomes when they have the opportunity to learn content within a meaningful context. For example, students are more likely to develop strategies for working in groups by participating in a meaningful group work activity, than they are by reading about a series of steps involved in group work from a text.

**Principle 2.** *Developments in personalising learning make it possible for every student to learn*

Personalising learning has been explained as 'every student should, within their school, have excellent teaching that suits them; building on what they know, fitting them for what they aspire to, and helping them reach their full potential'.[20] Thus every student can learn.

The work of the UK Department of Education and Skills has been drawn upon in describing personalised learning and the kinds of learning environments that support this, i.e.:

- high expectations of every child

- promotion of learning beyond the classroom

- a focus on developing learning skills and strategies (metacognition)

- planning for a combination of independent and collaborative learning

- use of the learning needs and talents of young people to guide decision making

- active participation of learners in determining what they learn

- self direction as one of the core skills learned

- one-on-one learning, suggesting individual learning plans (acknowledged to be prohibitively time consuming for teachers and not recommended in this report, but one that may become feasible as reliable learning analytics systems for recording, interpreting and planning student learning are developed)

- students' interests being built on to initiate project or inquiry-based learning and creating local and global communities of teachers, administrators, students, parents, and other interested learners.

**Principle 3.** *All learning should be student centred*
Digital technologies make it possible for learners to engage in learning that is tailored to their particular situation (often termed individualised learning), thereby:

- increasing opportunities for learners to receive feedback on their own progress from tutors, teachers, and peers

- using technology to help meet the challenges of establishing effective learning environments through adaptive teaching technologies (e.g., Knewton, MyLabs[21])

- developing mass customised, personalised learning systems in which students have a customised digital textbook and sequencing of lessons.

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[20] *Five year strategy for children and learners*, 2004.  Department for Education and Skills (UK). Presentation to Parliament by the Secretary of State for Education and Skills, UK.

[21] Knewton: http://www.knewton.com; MyLab: www.mylabs.com.au

| DEAG Finding 6 | Digital technologies have an impact on teaching and learning when their use: |
| --- | --- |
| | • enables promotion of social inclusion and reduces the educational disadvantage of children, especially Indigenous children |
| | • engages and benefits all children in school, and |
| | • facilitates student-centred learning. |

## 4.2 Embedding innovation in learning

Innovation is a defining characteristic of a knowledge society and a digital economy. It is therefore key to high quality educational delivery. Many external formal reviews of education call for innovation in learning yet many teachers and schools claim that they are already engaged in this practice. Yet there is a lack of clarity on what constitutes innovation in learning, in part because any change in practice or use of a new technology can be labelled as innovation in learning despite achieving little real change in learning outcomes.

In general terms, innovation is thought of as new (or modified) products and processes that are new to, or enhance, a particular environment or context. For many in education this has come to mean the use of new technologies such as YouTube, Twitter and Pinterest, or the redesign of the spaces in which learning takes place. As noted earlier, years of sustained educational research have clearly demonstrated that it is not the presence of these technologies or spaces of themselves that enhance learning outcomes. It is the system or environment around the innovation that can lead to enhanced learning.

Australia needs to generate a culture within schools and the community in which innovation is understood as an important component of continuous teaching and learning improvement. Further, innovation must come to be seen as linked to engagement and success for all students and as a way of developing new paradigms for student learning.[22]

For example, in the future we will need to rely on sufficiently educated and aware teachers and schools to make judgements that balance cyber safety risks against the need to innovate. While regulation will continue to play a part, there will need to be sufficient professional judgement at the delivery point to make final decisions and deal with the consequences. Innovation requires a degree of organic growth—an environment in which ideas are shared, developed and stimulate further independent activity focused around common goals.

## 4.3 Strengthened partnerships

The private sector can contribute significant research and development capability in the interest of improved learning outcomes. Provided that schools, school systems and industry partners share common goals and are equally committed to working collaboratively, private sector partnerships can be mutually beneficial across most areas of teaching and learning. Partnerships include:

• reliable and sustainable infrastructure, including technical support which remains a challenge, particularly for smaller schools and systems

• professional development programs

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[22] Fullan, M, 2011. *Choosing the wrong drivers for system reform.* Seminar Series Paper no. 204, Centre for Strategic Education, April 2011.

- development of curriculum materials

- development of better tools and products

- initiatives for fostering entrepreneurial thinking among young people

- programs that sponsor students' education through scholarship agreements

- other initiatives that celebrate and reward achievements in education performance.

| | |
|---|---|
| **DEAG Finding 7** | There is a role for the private sector, acting as a partner, in providing infrastructure and contributing to curriculum design and development, and teacher education. |

Public-private partnerships in education can take many forms. Learning can be made more relevant and authentic to learners by involving the community, local businesses and other education sectors. Through such activities learners working with external experts and teachers can start to see where their learning relates more clearly to their lives and their community, and hence become more motivated and engaged.[23]

There are some excellent examples of schools and universities being able to work together (e.g. John Monash Secondary Science School and the Australian Science and Mathematics School) to pursue innovative teaching and learning with new technologies in specific fields of interest. The value of this approach is to bring the innovative research closer to where it has most impact, and to leverage the expertise in universities.

University students can also act as mentors to encourage learners in the later years of schooling into university, especially in science, technology, engineering and mathematics (STEM) subjects where there is often a shortage of entrants. One example of this is www.nrich.org, a mathematics website hosted by the University of Cambridge in the United Kingdom which has been in existence for over 20 years.

The ATC21S Intel/Microsoft/Cisco partnership with the University of Melbourne is one example of a successful industry and university partnership. This program has generated excellent research on ways to improve education assessments, leading to practical applications based on the research findings.

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[23] http://www.schoolsfirst.edu.au/sf-2011-winners/lenah-valley-primary-school.phps

Engagement with parents is also critical, particularly when schools are making changes that impact on the learner. In this case, the partnership needs to be between the school, parent, learner and teacher. Schools have to make serious efforts to build school communities and to communicate well with whomever makes up that community (e.g., engaging with local industry).The untapped resources of parents, grandparents and the older community supporting students to learn can be incorporated into school communities with great effect. For example, Hole in the Wall Ltd,[24] developed through Newcastle University in the United Kingdom, employs a group of grandmothers all over the UK who log on once a week to Skype with children in India to tell stories, stimulate fresh ideas and new ways of viewing the world as well as listening to children read in English. This program, known as 'Granny Cloud',[25] is expected to achieve a 25 per cent increase in literacy attainment.

Museums, galleries and other organisations with specific knowledge for educational purposes are able to contribute to the digital marketplace. With a media rich environment in schools, the potential for virtual tours provides opportunities for links to experts is enormous and extremely beneficial. The engagement model should be one of partnership with organisations that focuses on the broader goal of impacting at the classroom level.

Field trips are recognised as an important component of learning. However, with the costs, risks, insurance issues and staffing resources associated with real-world field trips, they have become less frequent. Virtual field trips can be included in the core curriculum to complement real-world field trips (noting the continued importance of field trips in learning). In the new world of digital education, experts can broadcast directly into the classroom or home environment, using video and collaborative tools (for example to facilitate questions and answers, project activities etc) to engage students in virtual field trips. This approach has the added benefit of, facilitating two-way engagement rather than the more passive, one-way activities of the past.

## Linking Schools to cultural institutions

Two Sydney universities are collaborating with the Powerhouse Museum to enable school students to remotely control purpose-built Mars rovers in the museum's 'Mars Yard', using the experience to extend their knowledge of science, engineering and mathematics as well as to increase their understanding of the importance of creativity and imagination in science. Students and teachers communicate directly with subject experts in the Museum and universities using video conferencing tools made possible via high speed broadband.

This extension of the *Pathways to Space* program is a NASA student research project - the Mars Student Imaging Program, where a group of year 10 and 11 students from 4 Sydney schools have collaborated with a US high school. Together they were able to gain access to the THEMIS camera on board Odyssey, in orbit around Mars, and to take an image of a specific crater type they predicted would contain a hydrothermal system. They proved their hypothesis, wrote an abstract for the Australian Space Science Conference which has been accepted into the Planetary Science session.

Although in its early stages, students' enthusiasm is encouraging this direction for schools to enrich the national curriculum.



Image Source Page:
http://www.powerhousemuseum.com/pathwaystospace/

Museum curators, artists and authors are also able to access classrooms surrounded by their artefacts, and engage with learners from one class or with multiple classes located around the state, country or even further afield. When applied in projects such as GLOW in Scotland[26] and the Connected Classroom Project[27] in New South Wales, this interactive approach to learning led to increased levels of engagement and motivation.

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[24] http://www.hole-in-the-wall.com/

[25] A TED video about the Granny Cloud is available at
http://www.ted.com/talks/sugata_mitra_the_child_driven_education.html

[26] Details of videoconferencing in GLOW available from the report at
http://www.scotland.gov.uk/Publications/2011/02/23091038/6

| **DEAG Finding 8** | Leveraging partnerships between industry, schools and community groups, cultural organisations, NGOs, local and federal governments can have significant benefits for school systems, teachers and learners. The most effective partnerships are those that share risk and reward. |
|---|---|

## 4.4 Opportunity to leverage the technology base

As our technology base becomes more established, there will be opportunities to leverage this in order to further develop digital education. Connecting to our existing technology base allows us to:

- improve educational outcomes

- embed innovation in schooling to keep pace with the digital economy, and

- expand the partnerships with non-education sectors to embrace informal learning.

