RESEARCHING
CONNECTED COMMUNITIES

MacICT
Macquarie ICT Innovations Centre

PEDAGOGY
CURRICULUM
TEACHERS
LEARNING
CHANGE
TEACHERS
STUDENTS
PEDAGOGY
TECHNOLOGY
CHANGE
LEARNING
CURRICULUM
TEACHERS
STUDENTS
PEDAGOGY
MACQUARIE UNIVERSITY
NSW Education & Communities
Public Schools NSW
Researching Connected Communities 21 is a report published by Macquarie ICT Innovations Centre, representing a collaboration between Macquarie University and The New South Wales Department of Education and Communities.

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This report was prepared by Michael Stevenson and Cathie Howe, with input from all project team members, especially Professor John Hedberg. Website and project administration, graphic design and some photography and event management were provided by Lyrian McGregor.

CITATION


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EXECUTIVE SUMMARY

Research on current technology-related issues in Australian education reflects some common themes: the fast-changing nature of available tools and current push to nationalise the curriculum alongside substantial increases to both technology access and use in Australian schools. At the same time, there exist problems such as ineffective use of ICTs for learning, with managing and leveraging change, and the implementation of “one-size-fits-all” interventions that may not address the unique needs of each school – problems that are not unique to the Australian context. The Connected Communities 21 (CC21) project represents a collective case study of seventeen Australian government schools promoting the development of self-managed models of change while exploring digital tools for learning and connecting best practice within and between schools.

This project was developed as a research and professional learning partnership between Macquarie ICT Innovations Centre (MacICT) and the Department of Education and Communities (DEC) in December 2012, with both professional learning and research activity undertaken throughout 2013. The research component of the project explored how schools self-manage change when confronted with the pressures of a redeveloping materials for changing curriculum, adopting new technologies and re-thinking pedagogies. Each individual participant was identified by his or her school community as either a technology innovator or as someone who is disposed towards learning about innovating with technology in the school. As part of the study, schools were asked to submit expressions of interest and successful schools received AU$10,500 in funding.

Each expression of interest articulated a school addressing the three areas of pedagogy, technology and the new Australian Curriculum. Because of the different needs and collective interests in each school, the proposed projects differed in scope, focus and scale. For example, while some schools focused on technologies that were currently in place, others used their project as an opportunity to acquire and explore new technologies. Likewise, while some schools attempted a school-wide project with every teacher involved, others included only a small number of teachers. Consequently, each school also employed their resources differently. The research team gathered extensive data through one-on-one and focus group interviews, classroom observations, blog posts, participant reflections and questionnaires.
KEY FINDINGS

• CC21 schools were typical of Australian schools, with very high levels of access to technology. Nonetheless, each school recognised the challenges of transforming access into meaningful use.

• The majority of CC21 funds were spent in the area of teacher release. Related findings strongly suggest that teachers and school leaders used release time for unstructured professional learning rather than formal training. Participants perceived time as the most important factor in the success of their school’s project.

• A considerable portion of overall funds was spent on the acquisition of new hardware devices, especially iPads. Given that iPads were not a device supported by the school system, many schools spent additional funds purchasing infrastructure (especially wireless access points) for connecting these devices to the Internet. Related findings suggest that self-managing schools typically consider the learning affordances of technology over support for specific devices and software platforms.

• Many participants used the changing curriculum context as an opportunity to explore pedagogical models that had previously not been part of the school’s curriculum. In particular, teachers and school leaders with varying levels of experience and training employed the models of Inquiry-Based Learning (IBL) and Project-Based Learning (PBL). However, findings suggest that the implementation of these models was not always consistent, especially where there was evidence of change-resistance and/or limited training.

• Most school leaders cited the influence of current popular thinkers in Education. In all cases, these thinkers each had a well-established online presence (for example, attractive websites and/or thousands of followers on social media). Most CC21 school leaders used technology tools to connect with these popular thinkers and draw ideas and inspiration from online communities of connected educators.

• Leadership styles across the participating schools varied enormously, sometimes reflecting “top-down” and “bottom-up” approaches. The style of leadership was usually reflected in the school’s project. Leaders that chose to implement whole-of-school projects tended to ensure clear directions, guidance and appropriate monitoring of all teachers. By contrast, leaders whose projects were limited to small teams tended to allow for greater autonomy and did not require all teachers in the school to implement the project. In general, projects were more successful in whole-of-school projects, where the principal took an active role.

• Among the participating schools, secondary schools reflected a range of project-related challenges not typically found in primary schools. These included the fragmentation of teaching staff in subject areas and geographically-divided staffrooms, pressures associated with teaching HSC classes such as exam preparation and marking, and the relative size of each secondary school. Findings suggest that the professional learning model employed as part of CC21 could be adapted further to respond to the unique needs of secondary school teachers.

• Further research in relation to equity is warranted. Many of the classrooms and opportunities for enhanced student learning reflect best cases. However, mechanisms for ensuring that resources for quality teaching are shared within and between schools require further development. In particular, inter-school dialogue could be fostered further through models like CC21, where participants are encouraged to document and share best practice through as members of a broader online community.
1. CONTEXT

INTRODUCTION

The Australian Curriculum encompasses its own broad set of skills and standards, the seven “general capabilities” that include ICT, critical and creative thinking, ethical behaviour and intercultural understanding. This new curriculum represents ICTs both as specialised subject skills and content knowledge, and as broader, cross-curricula skills. Future curriculum development will focus on the areas of design and computational thinking as new skill sets to be developed further.

1.1 – General Capabilities in the Australian Curriculum

“All Australian students need to become creative and productive users of technology, especially ICT, as a foundation for success in all learning areas” (MCEETYA, 2008, p. 8).

In line with many of the changes to technology devices and applications in recent years, education systems throughout Australia continue to plan and implement one-to-one device-to-student ratios through large-scale deployments of laptops and mobile devices. As part of the Digital Education Revolution (DER), this wide-scale implementation of technology devices still represents what could be regarded as a “heretofore-unattained scale and disturbance in the equilibrium of classrooms and schools” (Bebell & O’Dwyer, 2010). Improved access to technology devices in the classroom is a trend likely to continue, given the ubiquity of very low-cost mobile smart devices along with the proliferation of education apps, e-textbooks and web tools for collaboratively engaging with, remixing and publishing content. For students in Australian schools, the level of access to technology devices and software now places us very highly in international OECD rankings – a close second position in the percentage of students (91.6% to Norway’s 93%) who regularly use a computer at school (OECD, 2011). Further, Australian students are well above OECD
averages in access to computers at home and in terms of the percentage difference in access (both school and home) between the top and bottom quartiles of the PISA index of socio-economic status.