*4.4.1 A conceptual framework*
A strategic framework that both fits within existing educational systems and curricula and provides a roadmap for achieving significant innovative and lasting change, is needed. One such framework, is the Education Innovation Grid[28] (the Grid), outlines four kinds of change: improving schools; supplementing schools; reinventing schools; and new paradigms. Achieving each change depends on re-thinking the way formal education engages with the world outside school to provide relevance, engagement and motivation.
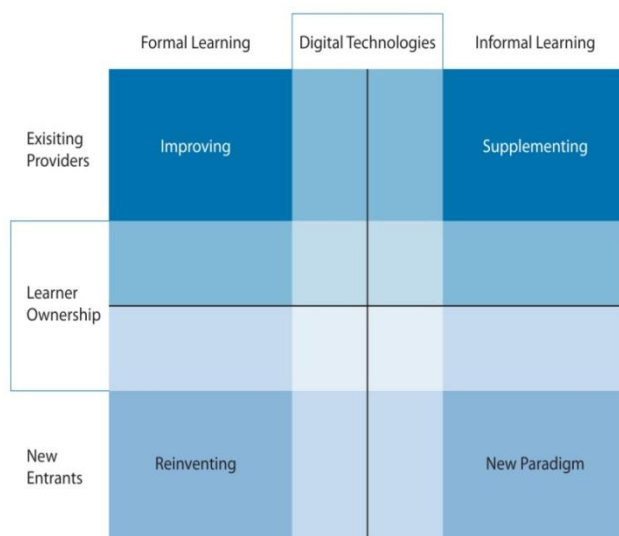


**Figure 1.** The Education Innovation Grid[29]

This framework acknowledges that learning no longer takes place solely within formal learning environments such as schools, but increasingly occurs within the home, community and other informal learning environments. Access to digital technologies has accelerated this shift, providing

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[27] https://www.det.nsw.edu.au/detresources/ccp_in_action_compendium_FNOouLXKim.pdf

[28]Leadbeater, C and Wong, A, 2010. *Learning from the Extremes*.  Cisco Systems, Cisco Public Information.

[29] Hannon, V, Patton, A and Temperley, J, 2011. Developing an Innovation Ecosystem for Education. CISCO/Innovation Unit White Paper, November 2011.(adapted from Leadbeater and Wong 2010)

opportunities to connect the learning that takes place in informal settings, to learning within existing formal school settings.

The Grid acknowledges the important role played by existing providers in supporting continuous improvement in learning in schools. Much of the existing investment has been on formal schooling supported by existing providers, resulting in increased opportunity for learning and enhanced learning.

The Grid also acknowledges the critical focus on the learners who have access to a wealth of resources to draw upon as a result of new information sources. Once reliant on teachers and textbooks as the sole source of content for learning, contemporary learners can now access online content from sources, ranging in degree of authority from museums and government agencies, to myriad views and opinions derived from social media. Developing the skills to know the difference, two Sydney universities are collaborating with the Powerhouse Museum to enable school students to remotely control purpose-built Mars rovers in the museum's 'Mars Yard', using the experience to extend their knowledge of science, engineering and mathematics as well as to increase their understanding of the importance of creativity and imagination in science. Students and teachers communicate directly with subject experts in the Museum and universities using video conferencing tools made possible via high speed broadband.

This extension of the *Pathways to Space* program is a NASA student research project - the Mars Student Imaging Program, where a group of year 10 and 11 students from four Sydney schools have collaborated with a US high school. Together they were able to gain access to the THEMIS camera on board Odyssey, in orbit around Mars, and to take an image of a specific crater type they predicted would contain a hydrothermal system. They proved their hypothesis and wrote an abstract for the Australian Space Science Conference which has been accepted into the Planetary Science session.

Although in its early stages, students' enthusiasm is encouraging this direction for schools to enrich the national curriculum and to be able to make judgments about the relative value, bias and relevance of these sources is critically important for 21st century learners.

The most meaningful impact on learning occurs at the intersection of the two axes of the Grid: that is, where learners are deeply engaged with, and actively building, their knowledge from traditional and non-traditional sources using digital technologies to bridge their learning in formal and informal settings. The strategy proposed in this report focuses on this area.

| **DEAG Finding 9** | Digital technologies have the biggest impact on teaching and learning when they combine formal and informal learning structures and result in improvements in, and supplements to, learning.<br><br>Learning is also reinvented and new paradigms created when these technologies are used in partnership with new providers. Learning in such environments is more relevant, engaging and motivating. |
| --- | --- |

*4.4.2 New approaches for learning*
There is a need to create and sustain knowledge-building environments where the focus is on the support of students' development of 21st century skills. When used in support of contemporary, knowledge-building strategies, new and emergent technologies such as tablet computing, personal learning environments and augmented reality (as identified in the Horizon Report 2012[30]), will

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[30] op. cit., Johnson et al 2012.

realise the meaningful impact on learning needed to equip students for the future and thereby support innovation in learning.

One such group of strategies is referred to collectively as inquiry-based learning and includes project-based learning, problem-based learning, and design-based learning. These strategies engage students in completion of authentic tasks, investigation of meaningful problems, and the design or creation of a product respectively.[31] Students work on these tasks and problems collaboratively in small groups, making it an even more powerful learning experience.

The research evidence supporting the use of these approaches is unambiguous and demonstrates significant learning benefits for:

- student learning outcomes in terms of deeper learning and enhanced performance on complex tasks when engaged in such authentic learning, and significantly higher achievement on intellectually challenging tasks[32]

- all students working on collaborative learning activities benefit[33]

- students from low-income backgrounds and ethnic minorities, who benefit more than those from high-income, non-minority backgrounds.[34]

Another approach to building such capacity is through the teaching and use of design thinking.[35] The value of this approach in promoting abstract thinking and problem solving is increasingly being extolled by industry and educational institutions alike. In her recent address to the 2012 Clunies Ross Awards for example, Catherine Livingstone AO described innovation as 'about finding creative solutions to problems'.[36] She advocated a more sophisticated approach where designing is seen as playing the key role in innovation and could be learned as early as primary school.

**Global partnerships for the 21st Century**

Digital technologies in schools are creating new, innovative learning environments and connecting Australian students to the world.

Since 2008 Parramatta Marist High School has been working in partnership with Republic Polytechnic, a tertiary institute in Singapore, to deliver innovative problem based learning. Republic Polytechnic uses the 'learning by doing' approach that aims to instil problem solving and teamwork skills in students.

Through this partnership, students and teachers at Parramatta Marist High School connect to an innovative learning environment via instant messaging, wireless projection and online learning. They are utilising new learning models to assist students in developing their strategic thinking and collaborative problem solving skills, to look beyond the walls of their classroom and to further develop their Asian cultural literacy.

Problem based learning incorporates new and innovative teaching strategies such as student self-reporting, teacher-student feedback, teacher-student relationship building, and concept mapping into day to day classroom practice.

In another example of 'learning by doing', the **Hands-On-Universe** (HOU), Australian school students are remotely operating research class robotic telescopes based in Hawaii.

Developed and operated by the University of California, Berkeley, HOU is an educational astronomy collaboration that enables students to investigate the universe while applying tools and concepts from science, maths, and technology. Participants from around the world request observations from an automated professional grade telescope, download images from a large archive, and analyse them with the aid of user-friendly image processing software.


Image Source Page: http://www.visualphotos.com

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[31] Barron, B and Darling-Hammond, L, 2010. Prospects and Challenges for Inquiry-Based Approaches to Learning. In *The Nature of Learning: Using Research to Inspire Practice*. H. Dumont, D. Istance and F. Benavides (eds). OECD Publishing, Paris.

[32] ibid.p. 200

[33] ibid. p. 210

[34] Ibid.

[35] http://ideasatplay.com.au/big-picture/

[36] Livingstone, C, 2012. Address to the Australian Academy of Technological Sciences and Engineering. Clunies Ross Awards, 14 June 2012.

These two examples of contemporary approaches have in common the development of the kinds of skills needed for the future, as well as the requirement for students to work collaboratively. It is not enough, however, to put students into groups and expect them to know how to work collaboratively, or to have developed the skills needed to resolve the common problems that occur within groups, such as resolving conflict and dealing with 'free loaders'. They need access to resources and scaffolds to support their knowledge-building activities, and be assessed in ways that allow them to demonstrate their development of skills such as reasoning, problem solving and designing. Similarly, teachers need development and support to deliver these new approaches to learning.

These new approaches will require the development of new forms of assessment to support future planning (formative assessment for learning) and reporting against students' developmental progressions of these knowledge-building strategies. Progress is being made in a number of countries through small-scale pilot studies to generate bases for automatic coding and scoring of student performances on the tasks and to determine the technology and administration requirements for implementation and assessment administration.[37]

The assessment component is essential, as any innovation will be short-lived if the measures of educational success are predicated on the results of state and national assessments alone. It is expected that students who perform well in the new forms of assessment described above will also perform well in the traditional standard assessments such as NAPLAN.[38]

The following gaps have also been identified in achieving this goal:

- the availability of resources to support learners and teachers in their participation in, and support for, contemporary learning activities as well as building their capacity for working in and supporting groups

- professional development for teachers

- design and development of new assessment strategies that provide evidence of students' development of higher order skills.

Efforts to support these changes should focus at three levels: adding new curriculum and technologies; changing the emphasis of existing curricula towards the new knowledge

**Collaborative Problem Solving**

The prevalence of inexpensive video cameras and easy to use video editing tools has made documentary film making readily available from primary classrooms upwards. Mitzi Goldman, a documentary film maker in Sydney operates a program called "Sprout'" which helps learners to make documentaries of lives and events in the community, involving local people in the process and making learning more relevant to students' lives outside school. Working with primary aged children and their community, often in underserved and in indigenous communities Mitzi helps the students demonstrates the considerable 21st century skills involved in filmmaking including collaboration, decision-making, problem solving, and critical thinking. Working with Broadmeadows and Dallas primary schools in Melbourne Victoria, a group of Year 6 students from both schools agreed to each develop a short documentary to convey their ideas as precisely and as vividly as possible on what schools would look like in 2025. They had to agree the themes for the documentary, decide how to present their ideas, storyboard it, interview people, set up scenarios, film and edit the content, and join clips together with a scripted commentary. The end results included:

- a growth in visual literacy and engagement in school
- excited and passionate students working as teams
- increased focus, concentration and listening skills
- greater awareness for social issues
- development of empathy and understanding the perspective of others
- critical thinkers with tools for increased social enquiry
- increased confidence and self esteem.



Image Source Page: http://www.featurepics.com/

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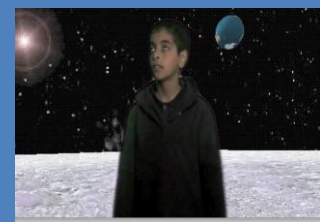[37] Griffin, P, Care, E and McGraw, B, 2012. The Changing Role of Education and School. In *Assessment and Teaching of 21st Century Skills.* P. Griffin, B. McGaw and E. Care (eds). pp. 1–15. Springer Science+Business Media, Dordrecht, The Netherlands.

[38] http://www.naplan.edu.au/

and skills; and transforming schools into 21st century organisations.[39]

A short-term approach to implementation is proposed, requiring assimilative change followed by systemic change, (for example modifying existing curricula and teaching approaches to emphasise the development of 21st century skills), followed by systemic change as the medium- to long-term goal.

The ATC21S initiative[40] is already working on the assessment issues and is developing an assessment framework to map how students learn two specific skills: collaborative problem solving and ICT literacy; and learning in digital networks. The results will provide policy makers and teachers with innovative resources for driving problem solving and digital capabilities. Based on extensive research, the ATC21S assessments will allow education jurisdictions to evaluate student achievement, identify gaps in development or competence, and see where they may need to invest in curriculum change.

The proposed project attached to this report—Building 21st Century Skills in a Global Environment— would provide the way forward to extend the ACT21S initiative and provide a platform for the large-scale adoption of contemporary, knowledge building learning strategies.

| **DEAG Finding 10** | The level of change required in schools is significant but is best supported in the short to medium term by changing the emphasis of existing curricula and assessment structures. |
| --- | --- |
| | In the medium to longer term, these changes should be transformative, such that schools operate as true learning organisations. |

*4.4.3 Communities of innovation in learning*
There is an urgent need to implement and expand innovation in learning and to establish communities of innovation in learning to bring about the required systematic change. Systematic change requires both a bottom-up approach on a large scale from the education sector (in particular, individual schools) combined with a top-down approach from governments (e.g. resources, staff support and policies).

By adopting innovative approaches to teaching and learning, Australian teachers, Principals and schools will demonstrate an 'anywhere, anytime' process, giving learners the best opportunity to achieve high quality learning outcomes. There are schools using the remodelling made possible by Building the Education Revolution to combine students in both large and small groups to accommodate individual programs, and to allow more effective use of staff expertise. Schools are communicating directly and promptly with parents and carers to improve school attendance and performance.

Establishing communities of innovation in learning will require the whole school community to be motivated to achieve continuous improvement for all students. In doing so, they must accept and manage the risks and rewards in doing new things and finding better ways of doing old things. This new culture will be open to engagement with other industries and enterprises that have made similar shifts within a context of digital economy adaptation. In particular, innovative approaches

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[39] Scardamalia, M, Bransford, J, Kozma, B and Quellmalz, E, 2012. New assessments and environments for knowledge building.  In *Assessment and Teaching of 21st Century Skills.* P. Griffin, B. McGaw and E.  Care (eds).  pp. 231-300. Springer Science+Business Media, Dordrecht, The Netherlands.

[40] See www.atc21s.org

will involve a greater reliance on teams, collaborative endeavours and supplementary services. These will not be possible without the adoption of new technologies in schools and learning spaces.

The difficult shift required to achieve the systemic change needed in education is from one teacher working with a class of students to that of a teacher working as part of a team, connected to, and drawing on a wider learning community to manage, assess and improve individual and group learning outcomes.

Whilst acknowledging the importance of maintaining and enhancing the practical leading role of teachers in the learning environment, it is also recognised that knowledge, experience and skills can be sourced from the wider community to supplement the teachers' role. Digital infrastructure makes it possible to establish environments that engage, support and inspire learners.

Scootle provides a good example of an emergent learning community where teachers contribute ideas and work, adapting them in the light of feedback from others and thereby generating further ideas. Many schools include scientists or artists in their emerging learning communities, e.g., engaging students in scientific research or the production of community art projects. Students learning languages other than English can accelerate and deepen their learning by working with communities or classes of native speakers. For example, the proposed project attached to this report—National Virtual Languages Space—accelerates learning languages through digital education.

The collaborative website Teachmeet is another example of a successful, emerging, self-organising learning community of teachers in Australia where teachers 'share good practice, practical ideas and personal insights into teaching with technology'.[41]

While it is not difficult to find examples of productive learning communities, more needs to be done to develop systemic inclusion of learning communities as integral to improved learning outcomes. This approach been described as '...the commitment that comes from intrinsic motivation and improved technical competencies of groups of educators working together purposefully and relentlessly'.[42]

It is important to trigger a critical mass of educators who not only use the available digital tools, but understand that they cannot improve instruction without the support of a learning community, a critical mass of the community engagement, and a cultural expectation that children will participate. The education community, industry and local communities need incentives to develop the partnerships required by an effective, contemporary education system.

*4.4.4 Capacity building through partnerships*
Digital technologies enable individuals to do many things that were once brokered through agencies. These include research, gather information, communicate, transact business, locate and connect with others with similar interests, measure impact, analyse data and build intelligence. Skills that took months or years to acquire can now be learnt in a fraction of the time with access to digital resources. For society to be more productive, young people need the capacity to build on these skills—to interpret, discriminate, assess, infer, conclude, apply judgement and build their capacity to innovate, create and generate.

Additionally, teachers need the capacity to design and implement new ways of learning, incorporating continuous growth in knowledge and understanding. They need to be able to identify and develop innovative teaching practices that create high quality learning environments underpinned by technologies.

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[41] See *www.teachmeet.net.*

[42] op. cit., Fullan, M, 2011.

It is not just the capacity of individuals that must be built. A knowledge society is far more than the sum of its parts. While a digital economy empowers individuals, it relies on social capital, teamwork and collaboration than did the industrial society.

To meet this challenge, schools require the capacity to:

- diagnose learning needs on an individual basis, moving to personalised teaching

- design, develop and adapt learning programs for individuals, groups and cohorts

- improve, supplement and reinvent existing learning programs

- continuously adjust structure and organisation to improve delivery

- manage student progress through those programs to achieve national standards and establish habits of a learning lifetime

- readily analyse a wide range of student data

- source and utilise community expertise locally and globally

- communicate clearly and continuously with students, parents and community

- create and maintain dynamic community and industry partnerships.

This will require new ways of deploying staff, community and industry partnerships as well as new relationships with universities, TAFE colleges and professional organisations. These new relationships and ways of working require both local and systemic rethinking of accountabilities, risk-management, social and legal responsibilities as well as cultural awareness and competence. It may also involve the school in training community members (in particular parents) in the use of digital tools and systems.

Never before has education had the opportunity to make creative use of the vast internet resources and to partner across schools, businesses and the community—locally and globally—through open standards and architecture, and cloud services.

# 5. The road ahead: a tipping-point strategy

As we look ahead, the overarching challenge is to maintain the momentum created by the Digital Education Revolution and ensure that digital technologies are used more systematically to improve the quality of education provision and learning outcomes for all students.