### 1.2 – Technology in schools: how Australia compares

<table>
<thead>
<tr>
<th>OECD Country</th>
<th>Percentage of students who use a computer at home (%)</th>
<th>Percentage of students who use a computer at school (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD Average</td>
<td>92.3</td>
<td>74.2</td>
</tr>
<tr>
<td>Korea</td>
<td>87.5</td>
<td>62.7</td>
</tr>
<tr>
<td>New Zealand</td>
<td>92.5</td>
<td>83.4</td>
</tr>
<tr>
<td>Australia</td>
<td>96.7</td>
<td>91.6</td>
</tr>
<tr>
<td>Japan</td>
<td>75.9</td>
<td>59.3</td>
</tr>
<tr>
<td>Iceland</td>
<td>99.1</td>
<td>79.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>97.7</td>
<td>89.1</td>
</tr>
<tr>
<td>Ireland</td>
<td>93.2</td>
<td>62.9</td>
</tr>
<tr>
<td>Belgium</td>
<td>96.9</td>
<td>62.8</td>
</tr>
<tr>
<td>Norway</td>
<td>98.7</td>
<td>93</td>
</tr>
<tr>
<td>France</td>
<td>m</td>
<td>m</td>
</tr>
<tr>
<td>Denmark</td>
<td>98.8</td>
<td>93</td>
</tr>
<tr>
<td>Spain</td>
<td>92.6</td>
<td>65.5</td>
</tr>
</tbody>
</table>

(OECD, 2011)

As we move forward, there are at least as many questions around effective *use* of technology in education as there are perceived benefits. In stating its goals for equity and excellence in schools, the products of which should be confident, creative, successful, active and informed citizens, the *Melbourne Declaration on the Education Goals for Young Australians* subtly draws attention to the disjuncture between technology access and effective use: “while schools already employ these technologies in learning, there is a need to increase their effectiveness significantly over the next decade” (MCEETYA, 2008, p. 8). In order to explore use further, as Clinton, Purushot, Robison and Weigel (2006) point out, we need to “shift the focus of the conversation about the digital divide from questions of technological access to those of opportunities to participate and to develop the cultural competencies and social skills needed for full involvement” (p. 6).
The Connected Communities 21 Project (CC21) was developed and managed by Macquarie ICT Innovations Centre as part of the research and professional learning partnership between the NSW Department of Education and Communities and Macquarie University in December 2012, running as a yearlong project in 2013. The purpose of the project was to explore how schools self-manage change when confronted with the pressures of redeveloping materials for changing curriculum, adopting new technologies and re-thinking pedagogies. The project employed the research design of a collective case study, which closely examines the professional learning of educators from seventeen Australian government schools. Each individual participant was identified by his or her school community as either a technology innovator or as someone who is disposed towards learning about innovating with technology in the classroom. As part of the study, schools were asked to submit expressions of interest and successful schools received AU$10,500 in funding which they were then free to employ in any way they saw best.

Each expression of interest articulated a school project for enabling teacher professional learning that addresses the three areas of pedagogy, technology and the new Australian Curriculum. Because of the different needs and collective interests in each school, the proposed projects differed in scope, focus and scale. For example, while some schools focused on technologies that were currently in place, others used their project as an opportunity to acquire and explore new technologies. Likewise, while some schools attempted a school-wide project with every teacher involved, others included only a small number of teachers.

As schools implemented their projects, researchers studied each school in relation to the following research questions.

1. *What teacher actions impact upon ICT usage in the classroom?*

2. *How can teachers be supported to effectively employ ICTs as part of their pedagogy?*

3. *How can teachers be most effectively supported to effectively implement the new Australian Curriculum?*

4. *What are the contextual constraints that impact on teacher use of ICT as part of implementing the new curriculum?*

5. *How can contemporary technologies be most effectively used to support learning and teaching?*

6. *How can evidence-based approaches to learning technology innovation influence teacher practice?*
1.3 Summary of Stages, Procedures and Methodology

<table>
<thead>
<tr>
<th>Stage</th>
<th>Procedures and Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Orientation</td>
<td>The CC21 Project was introduced and discussed at a general workshop (Killara Public School), with participants informed of the key stages, requirements and objectives. Participants shared their professional learning goals with reference to their school’s strategic vision for ICT use. One-to-one interviews were conducted with each participant to establish their role in the project and personal learning goals.</td>
</tr>
<tr>
<td>2. Digital Learning journey (ongoing data collected via weekly emails and blog posts)</td>
<td>A combined/centrally-managed Wordpress blog with ongoing posts from each participant documented the sharing of each school’s learning journey. This was combined with ongoing email and phone contact from the project team.</td>
</tr>
<tr>
<td>3. The school environment</td>
<td>Project coordinators visited participants’ schools to interview key change agents, including principals, teacher leaders and classroom practitioners. Many participants invited researchers to visit classrooms and observe teachers engaging in effective use of technology.</td>
</tr>
<tr>
<td>4. Project conclusion and report</td>
<td>Participants completed an evaluation questionnaire (developed from the weekly reports) in which the project as a whole and their own professional learning were evaluated. Technology uses within the project were measured against the identified learning goals, with implications for next steps beyond the life of the project. Project coordinators collaborated to produce the final report on the study as a whole.</td>
</tr>
</tbody>
</table>

We are now at a point where more teachers and students are accessing innovative connected technologies in many more Australian schools and classrooms than at any time in history. As we critically examine our uses of these technologies, teachers need to invest in their own professional learning as active participants in research, collaboration and reflection. The Connected Communities 21 project worked with teachers as partners in the digital learning journey – exploring their levels of ICT use, building technology and discipline knowledge, understanding contextual factors shaping their practice and helping them to become change leaders within their school environment and the wider community. Through a rigorous, staged design utilising multiple methodologies that reflect the breadth and depth of participants’ learning journeys, CC21 represents innovative, robust research with the potential for making valuable contributions to the field of twenty-first century learning.
2. PROJECT TEAM

**Project Leader**  Dail McGilchrist

In 2012, when the CC21 project was initiated, Ms Dail McGilchrist was a School Education Director and Macquarie ICT Innovations Centre (MacICT) Executive Director. Through her efforts, MacICT received funding for the CC21 project and Ms McGilchrist was closely involved in the initial project design and selection of schools. During the project, Ms McGilchrist relieved as a Regional Director and then went on to become an Executive Director, Public Schools NSW. She has worked for the Department of Education and Communities for over 25 years in a range of teaching, leadership and consultancy roles. Ms McGilchrist has a depth of leadership experience and has led systems improvement in service delivery ensuring responsiveness to customer need is central to strategic planning. She has written documents to support implementation and assessment strategies for key reforms in public education and has led regional initiatives focusing on developing leadership capacity.

**Project Leader**  John Hedberg

Professor John Hedberg holds the Millennium Innovations Chair of ICT and Education in the School of Education. He has taught postgraduate courses on cognitive strategies, interface design for learning, and implementation and evaluation of technology-based learning. He has also taught strategic planning for technology implementation in schools and has also written on policy aspects of new technologies in education. He has designed training needs assessments, evaluation systems and conducted workshops on the instructional design and evaluation of e-learning environments. He has been keynote speaker at numerous conferences on the educational technologies in Canada, United States, Singapore, Malaysia, China, Europe, and many states in Australia.