It is broadly accepted that policies and strategies for change in education 'must generate the conditions that make intrinsic motivation flourish'.[43] We know from extensive research that the most effective drivers are those that work directly on cultural change—a culture in which all teachers and students are intrinsically motivated to continuous improvement in learning and teaching, and inspired to work collaboratively or in teams.

The signs of this new culture based on intrinsic motivation are evident in some schools. In industry and beyond, employers, parents and others instinctively recognise the benefits of this new approach. To be truly effective, however, cultural change must be systematic.

Australia needs a strategy, therefore, that is aimed at integrating the achievements of the DER and decades of achievement in ICT in schools into a systemic and holistic cultural change in our perception and expectation of what schooling is and what it involves.

## 5.1 Components of the strategy

To achieve lasting cultural change in education, and embed the achievements of the DER, requires a multi-pronged strategy focused at all levels of society and industry. At its core, the strategy must foster an expectation and capacity for students and teachers to go beyond their comfort zone, as well as encouraging continuous improvement in teaching and learning among students, teachers, parents, communities, business leaders and the community at large.

The strategy builds on past achievements in the DER, acknowledging and targeting barriers, whilst moving away from isolated examples of effective change to more systemic change. New drivers of change are also required. Capacity building, teamwork and pedagogy will become more significant.

Building stronger school-community partnerships is a key dimension of the strategy. As expectations of regular, immediate and continuous feedback in all aspects of schooling delivery using technological tools grow, priority should be given to devising home access programs that build the capacity of all parents to support student learning. Accredited programs for industry and community members acting as mentors, tutors, coaches and supervisors in school programs, should be developed.

A second dimension of the strategy is focused on building learning communities among educators. This includes creating opportunities and accreditation for teachers to engage in a scholarly approach to furthering their skill development in areas such as learning design, diagnosis of learning needs and learning in the community. Partnerships should be extended to the tertiary education sector through the establishment of specific learning communities designed to accelerate the learning of groups of teachers in partnership with universities and industry. Incentives should also be given to schools to restructure services and to work in teams.

Among the broad community goals for digital economies, priority should be given to promoting accountability and improving access to learning improvement for teachers. Examples include providing opportunities and structures for teachers and teachers-in-training to gain accreditation within industry partnerships and placements. More broadly, we must ensure that learning in school has relevance to the local society and culture in which students live as well as having national and

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[43] ibid.

international relevance. This extends to the development of scalable models of systemic and cultural change in districts, regions or communities, as well as the development of tools for community-based progress reviews.

## 5.2 Initiatives

The strategy features a number of initiatives designed to further apply digital education directly to redress disadvantage, in particular, engaging parents, business leaders and the community in digital projects that raise the capacity of whole communities in relation to the digital economy.

A core focus will be the establishment of a learning ecosystem in which scalable school or district models are developed, tested and implemented. It will explore new models of learning in which:

- students learn in a networked way, engaging with industry, the community, home and knowledge experts

- students and parents are supported by online resources, formative online assessment and tutoring

- accredited training in digital learning support is available to parents and community members

- teachers diagnose student learning needs, design and manage learning programs, supervise and assessed individual student learning

- substantial partnerships with cultural institutions nationally and locally are established

- partnerships with universities result in internships and online engagement of pre-service teachers

- service models provide support and evaluation from universities and industry.

A further initiative will be the development and dissemination—in partnership with the relevant jurisdictions— of print and online materials[44] for all school communities to use, including:

- school and district case studies

- clear policy and strategy documents

- guidelines and indicators of progress and success

- 'how-to' support for parents and communities

- online multimedia tutorials, webinars and presentations

- forums that feed into learning communities.

Finally, the strategy will give priority to targeting hard-to-staff or under-serviced curriculum areas for national digital delivery programs and accelerated professional learning.

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[44] Some of the materials already produced by the MCEECDYA *Learning in an Online World* initiative provide examples.

## 5.3 What will success look like?

The DER has achieved much in a short time. Australia now has a strong foundation of technology, knowledge and pedagogy to build from. With this report we now have a clearly articulated strategy for change. So what will this future education system look like and what will be the defining characteristics of the next stage in the digital education revolution?

**Our vision** is that by 2020:

> Australians will recognise schools as belonging and contributing to the digital economy. Businesses and community organisations will be familiar with seeing students studying and learning in community and industry settings. Community members and industry workers will expect to spend some time in schools, and be regularly networking with students and teachers to directly support student learning. Businesses, government agencies and community organisations will expect to engage in online communication with schools on a regular basis. Some groups will participate in school programs such as learning languages.

> There will be accredited programs to provide training for community members, businesses, parents and carers to support learning programs. Trainee teachers will be accredited for educationally relevant time spent in community, business and industry settings. University education faculties will seek opportunities to develop community partnerships to support their programs and students.

> Many schools will run programs, both online and face-to-face, for parents and carers to learn more about home-school partnerships to maximise student learning. All students will have access to at least one digital mobile device through which they can access resources, upload work, link to their learning program and communicate with their learning community. There will be fewer identical student learning programs than there were in 2012. There will be a variety of inquiry-based learning models evident in any school, including self-directed projects, activities, games and demonstrations. Students may be seen in several different groupings and configurations within any single day. Or they may spend hours on a single activity, continuing online outside school.

> The staff profile of a school will be described in more complex ways than is currently the case. In addition to subject, content or pastoral specialisations, schools will seek and employ staff to obtain a mix of specialist skills, including diagnosis of student learning needs, program, coaching and learning pathway design, resource matching, data analysis, community development and case management. The concept of the general class or subject teacher will be giving way to an expectation of greater teamwork and collaboration among teachers. There are likely to be more paraprofessionals and community members, both in schools and linking in via video and online connection, supporting groups or individuals, coaching, tutoring and assisting students with aspects of their programs. Cultural institutions, industry partners and community groups are likely to be regarded as part of the school service.

> The data generated by students and the adults they interact with will be automatically collected, analysed and delivered to the personal devices of their supervising or case-managing teacher. Educators will use this data to adjust the student's program on at least a weekly basis, as well as to identify any student whose learning is at risk and to trigger early intervention.

> Using a digital device, a school principal or coordinator will be able to locate any student, analyse attendance, and progress any indicators of concern. She/he will be able to aggregate data and identify trends for the whole school cohort, matching this against state, national and international data. The school will be working in partnership with a number of community organisations and local industries. Principals will be part of community networks and very familiar with their partners. Local communities will look to schools to

generate knowledge in areas of local concern, such as certain environmental issues, data gathering, analysis, performance and narration.

The school buildings and grounds will be in use for 12–16 hours a day. School communities will be able to identify and draw on a pool of local, national and international experts and champions of digital learning innovation to assist in their transformation.

## 5.4 Criteria for success

Since it is designed to impact on most parts of the economy and society, the success of the strategy can be measured in several ways. Change could be measured, for example, through economic modelling or research into changes in public perceptions of schooling.

Within an education industry framework, criteria for success would include:

- the shift to facilitating students' development of 21st century skills is scaled up in a significant way

- curriculum standards are met by students in, or linked to, locations other than schools

- students have greater flexibility and choice in their learning options, being able to identify and pursue individual learning pathways

- engaging learning experiences for all students resulting in improved literacy, numeracy and retention for students of low socio-economic status, especially Indigenous students

- families, especially those of low socio-economic status and Indigenous families, have productive relationships with schools and are confident partners in schooling

- schooling is conceptualised, organised and managed as a service rather than a location or institution

- industry demand for high-end skills is being met through productive partnerships at both national and local levels

- career pathways in education are more varied and flexible and teaching attracts a higher percentage of high performing matriculants

- investment in ICT is guided by the drive to achieve innovative practice, rather than simple efficiencies

- schools adopt new pedagogies, new structures and new behaviours.

## 5.5 Indicators of success

To be successful, the strategy must achieve visible, lasting changes at all levels of society. Arguably, the most import indicator of success would be the wide-scale adoption within pedagogies of the 21st century skills described in this report. The following four levels of innovation can be used to judge the extent of change:[45]

- **Depth**: The innovation has resulted in change in the classroom that 'goes beyond surface structures or procedures such as changes in materials…to alter teachers' beliefs … and pedagogical principles'.[46]

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[45] Coburn, C, 2003. *Rethinking scale: moving beyond numbers to deep and lasting change*. Educational Researcher 32 (6), pp. 3–12.

[46] ibid.

- **Sustainability**: The change as described above is sustained over time in the original and subsequent contexts.

- **Spread**: The innovation spreads to a greater number of contexts.

- **Shift in reform ownership**: Ownership of the innovation shifts from the original innovator to the adopter.

Other indicators of success would include:

**Community perceptions of schools shift to a notion of 'our school is with us'**
In the health sector, the notion of co-production of health services is gaining ground. This approach recognises that individuals and families have a role and responsibility in keeping healthy while communities need to make choices that positively, rather than negatively, impact on health.
A similar co-production notion is required in relation to education. Parents and communities either help or hinder education. Working in a more connected and shared way requires shifts for both schools and the community, and requires support from government in policy, regulation and public awareness.