**Project Leader (Rel)**  Myra Wearne

In 2013, Mrs Myra Wearne relieved as a School Education Director for the NSW Department of Education. As part of this role, Myra was an Executive Director of Macquarie ICT Innovations Centre and took over the CC21 Project Leaders role when Ms Dail McGilchrist became a Relieving Regional Director in 2013 for the NSW Department of Education and Communities.
Project Manager  Cathie Howe

Cathie is a Professional Learning & Leadership Advisor managing MacICT. She is the creative and strategic leader of an expanding, collaborative team that develops professional learning workshops for teachers as well as a range of student workshops. The teacher workshops focus on the challenges of designing learning that addresses content, pedagogy and the innovative integration of existing and emerging technologies in order to enhance learning and teaching across the NSW K-12 education sector. All workshops are grounded in evidence arising from research into transformative pedagogies for 21st century learners and how technology enhances learning. In collaboration with academic partners, Cathie pursues an innovative research agenda. Findings from research projects conducted through MacICT inform the education community & provide insight into new pedagogical approaches & the capacity of new technologies to enhance learning & teaching. Cathie also has expertise in building strong relationships and collaborations with a range of educational institutions and industry partners. Cathie has been involved in many research projects, including Transmedia Storytelling: Weaving a StoryWorld Web, Researching Connected Communities 21, Augmenting Reality: Students as e-design artists, iPads in the Year 1 Maths Classroom, Game Design: Invasion of the ShadowPlague.

Lead Researcher  Michael Stevenson

Michael is a doctoral student in the School of Education at Macquarie University. As an educator with over a decade of experience in the secondary classroom alongside a growing list of publications and conference presentations, he bridges the gap between research and practice with an ongoing commitment to professional learning. In addition to classroom teaching and research, Michael has worked as a technology mentor and strategy leader, advising in the development of learning management systems, 1-1 programs and ICT-curriculum alignment. His doctoral study explores the role online Personal Learning Networks in teacher professional learning. Since commencing full-time at Macquarie in 2013, Michael has been involved in several projects, including Connected Communities 21, Evaluating ABC Splash and a project exploring the impact of the NBN on pedagogies in the Australian Independent Schools network.

Project Critical Friend  Meredith Ash

Research Assistant  Vivian Tsui Han Leung
3. SCHOOLS & PROJECTS

A panel chose the seventeen participating schools based on expressions of interest submitted in December 2012. Over 100 primary K – 12 teachers were involved in this project. This chapter provides a brief profile on each school and excerpt from their Initial Project Plan submitted during Term 2, 2013.

Further details (including copies of each school's plan) are available on the CC21 website:

http://macictcc212013.wordpress.com

Artarmon Public School
Type of School  Primary
Enrolments  920

“...working collaboratively to investigate research that identifies pedagogical approaches for supporting 21st century learners... using the findings to plan, implement and review a series of lessons based on the new English syllabus.”

Beaumont Hills Public School
Type of School  Primary
Enrolments  612

“Inquiry Based Learning skills and strategies must be explicitly taught to students to ensure authentic learning takes place in a meaningful and purposeful learning environment...”

Barnier Public School
Type of School  Primary
Enrolments  690

“...the opportunity for Stage 3 students to mentor younger students and teachers in their existing knowledge of filmmaking... this empowers students and shows connectedness and value in existing knowledge and redefines the role of the teacher...”
Carlingford West Public School
Type of School  Primary
Enrolments  714

“This project is designed to engage teachers in effective ongoing professional learning in the authentic use of technology in teaching. The innovation is the creation of a learning environment that values sharing, trust, risk-taking experimentation, collaboration, inquiry and self-assessment.”

Epping North Public School
Type of School  Primary
Enrolments  414

“Teachers engage in a variety of professional learning opportunities including; robotics, web 2.0 tools, filming/editing, animation, online communication and collaboration platforms and Adobe software. They will then embed these technologies into their everyday practice...”

Hilltop Road Public School
Type of School  Primary
Enrolments  618

“...trialling iPod tracking systems which allow for immediate responses to assessment and reporting, uploading work samples to support consistent teacher judgements... and working with applications to create multimodal texts...”

John Purchase Public School
Type of School  Primary
Enrolments  654

“...working collaboratively to produce units of work incorporating the authentic use of technology... sourcing software and team teaching to trial and reflect on the effectiveness of the technology in enhancing the teaching and learning of mathematics.”

Chatswood High School
Type of School  Secondary
Enrolments  1228

“This project explores the use of iPad technology and constructive apps such as Explain Everything, Keynote, Pages, iMovie and others to enhance children’s learning for a digital age. Teachers will develop professional learning plans that focus on transforming learning for our Stage 3 students.”

Killara High School
Type of School  Secondary
Enrolments  1544

“...to improve student outcomes in the area of comprehension and digital technology and to continuously meet the needs of all students through higher order thinking and a quality learning environment. Our project aims to make learning relevant, significant and connected to students’ lives.”
Killara Public School
Type of School  Primary
Enrolments  325

“...to support and enhance staff confidence with ICT, particularly when using mobile technology... and work collaboratively to develop literacy units which are based on the new Australian English Curriculum...”

Pymble Public School
Type of School  Primary
Enrolments  414

“...developing classroom environments to support information and communication technology across the new syllabuses. Teachers will investigate ideas, beliefs, philosophies and case studies including those from Stephen Heppell and Yong Zhao...”

Regentville Public School
Type of School  Primary
Enrolments  663

“...exploring the development of a collaborative learning space within the English Faculty, that aims to incorporate a variety of teaching methods including lecture, project-based learning and team teaching... trialling a Bring Your Own Device (BYOD) program with Year 7... and researching platform-agnostic tools that function effectively across all devices...”

Manly West Public School
Type of School  Secondary
Enrolments  1228

“...exploring the pedagogical change that is required to incorporate 21st century learning fluencies whilst implementing the new Australian Curriculum: English.”

Quakers Hill Public School
Type of School  Primary
Enrolments  735

“...exploring a range of Literacy Apps for iPads that support both the teaching and learning with an emphasis on our Focus on Reading strategies. The apps support teachers in the delivery of curricula, teaching with 21st applications and skills and supporting student learning and assessment...”

St Ives High School
Type of School  Secondary
Enrolments  838

“This project explores how iPads and digital storytelling apps can be utilised to enhance creativity and creative thinking skills in K-6 classrooms. Project-based learning will be used as a platform in which students will have the opportunity to collaborate and work towards a shared goal...”
Turramurra High School
Type of School  Secondary
Enrolments  1206

“...following the TPACK model in our design process being careful to integrate rather than ‘add on’ appropriate technology to facilitate learning... with a much greater use of both student-centred learning and digital resources...”

William Dean Public School
Type of School  Primary
Enrolments  259

“...to develop an integrated unit of work that reflects part of the English and Science and Technology Syllabus content, skills and capabilities.... with a wide range technologies to support students to research information, collect evidence, organise and sequence findings in a way that they are able to apply the knowledge to a real life situation and share their learning with others.”
The Principal or nominated executive, and another staff member from each school, were required to attend three face-to-face full day workshops throughout the duration of the CC21 project. The purpose of these workshops were to provide project information and updates, professional learning, facilitate the sharing of project goals and progress, answer questions and provide support. A selection of Google Apps were used over the three workshop days in light of the New South Wales Department of Education and Communities (NSWDEC) announcement that Google Apps@DEC would be available to every student and teacher through DEC’s portal sometime during 2013.

CC21 Launch Day Workshop, Friday March 1st 2013
This was the first workshop the nominated participants were required to attend. At this workshop the project team:

- introduced the MacICT project team of Myra Wearne, Prof. John Hedberg, Cathie Howe, Michael Stevenson and critical friend, Meredith Ash;
- welcomed each of the project schools;
- provided an overview of current research and literature around transformative pedagogies, 21st century fluencies and the role of technology;
- explored some contemporary instructional models;
- explored notable changes in the new NSW BOS syllabuses for the Australian curriculum and how the content is organised;
- informed participants of the project timeline, objectives and requirements;
- required participants to outline their initial project plan in a co-constructed Google Doc; and
- introduced participants to the project blog and allowed time for each school to write their initial blog post.

CC21 Progress Meeting, April 9th 2013
This workshop provided CC21 project participants with an opportunity to share project plans and seek further support from project team and other participants.
Data collection methods were discussed as well as support requirements once projects commenced in Term 2.

During this workshop day, participants participated in a presentation by Drew Arthurson, National Business Development Manager, Education Apple on *How to Design and Implement successful Technology Projects in Schools*. Project leaders introduced participants to Google Presenter and Creative Commons. Participants then presented their updated project plans to the rest of the group. These 5-minute presentations were videoed. Blog posts were written to reflect the challenges and key actions by each participant in their project’s progress. To conclude the day, participants all contributed material to a shared Google Presentation.

**CC21 Showcase Planning and Preparation Workshop, August 13th 2013**

The purpose of this workshop is to outline to participants what was going to happen at the CC21 Showcase on September 10 2013 at Macquarie University and assist project participants in preparing for the Showcase. During this workshop participants were: first, informed of the plan for the Showcase day including Showcase themes of *Telling Stories* and *Why Learning Matters*; and, second, introduced to the concept of creating a mashup video as a suggested approach to telling their school’s story.

Participants were also given advice on creative processes and cross platform Apps useful for showcasing project work. Some of these Apps included Animoto for project highlights, Popplet for conceptual planning, Google Drive for collaboration, iPad video for student learning in action and Edmodo for organisation and sharing. Participants were also given time in school groups for planning and to start creating some of their Showcase elements with the option to receive technical support and guidance from the Project Team. The final workshop session involved the school representatives participating in a Critical Friends session. This helped to further develop collegial relationships between the CC21 community, encourage reflective practice provided useful feedback to each school on their Showcase plans. Feedback via the critical friends process was recorded into a co-constructed Google Doc.

The Project team received positive feedback on each of the CC21 workshop days. One of the greatest benefits to the participants who attended the workshop days was the opportunity to hear each school’s projects plans and approaches to leadership and implementation. Strong networks emerged from these days resulting in school visits and phone, email and online discussions between participants from different schools.
The twenty-first century presents new opportunities for professional learning within and beyond the school, not least with the increasing connected affordances of free and cheap technology tools now commonplace throughout most developed (and many developing) world contexts. In particular, the proliferation of mobile apps and Web 2.0 tools enables access to both information sources and people across traditional geo-political divides. For example, educators can use tools for content aggregation and social media to access a wide range of information sources from industry, education and other experts, and to form people-to-people connections outside of traditional school- and system-based networks. Increasingly recognised as the “Personal Learning Network,” or PLN (Couros, 2010; Richardson & Mancabelli, 2011; Warlick, 2009) educators are now able to use technology tools construct and manage very personalised online networks of information and people that are relevant to their professional learning needs. As Warlick (2009) explains, the PLN provides educators with ways:

- to tap into connected and cultivated communities of interest to find information sources, suggestions for lesson plans, potential collaborators, current events and trends, new opportunities, resources, and a wide variety of other answers and solutions. PLNs open up doors to sources of information that were not even available a few years ago, and continually evolving technologies are making it easier to capture and tame the resulting information overload (p. 13).

Apart from the many combinations of information sources and people-to-people connections, the PLN also reflects a diversity of technology tools. For example, tools like Feedly and TweetDeck provide ways to aggregate multiple RSS feeds, follower lists and hashtags, while teleconferencing tools such as Skype and Adobe Connect facilitate audio/video links between geographically divided schools. Social media tools like Twitter enable both content aggregation and people-to-people connections, allowing educators to follow and communicate with professionals in areas that include key organisations, current thought leaders, academics and teacher bloggers, while having all of these connections appear in the form of tailored news feeds. The use of available tools like these often reflects the unique needs and interests of the user – with tools often combined and used in any way that supports their needs and interests.

The CC21 Community Blog

The popularity of educational blogs (or “Edublogs”) suggests that many educators are also seizing opportunities to publicly reflect on their practice as members of online education communities. Research on educational blogs identifies, in particular, the role that like-minded blogging communities play in reflective teacher practice (Sun, 2010) and continuing adult education (Lin & Li, 2011). Blogs often serve as platforms for sharing digital artefacts such as student work samples, lessons and teacher resources; the “blogosphere” can provide sustained, online learning communities that exist across the traditional geographical divides that previously hampered professional learning opportunities. To further explore the potential of blogs, CC21
required all participants to post weekly in the CC21 Community Blog accessible to all schools and the wider community. The blog posts prompted schools to report on their progress, and was often used to identify common problems and solutions, promote inter-school dialogue, continue previous face-to-face discussions online, share school project highlights, facilitate teacher reflection and include links to related digital resources. Participants also discussed how they were using current technology tools to support professional learning in their school.

For many participants, the CC21 project represented their first experience in educational blogging. Some saw the challenges of sharing their ideas with an online community of seventeen schools daunting; however, participants were assisted with blogging protocols and procedures during each of the face-to-face sessions. Importantly, as one school leader describes, blogging throughout CC21 provided teachers with an opportunity to acknowledge their strengths and successes in the classroom:

A lot of people had spoken to me about the [CC21] blog, saying, “Is this the kind of thing that I should be worrying about?” They don’t realise that with blogging, you’re actually going a step further. [I say to them] “You could have actually written about this, this, and this.” They say, “Oh, okay. Right,” because people don’t realize what they’re doing is actually very, very good.