**A sustained network of community members who are part of a school and have access to training, assistance and recognition for this role**
To build a network of partners to support school learning will require policy, regulation and support. To gain the benefit of community expertise, schools will need to provide both leadership and support for the community. Expertise will flow both ways. Community members need a range of training and education in areas such as child protection, anti-bullying, curriculum, legal requirements and frameworks such as the Melbourne Declaration, whether working physically with students in a school or at other sites, or with students and/or teachers online.

**Schools and teachers work in teams with some differentiation of roles, a recognition of skills such as learning liaison, design, diagnosis and coordination, educational networking, tutoring, coaching, supervising and mentoring**
At present the dominant model of schooling hinges on teachers with expertise in education generally, a child development age range and content specialisation, supported by psychologists, chaplains, speech therapists and, occasionally, nurses. The approach of the future will require teachers to develop other areas of specialisation, such as identifying barriers to learning, matching resources to need, designing individual programs, case management, coordinating coaching, practice and tutoring, managing community networks. It will not be reasonable to expect every teacher to have all the skills required, but every teacher will be expected to work as part of a team to deliver a comprehensive service.

**All schools are utilising high speed broadband for extended hours each day**
While the hours of usage of school broadband networks will vary, in many communities, especially those that are remote or otherwise disadvantaged, usage will increase to 12–14 hours each day. Many schools will utilise their broadband during school holiday periods with vacation schools and community use. There will be evidence that teachers, students and parents are logging into the school network out of school hours, with peaks between 5 pm and 10 pm. All school staff will be trained to monitor student safety online and schools will have checking systems and procedures in place.

**All teachers are accessing and using the National Digital Learning Resource Network and 60 per cent are contributing to it**
The use of this service is already significant and growing. Under a Digital Education Policy, the states and territories that provide access to the network through local gateways, will aggregate and make available their NDLRN data enabling a reliable set of fully national data. Within three to five years this data will indicate all schools and teachers use digital resources. Resources will continue to grow

in number and quality. We would expect this network to be of world's best standard. Teacher sharing networks will grow significantly, with most teachers belonging to networks.

**All schools are using digital formative assessment tools, aggregating, analysing and using student learning data to improve student outcomes**
The Improve tool will have progressed from trial to implementation across all jurisdictions. Students will increasingly have immediate feedback on learning tasks and the opportunity to generate follow-up extension and remediation. While schools will monitor, analyse and use high-stakes data, the availability of formative assessment tools and the data these generate will create a shift in teacher, student and parent expectations and practice.

**Australia's digital education system is recognised internationally as a model to be followed**
Given Australia's population, the number of teacher education institutions, professional bodies, education jurisdictions, national bodies and the existing governance structures, COAG will be able to coordinate and lead the changes envisaged. There is a history of cooperation and national leadership to draw on. The greatest challenge is to overcome the equity issues. Without that, Australia cannot expect to be a model for others.

**Australia is a high achiever and high equity performer when analysed against TIMSS and PISA data**
Within five years of introducing the Digital Education Policy we should expect a statistically significant reduction of the gap between the performance of students of low socio-economic status and high socio-economic status on TIMSS and PISA tests. Within 10 years we would expect Australia to be a high equity, high performance nation.

**Jurisdictions, schools and universities can articulate how all learners (including teachers) are engaged with ICT, supported to become proficient, and gain transferrable skills they can continue to use**
To achieve this success indicator, workers in the education industry need to be proficient users of technology. Additionally, the daily operations of education provision must incorporate seamless, efficient technology use and data exchange. The teaching profession must also be able to communicate the effective educational use of technology to students, parents and the public.

**Cultural institutions locally, nationally and internationally are leveraged to improve both teacher and student learning**
There have been shifts in the last three decades in the way cultural institutions operate. The NDLRN has forged important partnerships with cultural organisations in relation to digital resources. Many cultural organisations have education officers, most have an educational purpose and role within their constitution. Funding for digitisation of archival material, and educational services at cultural organisations sometimes falters in the light of budget constraints and compartmentalised views of the education sector. These organisations, however, are essential to a digitised democracy and to the community networks upon which schooling will depend in the future. In light of the National Broadband Network, strengthening partnerships between the cultural and education sectors nationally and locally will be more important than ever.

# 6. Conclusion

In a century when 'wicked' problems defy simple solutions and market forces drive whole industries to flat world practices, it is unsurprising that an education industry should require coordinated effort by governments, communities and educators to transform our society. Australia has most of the components in place to achieve transformation in education. What is now required is a catalyst intervention to bring into recognisable focus the change that the whole community will recognise and welcome as transformation that shapes our future.

# Proposed Project 1

## Building 21st Century Skills in a Global Environment

This project provides a framework for taking the recommendations of this report forward. It is designed to investigate links across selected general capabilities of the Australian Curriculum and the key learning areas. The emphasis is on enhancing student skills at both general and specific levels. The approach is one of capacity building, with a reliance on teachers building relevant ICT based pedagogic and content specific strategies to enhance their teaching. The project addresses the following question: To what extent does the explicit teaching of general capabilities skills such as Collaborative Problem Solving and ICT Literacy influence (1) development of these skills, and (2) student performance in key learning areas?

In order to investigate these questions, access to and use of ICT is assumed. The project is conceived in three phases.

**Phase 1** is the shared procurement, development and distribution of digital resources to support:

- students' development of 21st century skills

- teachers' use of knowledge building and inquiry-based learning designs

- teachers' development and use of ICT based pedagogical strategies through which formative assessments will support students' classroom and independent learning .

**Phase 2** is the piloting of these resources and approaches with a sample of 40 schools, and involving students in Years 8 and 9. Intrinsic to the piloting of innovative formative assessments is both the use and the measurement of ICT literacy skills.

**Phase 3** is the systematic adoption of these approaches across all level of schools through communities of innovation within schools. These communities will share experiences and resources, thus ensuring a bottom-up approach to innovation. This phase will increasingly involve partnerships, members of the community and others who will form a community of learners.

The project assumes access to, and use of, digital technology to support teaching and learning in a manner consistent with 21st century lives and education. The project lies within the lower segment of Leadbeater's Education Innovation Grid in that it provides learning opportunities for students that cross discipline borders as well as traversing formal and informal learning boundaries. Its focus is on extending a new paradigm for contemporary school education where teaching is conceived as supporting learning that is personalised, collaborative, and involves the development of 21st century skills. This supports the Melbourne Declaration's emphasis on the importance of knowledge, understanding and skills of learning areas, general capabilities and cross-curriculum priorities as the basis for a curriculum designed to support 21st century learning.

|  | **Formal learning** | **Informal learning** |
|---|---|---|
| Sustaining innovation | (improve) | (supplement) |
| Disruptive innovation | (reinvent) | (new paradigm) |

Table 1. The Education Innovation Grid [47]

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[47] Griffin, P, McGaw, B and Care, E. 2012. *Assessment and Teaching of 21st Century Skills.* Dordrecht, Springer. Adapted from Leadbeater, C. (2010) *Learning From the Extremes*, San Jose: Cisco

# 1. Background

This project has its origin in a large-scale multinational study, the Assessment and Teaching of 21st Century Skills (ATC21S), led by Professor Patrick Griffin. It has also been influenced by the 2001 Australian Research Council (ARC) funded project, School-University e-Learning research partnerships for scaling up innovation, led by chief investigator Associate Professor Lyn Schaverien.

ATC21S has produced developmental learning progressions in collaborative problem solving and ICT digital literacy. In order to identify the degree to which this approach can enhance student progress within the framework of the Australian Curriculum, it is necessary to link the 21st century skills to the general capabilities of the curriculum and embed these in the key learning areas.

The ATC21S progressions make two assumptions: that students can learn these skills; and teachers are able to teach the skills. These assumptions need to be examined. In order to do this, it is necessary to develop supplementary assessment materials linking student performance to the developmental progressions. Teachers need to be provided with instructional materials targeted at promoting student growth in these skills, and check whether growth is greater than that achieved through natural maturation.

*1.1 The ATC21S project*
The ATC21S project was sponsored by three corporations—Cisco, Intel and Microsoft—and by the governments of Australia, Finland, Singapore, the United States, the Netherlands and Costa Rica. The three corporations initiated the project because of the widely held belief that schools were not graduating school leavers with skills commensurate with the demands of 21st century technological society.

The project focused on the development of internet-based materials that would enable the assessment and teaching of 21st century skills. In the first instance it concentrated on the assessment and teaching of collaborative problem solving and learning through social digital networks. In a major success the project convinced the OECD that in 2015 collaborative problem solving should be a core skill assessed in the international PISA project.

The ATC21S project resulted in the development of a framework for 21st century skills with a focus on two skill areas: collaborative problem solving and ICT literacy for social learning. These skill areas are accompanied by online formative assessment tasks designed to be used in schools, which enable students to collaborate and have their problem solving behaviour captured electronically for scoring and reporting against developmental progressions. In addition, teacher professional development modules are included to provide an example of how teachers might integrate the use of 21st century skills into their pedagogical processes, and how students' educational progress might be enhanced by the use of these skills.