**Tools for Collaboration**

Increasingly, technology users are turning to cloud-based storage and applications as a way of keeping multiple devices – such as laptops, desktops and mobile devices – in “sync” with each other. For example, the widespread use of iPads in most CC21 schools prompted many teachers and students to explore services like Dropbox, which provide users with online storage for publishing and sharing projects on tablet devices that do not have USB ports or external storage capabilities. Likewise, some participants used tools like Evernote to catalogue, store, sync and share notes between devices and people. Given the emphasis on inter-school dialogue and the importance of sharing of ideas between each of the seventeen schools, tools for collaboration were an integral part of the success of CC21.
To model example uses of tools for collaboration, the CC21 face-to-face workshops substantially employed the use of Google Drive. Similar to Dropbox, this tool provides storage and syncing capabilities, but also includes a suite of office-style cloud applications – incorporating media such as documents and spreadsheets, presentations – that are accessible within a standard web browser. Each application allows users to share media with any number of people. For example, users may share a Google Doc with their team – and each team member may make changes to the document in “real-time” (that is, with their changes appearing instantly).

With current plans for the Department of Education and Communities (DEC) to introduce Google Apps for Education in 2014, many schools were keen to explore this technology in their school context. One school project explored the forms and spreadsheet applications in an online collaborative setting, with two members of the executive having used Google Forms for a staff survey and shared the findings with colleagues. Both of these leaders were keen to see this technology used for the development of an online network of schools, what they termed an “online learning alliance”:

...that’s where we see the learning alliance [going] of the four schools being able to use this technology... [our Deputy Principal] might be able to send something out and they can be there on the same document... sitting at their own desk... collaborating in real time... so we’ve talked about that [technology] as an important part of getting that learning alliance happening...

When examining the literature on cloud-based pedagogies – that is, how cloud- and Web 2.0-tools have been employed to consciously inform teaching and learning practices within institution deployments of cloud-based services – research has cited Google Apps for Education as an important current and future cloud-based ecosystem (Hastings, 2010; Meyer, 2010; Robinson, 2007). When used as a term in reference to software and/or hardware, an ecosystem implies that there is a broader architecture surrounding the technology and that the relationships between the software, hardware and services are underpinned by common platforms, operating through the exchange of information and system resources (Messerschmidt & Szyperski, 2003). As an ecosystem, Google Apps for Education users now have access to all of the service features previously only available to users with a standard Google account, provided that these applications are “switched on” by the system administrator. Since system administrators rather than the users themselves create accounts, an institution with a Google Apps for Education deployment is able to ensure, to a large degree, that all users have access to the applications in a relatively safe and secure online environment. The affordances of cloud service deployments like Google Apps for Education and Microsoft 360 will become especially important in participating CC21 schools in future as teachers and students continue to collaborate beyond the traditional classroom walls.
SCHOOL VISITS

As a study with a mixed methods design, CC21 employed a qualitative component to explore the local school context in-depth, including the decisions, actions and leadership styles of each participant and how these impacted on the development and implementation of their project. Researchers requested school visits and semi-structured interviews with school leaders from all seventeen schools; seven schools agreed to participate in this component. All seven schools represent critical cases that positively reflect important themes across the three CC21 areas of technology, pedagogy and curriculum. The following case summaries reflect some of the positive insights gained from visiting each of the seven schools:

Beaumont Hills Public School

Beaumont Hills Public School was unique in reporting, very early in CC21, a project involving all teachers (30) and students (approximately 580) in the (Western region) school. Their initial project plan articulated the school’s innovation as “the use of self-assessment through technology-rich Inquiry-Based Learning,” a model that is reflected in research exploring how technology can be used to support real-world inquiry in the classroom (Owens, Hester, & Teale, 2002) and one also supported through the development of thinking scaffolds (see, for example, Clark, 2009). To implement this model, teachers from each year level explored different technologies – including the use of robotics, iPads, game-based learning and a range of collaborative web tools – while implementing pre-developed, sample units of work published by the New South Wales Board of Studies, Teaching and Educational Standards (BOSTES). A key intention articulated by the principal of the school was for all teachers to adopt “yes we can” attitude in relation to both technology and the new curriculum. In an early blog post, the assistant principal reflected further on this, suggesting that in order to achieve a whole-of-school innovation, the leadership needed to “build professional trust and challenge staff to embrace change as we drive the implementation of the new curriculum.” The whole-of-school innovation was further enabled by the implementation of a school technology levy paid by 93% of parents, as reported by the principal.

[Our CC21 project] is a full staff decision and I know many of my colleagues in other schools are focusing on one stage only. We talked about that and felt that, since we have a parental levy, equity was huge. So if you’re going to do that [charge all parents], it has to be K-6 and to me, that makes perfect sense. Because if they come in at three using an iPad then why would you not give them that when they come in at kinder... like what is so special about turning ten or eleven? So it’s not been me driving it, it’s been the technology team and what they’ve learned along the way is that every six months, that technology plan that they start goes out the window... and that’s fantastic, because everything’s changed (Principal).
William Dean Public School

William Dean Public School has 17 teachers, six of whom (including the principal) are directly involved in CC21. With only 259 students, the (Western region) school was the smallest school involved. Similar to Beaumont Hills Public School, their school project involved an exploration of “Inquiry-Based Learning and the way that technology can be used to access and interpret information for a real life situation.” To enable classroom application, participating teachers worked together to produce five-week integrated units of work for each stage as part of the new Australian Curriculum English syllabus. The Australian Curriculum now requires every teacher and student to address the curriculum priority area of Sustainability in every stage, which William Dean planned to address through a study of growing flowers and life cycles in Stages 1 and 2 and a study of natural disasters in Stage 3. Unlike Beaumont Hill, who placed their project’s emphasis on a range of technologies and de-emphasised curriculum through their use of pre-developed sample units, William Dean chose to focus mainly on curriculum development and mapping across the three stages. Their technology focus principally involved the purchase and deployment of two iPads in each classroom, which began with the teachers who were involved directly in the project and would later extend to all teachers in the school.

One of my biggest philosophies is that you go with who’s ready to go first... and hopefully that ripple effect will take place... once they [innovating teachers] have the opportunity to share it [their ideas] with the rest of their stage, it [the reaction by other teachers] will be, “We want some of what you’ve having... we want some of that too.” It’s not “you will do this” [to the staff]... it’s “if you would like to... here it is for the offering” (Principal).
Regentville Public School

Regentville Public School is a mid-sized (Western) primary school, with approximately 650 students and 31 teachers, seven of whom were directly involved in their school’s project. The participating teachers initially articulated two goals for their school’s project: first, the use of iPad-based literacy apps to support a whole-school reading program; and, second, the development of a “learning alliance” of schools in the local area with a shared website for pooling curriculum-related resources and communication. Separate members of the school’s executive managed each of these goals; in both cases, however, this management has involved setting strategic direction and providing autonomy to individual teachers to assist with operational logistics and problem solving. In particular, the members of the school executive draw on the ideas of all members of staff, especially tech-savvy early-career teachers. These teachers are especially keen to explore the affordances of iPads in a highly connected classroom – and Wi-Fi connectivity was one of the main areas explored in their project:

When we do [get connectivity] there’s lots of things we can do... like my class uses the Internet for Edmodo and blogs and stuff... and it [more connectivity] would make reporting to parents and showing their [the kids’] learning online so much easier... and they could just upload things and you [the teacher] can just sit there and approve all of their comments... (Stage 1 Teacher, Regentville Public School).
Turramurra High School

Turramurra High School is a large, comprehensive (Northern) high school, with approximately 1200 students and 100 teachers, six of whom were directly involved in their school’s project. The school is also a member of the North Shore Secondary Schools Partnership (NS5), a collective established to promote inter-school collaboration and coordinated projects across five secondary schools serving adjacent communities on the North Shore. The NS5 includes the DEC High Schools in Chatswood, Killara, Ku-ring-gai, St Ives and Turramurra. As part of their involvement in both CC21 and the NS5, participants in Turramurra High School were involved in the collaborative development and sharing of curriculum resources for the new Australian Curriculum Stage 5 History syllabus. The project teams in each school used Google Docs to co-construct programs and units of work embedding new syllabus outcomes and content explicitly integrating “contemporary pedagogies and relevant technologies.” In particular, the participants wanted to avoid technology as an “add-on,” seeking to explore how iPads could be used to support self-assessment and metacognition:

The nature of education is changing all the time. As such we need to keep up with those changes. The 21st century learner is a very different learner to the 20th century learner. Not only do our students learn differently, the nature of their learning has changed. They need to ‘learn to learn’ more than learn large slabs of content. These new learners learn best by thinking for themselves and directing much of their own learning. In this age of almost limitless access to information, they can use many different ways to access the learning they require. The textbook is fast becoming a redundant resource, particularly in its old hard copy format. I was keen to embark on this project because as a faculty, we have always shared resources and ideas. Creating a wider platform for this sharing makes perfect sense. Other educators have so much to offer; facilitating this for this small project may help to broaden that sharing process (History Teacher).
Quakers Hill Public School

Quakers Hill Public School is a large (Western) primary school with approximately 730 students and 32 teachers, five of whom were involved in their school’s project. Their project involved the development of a technology-rich agile learning space (“The Hub”) to promote the use of creative pedagogies amongst all teaching staff. In particular, the school refitted a traditional classroom with a wide range of technology devices alongside supporting infrastructure. Technology devices that represent a range of platforms and interfaces (including Android tablets and iPads, games consoles, a Microsoft Surface Table, AV equipment for recording and iPod Touch devices) were deployed and set up in groups around the room, with the intention of challenging teachers to develop pedagogies that could be applied to the use of multiple devices at any given time. In addition to the room, the school has been heavily investing in technology across the campus, with a large number of interactive whiteboards, Apple TVs, iPads and laptops. The school leadership team strongly believed that a multi-platform environment was essential for developing students’ twenty-first century skills and equipping them for future workplaces. The Hub reflected the wider school focus, as the principal noted during the interview:

All of my executives have been trained in professional learning about how to use that room [The Hub]. The Assistant Principal who created that room for us has been the driving force with team teaching, demonstration lessons, observation lessons, providing units of work, helping to plan, [and helping teachers think about] how you would integrate that room. The specific purpose of the room was that I wanted something that challenged the norm where teachers had to embed the quality teaching elements into their teaching and leaning programs and actually plan and be prepared to go into that room. You can’t walk into that room unprepared and expect to provide for the education that comes with children because you don’t have enough of each of the devices (Principal).
Killara Public School

Killara Public school is a small (Northern) primary school with approximately 325 students and 15 teachers, eight of whom were directly involved in their school’s project. The team explored digital storytelling and multimodality as key elements of the new K-10 English Syllabus. Many of the participants had experience teaching with the instructional model of Project-Based Learning (PBL) and were keen to incorporate this model into their project as a possible step towards PBL as a whole-school pedagogy. To trial digital storytelling across each stage, the SCAMPER model (substitute, combine, adapt, modify, put to other use eliminate and reverse) was employed to ensure originality and enhance the development of ideas. The school had also deployed a small number of iPads in each class and each teacher was able to model the practice of developing digital stories using current apps. The principal was also actively involved in the project, readily engaging in team teaching with each class teacher and demonstrating her use of the technology. The school community was also supported by a teacher technology mentor who was strategically released from her own classes to work with other teachers on a weekly basis.

In terms of being involved in this [CC21] project, there’s a selfish reason for me… in that being not on class at the moment and particularly with the changes with the new syllabus implementation – and being asked to lead that implementation – [implement] a syllabus without a working knowledge of how it’s practised, it’s really important for me to lead a program that I understand and that I can see in action… and so for me it’s been nice to be able to get back into the classroom… and I think particularly in a staff that is very varied… I can say, ”I’ve been in the classroom – I’ve taught it – it’s possible – I can make it possible (Principal).
Hilltop Road Public School

Hilltop Road Public School is a large (Western) primary school with approximately 620 students and 35 teachers. Similar to Beaumont Hills Public School, the project plan for Hilltop Road indicated that all teachers in the school were involved in the project, assisted by a small leadership team of six teachers who were responsible for different curriculum Stages and year levels. Similar to Quakers Hill Public School, the school had developed a technology-rich agile learning space that allowed up to two classes to work with a range of technology tools, including robotics, iPads, microscopes, interactive tables and AV recording equipment. The teaching staff was also supported by a teacher technology mentor with industry experience, who worked with all staff to ensure that teachers across the school were able to implement the technology component of the school’s project. Broadly speaking, the aim of the school’s project was to ensure that both teachers and learners engaged in the use of a wide variety of technologies for online collaboration and sharing, concepts which are often referred to as the twenty-first century “fluencies.” To scale the use of specific devices, the school employed a partial 1:1 program across several classes with a view to implementing the program across the whole school in the future. By incorporating a wide range of technologies – and again similar to the principal of Quakers Hill’s philosophy – Hilltop Road’s project sought to ensure that teachers developed flexible thinking in embedding technology in the Australian Curriculum – “a common understanding... to support the way that children are expected to learn in the 21st century.” The principal described the important balance between strategic direction, consultation with her teaching staff and ensuring appropriate levels of support:

To be honest with you, it is a direction that we’ve thought about supported by the executives and supported by [all] staff. But we discuss it with people all the way along. From my leadership, for the lack thereof, I am a “talk it through” kind of person. They often smile and say, “here she comes again!” But we have to talk it through, about where the vision is... and what we want ultimately for every child in this school and for the whole school community. As people working for the Hilltop Road community, these are our people. This is what we doing. This is why we’re doing it. So there is a little bit of “This is the direction.” But by the same token, staff must be supported in every level to make that change and to take the direction. You can’t just set a direction and say “good luck with that”. It has to be [supported]. I think that’s where it comes with strategic leadership approach where you must think strategically about how you’re going to support staff and the different dimensions to the support (Principal).
CC21 Showcase at Macquarie University, September 10 2013

The CC21 Showcase represented the culmination of each school’s project-related activities during the research component. Two key ideas were used to frame the showcase: “Tell your story” and “Why learning matters” as these encapsulated what the project team had been exploring in the workshops, school visits and data analysis. Over 250 people attended the Showcase. These included project participants, other teachers and school executives from DEC and non-DEC schools, corporate staff from DEC, academic staff and pre-service teachers from Macquarie University, parents and students. Each school was allocated a large table and noticeboard and two of the project participants from that school were stationed at their table at there at any given time. Students from the participating schools were also encouraged to be involved.