There is an imperative to examine the integration of these skills for their effectiveness in improving achievement in key learning areas and the general capabilities of the Australian Curriculum. This will provide the opportunity to assess whether the explicit teaching and learning of 21st century skills in school will enhance educational performances of students across and within specific disciplines, and better equip them for the world of work.

The proposed project extends this work and examines the way in which teachers might use these materials and adaptations of them within the key learning areas of the Australian Curriculum to enhance student performance in 21st century skills. The project takes the position that assessment is a major impetus agent in large-scale change. A central question concerns how ATC21S developmental pathways enable skills to be monitored and enhanced through tasks embedded

in the Australian Curriculum key learning areas and general capabilities; and how these skills contribute to higher level learning in units of study.

The project anticipates the kind of skills to be assessed in the PISA study of 2015 in which collaborative problem solving will be assessed along with science. It will also investigate different ways in which the skills can be developed in anticipation of global pressure as a result of PISA. Partnerships between schools will result in collaborative teams of teachers and students, interacting across and within schools and regions. This approach allows teachers to model the approach to skills that students are developing. In doing so the project will follow the structures currently modelled in a linkage project funded by the ARC (LP0991123) and led by chief investigators Professor Patrick Griffin and Associate Professor Esther Care.

## 2. Phases 1 and 2 of the project

The aims of the project relate directly to the provision of learning opportunities for students that provide the most meaningful impact on teaching and learning by:

- facilitating students' development of 21st century learning skills such as collaborative problem solving (CPS) (Recommendations 1, 6)

- enhancing student learning in key learning areas and enhancing students' development of general capabilities (Recommendation 1, 2, 3)

- developing teachers as collaborative partners within and across schools (Recommendations 4, 5, 8)

- enhancing facilitation skills within class (Recommendation 5)

- enabling teachers to modify class management to facilitate individual and ability-based learning (Recommendations 1, 2, 5, 6)

- developing and trialling appropriate resources to support teachers in these diverse roles (Recommendations 2, 4, 5, 6, 7).

*2.1 Assumptions*
Twenty-first century skills such as collaborative problem solving and ICT literacy enhance student learning and achievement in key learning areas (KLAs) and in general capabilities (GC).

This project rests on the following assumptions:

- 21st century skills are teachable and students can demonstrate increased levels of competence if appropriate instructional strategies are implemented

- developmental progressions underpinning 21st century skills such as collaborative problem solving and ICT digital literacy can be adapted to the general capabilities of the Australian Curriculum

- skills resting in a 21st century framework can be used within discipline-based learning areas to inform teaching interventions and enhance student progress.

Two key skills explored within the ATC21S project were identified on the basis of their capacity to contribute to enhanced outcomes for students in terms of their successful preparation for future education and for the workforce.

The first, collaborative problem solving, is most usefully applied to complex and ill-structured problems, and characterises ways of working where multiple resources in terms of human skills and physical artefacts are required. These problems may be contextualised in the social and economic challenges facing Australia and the global economy, and may consist of mathematical, scientific, and

social science issues. Growth in global projects has provided the stimulus and need for individuals to collaborate with each other electronically, and an understanding of the factors involved in such processes is essential.

The second skill area, ICT digital literacy through networks, is an intrinsic component of such processes. This project will involve schools across Australia and, in its pilot phase, will involve students in Year 8 and 9 classes and their teachers. If it can be arranged, it would be entirely achievable to involve schools in Asia as part of group work projects. The students will be engaged in selected units of work in history and science within and across schools.

*2.2 Teacher program*
Twenty-first century skills include critical thinking, problem solving, decision making, creativity and innovation, as well as combinations of skills such as collaborative problem solving and learning through social networking.

In order to provide differentiated opportunities for students developing at different rates and on different trajectories, new techniques of classroom management and supervision are required. Teachers need to abandon teaching methods that follow a consistent scientific approach to engage students and instead adopt facilitating, organising and management roles in the classroom. In the linkage project currently led by Professor Griffin and Associate Professor Care, teachers are directed and helped in this development by working in professional learning teams as collaborators and partners. They establish intervention and management techniques for the classroom that will best offer opportunities to target instruction at students' readiness to learn. This is seen as a 21st century teaching skill and models the kind of behaviours expected of the students.

In this project teachers will be provided with professional development on explicit teaching strategies associated with developing 21st century skills among their students. This will be achieved through a priority recognition of developmental progressions of the 21st century skills derived from the ATC21S project. Teachers will become familiar with the assessment technology, a range of developmental progressions, and online support systems that include an understanding of developmental learning and assessment, targeted and directional intervention, assessment and monitoring of student development.

In order to deliver this skills development, certain technologies need to be developed and/or available. These may include social and broadcast media, project planning software, pencil and paper, and storyboarding. Means of monitoring and recording student development also need to be available. This will be achieved through students engaging in self-assessment and peer assessment, as well as completing more formal formative assessment.

It will be necessary for participating teachers to undergo training in the use of data for decision making. Such skills are essential for the implementation of facilitative approaches to teaching—to use formative assessment data to assist all students to learn.

There is a significant amount of teacher development required, and liaison across pre-service and in-service teacher education programs may usefully be established as part of the project. In the first instance, these should focus on science and history key learning areas. Teachers will then be able to search resource banks that will enable them to identify which material is the most likely fit with opportunities to learn, targeted at particular levels on a developmental progression.

*2.3 Project detail*
The project will incorporate six key activities or steps.

1. Project establishment including protocols, recruitment and timelines.

2. Develop teaching materials and assessment tasks through workshops and focus group discussions involving teachers that enable monitoring of skill development in collaborative problem solving between students within and across schools.

3. Gather baseline assessment data on student collaborative problem solving skills and general capabilities before the start of program by students.

4. Conduct professional development modules for teachers.

5. Two terms of student participation in a collaborative program within and across schools. Teachers will be expected to conduct formative assessments provided and use assessment data to scaffold teaching practices with students during the program. Teachers will engage in collaborative activities across schools, which focus on the design and use of formative assessment tasks specific to the teaching units selected.

6. Gathering of assessment data on student collaborative problem solving skills, ICT digital literacy for learning, and general capabilities at the end of the program.

*2.4 Teacher development*
The aspect of the project relating to teachers will require professional development workshops to help teachers understand how 21st century skills can be embedded within the core capabilities and in turn within discipline based key learning areas (KLAs). This will enable teachers to utilise the formative assessment data generated using collaborative problem solving tasks to improve student learning outcomes. It will enable them to draw on additional pedagogical approaches that may enhance performance. Additionally, it will enable them to evaluate how well students perform and how changes in performance are related to intervention strategies and resources.

Module 1 – Overview of developmental learning and assessment; procedures and environment to implement evidence-based teaching interventions; 21st century skills in the context of the Australian Curriculum general capabilities.

Module 2 – 21st century skills in context of the Australian Curriculum including specific strategies in specific units of study; identification of specific intervention strategies and resources that are relevant to levels on a developmental progression; guidance on evaluating the impact of teaching intervention which will involve linking intervention and resources to student change in proficiency.

*2.5 Development of curriculum materials, assessment tasks and teaching resources*
Curriculum materials and teaching strategies will be developed to help teachers prepare students for learning through the use of collaborative problem solving strategies appropriate for the curriculum area. The formulation of teaching strategies will be based on feedback obtained from the assessments of general collaborative problem solving in ATC21S, as well as from literature on collaborative problem solving, teaching practices currently used in the school systems, and from suggestions from teachers for enhancing student performance.

Workshops and focus group activities will be undertaken with teachers to identify best practice strategies and pedagogical approaches for the promotion of improved performance among students within a developmental approach associated with 21st century skills. In addition, specific progressions within the domain of collaborative problem solving for social and cognitive skills will be developed as they relate to the general capabilities and learning area in focus. Consistent with this will be use of ICT literacy skills and approaches relevant to the consumer, producer, or developer of social and intellectual capital streams of this domain.

*2.6 Outcomes*
The measurable outcomes of interest in this study are the:

- KLA skills

- collaborative problem solving skills

- ICT digital literacy for learning skills

- general capabilities.

It is presumed that high level performance across these areas will enhance students' successful progress through the education system as well as navigation of adult life. For the purposes of this project, science and history are proposed as the key learning areas through which development of the non-discipline-specific skills and the general capabilities will be examined. For Phase 1 subjects of the Australian Curriculum only are eligible for selection. Within these, science is slated for PISA 2015 and therefore constitutes a useful choice. History is selected based on its capacity for the consideration of the humanist issues reflected in the general capabilities. Both subjects provide a compatible environment for cross-curriculum activities through digital and e-learning technologies. Note that students' collaborative problem solving skills will also be assessed in PISA 2015.

*2.7 Project activities in phases 1 and 2*
Units of work within the core Australian Curriculum for Science and History in Year 8, and possibly Year 9 classrooms, will be taught with an emphasis on use of collaborative problem solving skills and ICT digital literacy for learning skills. These skills will be evident in the pedagogical approaches used by the teachers and in the work products and learning of the students. Additionally, clusters of schools will participate in professional development activities, and students across schools may collaborate in networks as part of their learning.