After welcoming everyone, Meredith Ash (School Education Director, Public Schools NSW) told a personal story about why students matter and why student voice is important when considering curriculum, pedagogy and technology. Myra Wearne (Principal, North Sydney Demonstration School) followed with a personal story on why teachers matter and the importance of considering their professional learning needs in the twenty-first century. Professor John Hedberg concluded this segment of the showcase with a story on why research matters including the importance of evidence based practice. After showing a video “mashup” of the project, guests were then invited to visit each school’s stand where schools had set up displays showcasing highlights of their involvement in CC21. Displays included work samples, photographs and video content. Guests were able to chat with project participants including students from project schools about what they had done to embrace change in terms of curriculum, pedagogy and technology and how they plan to sustain and scale best practice into the future.
5. PROJECT FINDINGS

PROFILE OF ACTIVE PARTICIPANTS

This section summarises descriptive statistical analysis of the active CC21 participants. It places particular emphasis on responses submitted in the Teacher Professional Learning Questionnaire.

As shown in 1, the main majority of participants (85.8%) in the project were current classroom teachers. This component comprises both regular teachers (“Teachers”) and those with leadership roles (“Teachers with leadership roles,” including ICT mentors, school executive with a teaching role and other coordinators). As shown, “Teachers with leadership roles” represent the largest component (n=35, 55.6%) of the overall sample.

5.1 – CC21 Participants by Role

The two regions of Northern Sydney and Western Sydney were involved in the project and are included in the sample studied. The responses for each region were roughly equal; when compared with the number of Northern (n=10, 58.8%) and Western (n=7, 41.2%) schools involved, the Western Sydney region is slightly over-represented in their number of responses (n=32) proportional to the number of schools involved. The number of active Secondary participants (n=9, 15.3%) was low in comparison to the cohort of Primary teachers (n=50, 84.7%). When compared to the number of secondary schools involved in CC21 (n=4, 23.5%), Secondary teachers as active participants are slightly underrepresented proportional to the number of schools involved.
The histogram provided in 5.2 compares the experience (in whole years) of the participants by the roles categorised. Each distribution exhibits a normal bell curve. The mean number of years for principals and non-teaching executive were the highest of the four categories, while the mean number of years for both regular and leader teachers were similar. Variability in years of experience was greatest for regular teachers, with many of these participants in their first four years of teaching alongside a substantial number of experienced teachers. It is important to note that the number of years for each participant may comprise different roles. For example, most principals began their teaching career as regular classroom teachers; likewise, regular classroom teachers may have, at some stage, assumed leadership roles.

5.2 – Participants’ Experience (Years) by Role

The individual value plot shown in 5.3 illustrates the distribution of age across the four roles categorised. The largest age ranges appear in the categories of “Teachers” and “Teachers with leadership roles.” Similar to the years of experience shown above, the relatively small sample of principals showed the least variability in age; the value plots shown suggest that while the sample of teachers reflect educators at all stages of their career, the values plotted for principals and non-teaching executive represent those at the mid-stage of career.
5.3 – Value Plot of Participants’ Age by Role

5.4 shows the distribution of experience (in years) by region. The distributions for each region were fairly similar, with Western Sydney teachers showing a slightly higher mean (=16.32) than Northern Sydney teachers (= 12.8).

5.4 – Participants’ Experience by Region
CC21 SCHOOL EXPENDITURE SUMMARY

This summary outlines CC21 project fund expenditure across all of the participating schools. Expenditure has been categorised into the following areas:

1. Training – including formal programs of professional learning (such as training days), the provision of guest speakers and purchase of training materials (such as books and DVDs).
2. Release – funds spent on releasing teachers from classroom duties.\(^1\)
3. Hardware – the purchase of new devices, such as tablets.
4. Software – the purchase of software packages and applications
5. Infrastructure – the purchase of necessary materials that support the deployment of technology, such as Wi-Fi routers, cables and trolleys for tablets.
6. Accessories – the purchase of additional accessories, such as screen guards, cases, adapters and storage media.

While each school employed their resources differently, the majority schools spent more funds in the areas of teacher release (the provision of time away from classroom duties to plan, work with colleagues or attend training) and the purchase of new hardware devices (most notably, tablets). Other areas like formal training and infrastructure development (such as the implementation of new wireless network access points) were less consistent, being applied in a relatively small portion of schools. 5.5 shows the allocation of funds by area of expenditure, indicating the number of schools allocating funds in each area:

5.5 – Collective Allocation of Funds by Area of Expenditure

<table>
<thead>
<tr>
<th>Area</th>
<th>Expenditure</th>
<th>Number/percentage of schools spending money</th>
<th>Percentage of total funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher release:</td>
<td>$60,170</td>
<td>n=14, 82%</td>
<td>47.53%</td>
</tr>
<tr>
<td>Hardware:</td>
<td>$41,405</td>
<td>n=9, 53%</td>
<td>32.71%</td>
</tr>
<tr>
<td>Formal training:</td>
<td>$10,830</td>
<td>n=4, 24%</td>
<td>8.56%</td>
</tr>
<tr>
<td>Infrastructure:</td>
<td>$8,875</td>
<td>n=5, 29%</td>
<td>7.01%</td>
</tr>
<tr>
<td>Software:</td>
<td>$4,599</td>
<td>n=4, 24%</td>
<td>3.63%</td>
</tr>
<tr>
<td>Accessories:</td>
<td>$705</td>
<td>n=2, 12%</td>
<td>0.56%</td>
</tr>
</tbody>
</table>

\(^1\) Note: these funds do not include the face-to-face days provided by the Department of Education and Communities; they only include funds spent by individual schools to release their own teachers for purposes relating to the school’s own project.
Teacher actions play a critical role in the development, sharing and implementation of ideas and practices across the school community. Throughout the CC21 project, teachers’ actions were at the heart of each school’s innovation. As participants documented and reflected on their learning, researchers identified key actions that served as leverage points for future change. This section explores some of the themes that arose during blog posts, interviews and the Teacher Professional Learning Questionnaire (TPLQ).