The project will be characterised by the use of formative assessment approaches. Inquiry-based learning will be scaffolded appropriately in order to develop among the students the 21st century skills identified through the ATC21S project and reflected in the general capabilities of the Australian Curriculum. Development of resources and strategies will occur in two stages: prior to, and at the same time as, the teaching and learning activities. The latter stage will consist of teacher input in order to maximise their learning and engagement with the approach.

The cognitive and social demands of collaborative problem solving are quite complex, as is the use of ICT literacy through digital networks. Factors such as year levels targeted for PISA 2015 and National Assessment Program 2014 may need consideration in finalising decisions concerning best year level/s for implementation.

*2.8 Participation*
Consideration should be given to school selection in order to optimise work in clusters of schools. This will ensure critical mass for both teacher and student collaboration. Participating schools will be offering the Australian Curriculum, will need to be prepared to work within clusters at the year levels and within subjects which are targeted, and will need to have one-to-one computing environments for students.

In order to provide meaningful professional development for teachers in participating schools, these schools will need to have current or potential capacity and readiness to work together. In part this will also act as a collaborative model for the students. Given the emphasis on e-learning, it is essential that the schools have infrastructure to support this.

The proposed sample size is 20 schools for each participation condition (experimental and control), making a total of 40 schools. This sample size is expected to provide sufficient substance to enable measurement of effects of treatment. Schools will be randomly allocated to one of the participation conditions: in both conditions students will provide data through pre/post tests on 21st century skills; through e-technology (ICT); and end-of-term assessment within the units of study. One condition will receive the teaching and learning intervention; the other will not.

Notwithstanding some technical issues associated with this design (for example contamination of the control condition schools due to the pre-test) it is simple and straight forward to implement. Given the relatively small number of schools required to provide a robust outcome, the randomisation might not be adequate to ensure that the profile of each sample is roughly the same. Consequently, some intentional allocations of participating schools to treatment and control may be necessary.

*2.9 Technologies infrastructure*
Necessary technologies include a registration and logon system for the cloud platform for the assessment tasks, social and broadcast media, mobile technologies, data logging, spreadsheets, databases, assessment tasks, and automatic scoring leading to the generation of reports for use by teachers for direct intervention.

*2.10 Summary of phases 1 and 2*
Both generic skills and learning area-related knowledge and skills will be taught and assessed. This requires that teachers receive professional development prior to teaching and learning activity start, and have appropriate curriculum resources to supplement those already intended for use by the schools. The major components of the project are:

- implementation of the learning area using strategies and resources based on collaborative problem solving skills and contextualised by the general capabilities

- measures of the implementation.

## 3. Phase 3

This phase should be a longer-term goal of governments and involves the systematic adoption of these approaches across all level of schools. It involves major change to the ways in which schools operate. Although the specific strategy will depend on the piloting of earlier phases, it is critical that it involve both top-down support in the form of policies, strategies and resources, and the critical bottom-up opportunities for teachers as innovators within a community of practice.

# Proposed Project 2

# National Virtual Languages Space

## 1. Project description

This project aims to develop an effective language learning environment through the use of innovative digital technology. The proposed project will establish a National Virtual Languages Space (NVLS) which will provide teachers and students with a range of digital resources and technologies to support the language learning process.

Language learning is already undergoing a digital revolution. By June 2013, Mandarin Chinese, the first Australian Curriculum Asian language learning area to be released, will be delivered on a virtual learning and teaching technology platform known as the Language Learning Space (LLS). Developed under the Supporting the Australian Curriculum Online (SACOL) initiative, the proposed project draws on the advantages afforded by the NBN and leverages the LLS to provide a breakthrough service to support students' learning languages, with an extensive range of digital resources connected to bilateral, regional and global networks in what will be a comprehensive language learning environment.

The digital resources will include video, audio and web conferencing, webinars and video on demand, portals and immersive environments, content and learning management systems and resource exchanges, email, Skype, social media, bulletin boards, forums and blogs. Engagement activities include simulated immersion experiences, games and collaborative projects with international peers.

The *Australia in the Asian Century White Paper*[48] recognises that there is much to be done to extend and deepen people-to-people connections upon which to build Asian cultural literacy in Australia, including proficiency in Asian languages. Language barriers can produce a disconnection between cultures and hinder interaction at a business and cultural level.

While Australia's awareness of engaging effectively with Asia has increased over the last decade, a decline in language enrolments and retention for language learning has been apparent. For example, in relation to Indonesian language, which in 1972 had 1190 students studying the language at Year 12 nationally, but only 1100 in 2010 when Australia's population had increased by a third. This is down from 1300 in 2008, and is half of what it was 10 years ago.[49]

Reasons for this decline include shortage of skilled teachers, limited funding, negative or misunderstood perceptions among students and parents about other countries and about studying foreign languages as well as the perceived difficulty and considerable time commitment required to develop fluency, particularly for Asian languages.

Many language classes lack quality materials and peer-to-peer communication and the language being learned is limited and lacks authenticity. This makes it difficult for learners to sustain interest in the communication, especially where immediate feedback is not available.

The National Virtual Languages Space will be accessible to teachers and students in schools through the Scootle digital education interface and via jurisdictional education authorities' delivery systems and portals. It can be accessible to students, their parents/carers and community members through

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[48] http://asiancentury.dpmc.gov.au/white-paper

[49] www.asiaeducation.edu.au/verve/_resources/OverArchingReport.pdf

other portals, such as those associated with universities and TAFE colleges or by national broadcasters ABC and SBS.[50]

## 2. How the proposed initiative will work

The online NVLS will systematically support language learning with a national and international reach through services, resources and tools designed to reinforce basic concepts, vocabularies and characters, reward and encourage practice and simulate the immersion experience. It will enable students to interact with resources including native language speakers, contextual and cultural information and online tools. Students will be linked with classes of their language speaking peers and provided with access to online tutoring and practice services and tools from both school and home. Parents/carers and community would also be able to engage through these media.

Professional support for teachers will be provided through online professional learning, networking and global communities of practice to enable participants to share ideas and strategies and link to language experts and professional associations. Teachers can also connect with native language speakers and supervisors, both in Australia and other countries.

The learning and teaching tools and resources will be aligned to the Australian Curriculum and potentially include video, audio and web conferencing, webinars and video on demand, portals and immersive environments, content and learning management systems and resource exchanges, email, Skype, social media, bulletin boards, forums and blogs. These language resources simulate an immersion experience, reinforce basic language constructs, build vocabularies and character recognition, encourage oral practice, link teachers and students to a network of native speakers.

Research and practice suggests that successful language learning best occurs when there are high quality, authentic and demanding cultural and linguistic resources, when there are plenty of opportunities to practice what has been learned, when there is positive feedback which helps learners to strengthen their linguistic knowledge, and when the program is responsive to learner differences and enables the learners to adjust the difficulty level of the content, control the pace of learning, and select content that is appropriate for their own needs.

The LLS will focus particularly on increasing students' engagement in language learning, although there will be some materials for teachers to use in the classroom. It will focus on core language skills, and on key 21st century skills of problem solving, decision making, creative thinking, collaboration, communication and negotiation.

## 3. Project delivery

The technical platform for the digital LLS will be completed in July 2013 along with procurement and development of tools, resources and networks to support Chinese Mandarin. At the same time, components for the comprehensive learning environment to support languages can be procured and developed.

It is proposed that the project development would be nationally managed to avoid duplication of effort and to optimise national interoperability.

The methodology includes:

- scope definition including learning objectives, target user segments, geographic coverage and optimal types of learning delivery methods

- planning of the environment including identifying technologies and resources to support the whole language learning process

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[50] The BBC offers a very accessible and highly sophisticated web-based language learning service at www.bbc.co.uk/languages/

- consultation with second language acquisition experts, teachers, professional bodies, publishers and other key stakeholders to inform development

- identification of appropriate technologies to support delivery of an appropriate learning environment

- resource procurement and development including alignment with the Australian Curriculum, content preparation and quality assurance

- project governance and reporting including visibility of project progress and opportunity for key stakeholders to participate in key decision making during the life of the project

- help desk to support users.

# Appendix 1

## Membership of the Digital Education Advisory Group

Professor Shirley Alexander (Chair)
Deputy Vice-Chancellor (Teaching, Learning and Equity)
University of Technology, Sydney

David Barnett
Chief Executive Officer
Pearson Australia and Pearson New Zealand

Susan Mann
Chief Executive Officer
Education Services Australia

Anthony Mackay
Chair
Australian Institute for Teaching and School Leadership
Deputy Chair
Australian Curriculum, Assessment and Reporting Authority

Dr Michelle Selinger
Director, Education Practice
Cisco Systems

Greg Whitby
Executive Director of Schools
Catholic Education Diocese of Parramatta

# Appendix 2

## Panel of Australian Experts on Learning

Professor Peter Goodyear

Australian Laureate Fellow

Co-director, Centre for Research on Computer Supported Learning and Cognition

University of Sydney


Professor John Sweller

School of Education

University of New South Wales


Professor Geoff Romeo

Associate Dean Learning and Teaching

Faculty of Education

Australian Catholic University


Professor Patrick Griffin

Executive Director, Assessment & Teaching of 21st Century Skills

University of Melbourne

# Glossary

**adaptive learning**
An educational method that uses computers as interactive teaching devices.

**artificial intelligence (AI)**
The intelligence of machines and the branch of computer science that aims to create it.

**assessment bank**
An online collection of assessments and resources.

**augmented reality**
A live, direct or indirect, view of a physical, real-world environment whose elements are *augmented* by computer-generated sensory input such as sound, video, graphics or GPS data.

**bandwidth**
A computer networking term referring to the data rate supported by a network connection or interface, most often expressed in bits per second. Bandwidth represents the capacity of the connection. The greater the capacity, the more likely that greater performance will follow.

**blog**
A contraction of the term *web log*: a discussion or informational site published on the World Wide Web and consisting of discrete entries ('posts').

**bring your own device (BYOD)**
A policy of students bringing personally owned mobile devices to their school and using those devices to access school and educational resources such as email, file servers and databases as well as their personal applications and data.

**cloud computing**
The use of computing resources (hardware and software) that are delivered as a service over a network (typically the internet). The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure contained in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation.

**cognitive load theory**
A theory designed to provide guidelines intended to assist in the presentation of information in a manner that encourages learner activities that optimise intellectual performance.

**collaborative tool**
Any computer device or program that helps people solve a predefined task together in a group more easily, including video conferencing, internet relay chat, instant messaging, online whiteboards, and wikis for peer collaboration.

**connectivity**
The ability to make and maintain a connection between two or more points in a telecommunications system.

**cross-curriculum priorities**
Three cross-curriculum priorities are identified in the Australian Curriculum: Aboriginal and Torres Strait Islander histories and cultures, Asia and Australia's engagement with Asia, and Sustainability. The cross-curriculum priorities are embedded in learning areas as appropriate.

**cyber safety**
The security of people and their information when using the internet: protection from computer viruses, internet fraud, unwelcome websites and unsuitable message exchanging.

**design thinking**
The methods and processes for investigating ill-defined problems, acquiring information, analysing knowledge, and positing solutions in the design and planning fields.

**digital**
Commonly used to describe programs, products and activities related to binary technology, such as computers, personal devices, CDs, DVDs and internet communication.

**digital economy goals**
http://www.nbn.gov.au/the-vision/digital-economy-goals/

**Digital Education Revolution**
An Australian Government funded educational reform program launched in late 2008, with funding of $2.1 billion over seven years.

**e-book**
An electronic book: a book-length publication in digital form, consisting of text, images, or both, and produced on, published through, and readable on computers or other electronic devices.

**e-learning**
All forms of electronically supported learning and teaching.

**e-portfolio**
An electronic portfolio, also known as an e-portfolio or digital portfolio, is a collection of electronic evidence assembled and managed by a user, usually on the Web.

**electronic whiteboard**
A large interactive display that connects to a computer and projector. The board is typically mounted to a wall or floor stand. Also called an interactive whiteboard or IWB.

**exemplar schools**
The six schools identified in the DEEWR Australia-wide Exemplar Schools project as promoting the exemplary use of information and communication technologies (ICT).

**future-proof**
To try to anticipate future developments so that action can be taken to minimise possible negative consequences, and to seize opportunities.

**identity management system**
An information system, or set of technologies, that can be used for enterprise or cross-network identity management, i.e. the management of individual identities in cyberspace, their authentication, authorisation, roles and privileges within or across system boundaries, with the goal of increasing security and productivity.

**knowledge society**
A highly competitive society whose key resource is knowledge and where knowledge workers are the dominant group in the workforce.

**knowledge economies**
Where knowledge technologies such as knowledge management are used to produce economic benefits and create jobs.

**Improve**
Improve is an online formative assessment tool developed by Education Services Australia for use by education jurisdictions. The tool assists teachers to easily access and use numeracy, literacy and science test items that are digitally linked to relevant curriculum and learning resources.

**innovative**
Using or showing new methods, ideas or technologies.

**internet access device**
Device allowing access to the internet, particularly the mobile devices such as laptop, tablet and smartphone.

**interoperability (interoperability standards)**
Interoperability is the ability of diverse systems and organizations to work together (inter-operate). The term is often used in a technical systems engineering sense, or alternatively in a broad sense, taking into account social, political, and organizational factors that impact system to system performance.

**inquiry-based learning**
A form of active learning, where progress is assessed by how well students develop experimental and analytical skills rather than how much knowledge they possess.

**KLAs**
Key learning areas. These are the mandatory subject areas taught in schools. There are six KLAs in primary school and eight KLAs in secondary school learning platforms.

**metacognition**
'Knowing about knowing'. It can take many forms; it includes knowledge about when and how to use particular strategies for learning or for problem solving.

**metadata**
The descriptive data about information and records that allows people to know what they are about, understand their context and purpose, and be able to find them when they need to.

**NAPLAN**
National Assessment Program – Literacy and Numeracy (NAPLAN) commenced in Australian schools in 2008. Every year, all students in Years 3, 5, 7 and 9 are assessed on the same days using national tests in Reading, Writing, Language Conventions (Spelling, Grammar and Punctuation) and Numeracy.

**online**
Connected to a computer or computer network.

**online portal**
A website that displays information from diverse sources in a unified way.

**paradigm**
Intellectual perception or view, accepted by an individual or a particular field or community as a clear example, model or pattern of how things work in the world.

**paraprofessional**
A person who is trained to assist professionals in an occupational field, e.g. education, but who does not have professional qualifications and standing in that field themselves.

**pedagogy**
The holistic science of education.

**personalised learning**
The tailoring of pedagogy, curriculum and learning environments to meet the needs and aspirations of individual learners, often with extensive use of technology in the process.

**pilot project**
An activity planned as a test or trial.

**Pinterest**
A pinboard-style social photo sharing website that allows users to create and manage theme-based image collections such as events, interests and hobbies.

**PISA**
Programme for International Student Assessment: a worldwide study by the Organisation for Economic Co-operation and Development (OECD) in member and non-member nations of 15-year-old school pupils' scholastic performance on mathematics, science, and reading.

**quantum technology**
A new field of physics and engineering which takes some of the special features of quantum mechanics and applies them in areas such as quantum computing and quantum imaging.

**scaffolding**
The support given during the learning process which is tailored to the needs of the student with the intention of helping the student achieve their learning goals.

**Scootle**
Website published by Education Services Australia for use by teachers, containing a large store of digital curriculum resources relevant to Australian schools.

**Semantic Web**
A collaborative movement led by the international standards body, the World Wide Web Consortium (W3C). The standard promotes common data formats on the World Wide Web.

**search engine**
A program designed to search documents for specified keywords and return a list of documents where the keywords have been found, e.g., Google, Bing, Yahoo.

**Skype**
A service allowing users to communicate with each other by voice, video, and instant messaging over the internet.

**smartphone**
A mobile phone built on a mobile operating system, with more advanced computing capability and connectivity than a feature phone, e.g., iPhone developed by Apple Inc.

**socio-economic status**
An economic and sociological combined total measure of an individual or family's economic and social position in relation to others, based on income, education and occupation.

**step-change**
A sudden or major change in the way that something happens or that people behave.

**student-centred learning**
An approach to education focusing on the needs of the student, rather than those of others involved in the educational process, such as teachers and administrators.

**systemic change**
Change that occurs in all aspects and levels of the educational process and that affects all of the people included in this process—students, teachers, parents, administrators, and community members.

**tablet**
A mobile computer, larger than a mobile phone or personal digital assistant, integrated into a flat touch screen and primarily operated by touching the screen rather than using a physical keyboard, e.g., iPad developed by Apple Inc.

**TIMSS**
Trends in International Mathematics and Science Study: an international assessment of the mathematics and science knowledge of fourth grade and eighth grade students around the world. TIMSS was developed by the International Association for the Evaluation of Educational Achievement (IEA) to allow participating nations to compare students' educational achievement across borders.

**transactive memory**
A transactive memory system is a system through which groups collectively encode, store and retrieve knowledge.

**Twitter**
An online social networking and microblogging service enabling users to send and read text-based messages, known as 'tweets'.

**virtual classroom**
Online, live teacher instruction and feedback that enables real-time voice interaction, whiteboard sharing, and 'breakout sessions' to enhance a student's learning experience.

**Web 2.0**
A concept that takes the network as a platform for information sharing, interoperability, user-centred design and collaboration on the World Wide Web.

**webinar**
An interactive seminar conducted via the World Wide Web. Usually a live presentation, lecture or workshop that happens in real time.

**wicked problem**
A phrase used to describe a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognise.

**wiki**
A website that allows its users to add, modify, or delete its content via a web browser.

**wired and wireless networks**
Wired computer networks communicate through data cables and wireless networks communicate through radio waves, as mobile phones do. Wired networking technology, known as Ethernet, provides high speed and high performance at relatively low cost, but the fixed connection via physical data cables limits mobility. Also known as Wi-Fi, the newer wireless network technology allows much greater mobility and does not require the installation of cables for connection.

**YouTube**
A video-sharing website on which users can upload, view and share videos.