The model of *Meaningful Learning* by Jonassen, Howland, Marra and Crismond (2008) explores situated learning with ICTs as a learning process driven by the five domains shown in 5.6:

5.6 – Meaningful Learning (Jonassen, et. al. 2008)

This model emphasises the role of thoughtful action, goals and collaboration when working on authentic, real-world tasks. In face-to-face sessions, researchers explored the model with participants as a starting point for addressing teachers’ learning needs and developing project plans. Teachers engaged in collaborative activities to identify authentic learning goals and plan their school’s implementation strategically.
KEY TEACHER ACTIONS IN CC21

When exploring qualitative data, researchers identified several key teacher actions that played important roles in the implementation of each school’s plan and the learning experiences of teachers:

- audits/surveys of teachers’ learning needs and interests;
- collaborative planning within school teams and between schools;
- research in current best practice;
- teacher reflection;
- strategic leadership; and
- use of current resources and tools.

The impact of teacher actions is reflected in a range of cases. At the start of the project, one Western primary school already had sizeable technology infrastructure, with podded classrooms, 150 iPads and an active technology committee that worked across Stages 1-3. To better understand teachers’ learning needs and interests, the school conducted an audit of all teachers using an online questionnaire. The findings suggested that many teachers were keen to explore technology in the classroom but wanted to integrate current tools with Inquiry-Based Learning (IBL), an instructional model that emphasises learner enquiry through active questioning and research. In order to learn more about this model, teachers and school leaders engaged in their own independent research, sharing relevant articles with colleagues and posting their reflections on the CC21 blog. From the research, the school further identified the area of self- and peer-assessment as an important element of facilitating effective IBL. The school’s budget involved substantial expenditure ($50000) in the area of teacher release, including professional learning days spent observing IBL classrooms and follow-up planning days with colleagues. One teacher reflected on the development of their school’s plan:

It was really interesting working on finalising our project plan earlier this week. We had already put together a plan and timeline of what we hoped to achieve by participating in this project, and completing this project plan gave us the opportunity to add more depth to this. Our school has a unique context. The use of technology is embedded in all that we do and we have access to an amazing array of technological devices. Our main focus of Inquiry Based Learning is going to provide us with the opportunity to further develop our use of technology. Self-assessment & peer assessment is an area our staff has identified [through the questionnaire] as an area of weakness. Participation in this project is going to allow us to address this area of assessment, which is going to be of benefit to our students.

Prior to the start of the project, one northern primary school had an interest in providing students with iPads in 1:1 ratio. Staff at the school then conducted
extensive research to gain knowledge about the potential of iPads 1:1 and develop a vision for the technology within the school. This involved searching online as well as visiting schools with the technology in place. Staff then made a collective decision to specify a core set of apps to be rolled out across the school. This allowed teachers to focus on learning how to use one group of apps that could be integrated across all subject areas. Creative professional learning sessions, aptly named “Appy Hour”, was found to be an effective and collaborative way for staff to share and experiment with various apps. While the previous case dedicated a large portion of the budget to teacher release, this school invested in the recruitment of educational technology specialists to support teachers’ implementation and evaluation of the iPad integration. This facilitated consistent teacher reflection throughout the planning process and as trials were conducted. The project leader comments on the benefits of a flexible learning environment noted by staff in their blog:

Staff are remarking on the classroom transformed through their ability to lead learning (via the smart-board) but not be tied to the board – and free to move around the room, also engaging students by placing the control of smartboard in the hands of the student through the iPad. The focus is not the student at the front but their thinking / work on the board.

One Western primary school began their digital journey by conducting a Microsoft Partners in Learning survey for staff. Actions were then taken to address the areas of weakness outlined by the survey, which included further professional development, technology mentoring and the availability of technology for integration. The school took a whole-school approach, encouraging teachers to collaborate and share innovative ideas through Edmodo and Google Docs. A purpose-built technology centre and video-editing suite were constructed to aid further integration of technology in teaching. Similar to other CC21 schools, a large portion of the budget was allocated to release days for teachers to attend professional development days to improve on the implementation of various hardware and software technologies made available at the school. Teachers also made extensive use of the blog, which demonstrated the effectiveness of lessons and benefit professional development days. One teacher was inspired by their staff development day and looked forward to experimenting with new technologies in their own time:

Each group was exposed to a variety of technology activities including Web 2.0 tools, Robotics, Crazy Talk, Adobe and Filming/editing. Wow! The students are going to have so much fun learning in this 21st Century way. Teachers too! I particularly enjoyed the potential of filming/editing but will probably explore the sites on Web 2.0 for my Learning Support reading students. Personally I would like to experiment with Adobe and Photoshop. Just need more hours in the day.
ICTs and Pedagogy

Research Question:
“How can teachers be supported to effectively employ ICTs as part of their pedagogy?”

Increasingly, schools are shifting their focus on pedagogy towards the plural form – from pedagogy (implying a singularly defined teaching method) to pedagogies (multiple teaching methods employed to suit different learners and contexts). This shift reflects a recurrent theme throughout CC21 research in that the project is predicated on the argument that there is no “one-size-fits-all” approach, model or framework that will work for every school, teacher or student. In the twenty-first century, many teachers are actively exploring pedagogies that support – or are enhanced by – their use of technology, and pedagogies that further enable them to demonstrate and develop their knowledge of teaching disciplines. During the research component of CC21, researchers explored teachers’ and school leaders’ understanding of pedagogy, as well as the role played by current technology tools to support teachers’ pedagogies when responding to the prescient challenges of the Australian Curriculum. This section reports pedagogy-related findings and raises questions about the development of teachers’ pedagogical knowledge that could be explored in future research.

To explore how each school employed ICTs as part of their pedagogy, school visits, project planning days and interviews were conducted, during which researchers asked participants to explain their understanding and use of pedagogy within the school context and with reference to their project plans. From this enquiry, two common themes emerged: first, an emphasis on the importance of instructional models as practical vehicles for implementing specific pedagogies in teaching; and, second, the influence of current educational thought leaders, commonly including high-profile education academics, teachers and authors (for a discussion on the impact of these thought leaders on school leadership, see the School Leadership section of this website). The role of pedagogy in relation to these areas is now discussed.

Instructional Models and Pedagogical Frameworks

As evident in Term 2 Project Plans, many of the schools employed specific instructional models to demonstrate their application of pedagogy. Common models included Inquiry-Based Learning (six schools), Project-Based Learning (three schools), Cooperative Learning (one school), as well as peer- and self-assessment (two schools). Similarly, some schools cited frameworks like the Quality Teaching Framework (QTF) and the development of technological, pedagogical content knowledge (TPaCK). Given that most school-based teams were cross-curricular and that the majority of participants were primary teachers, the pedagogies associated with these models and frameworks were often applied across two or more subject areas and developed in collaborative teams.
The TPaCK (Koehler & Mishra, 2009) theorises pedagogy as a separate knowledge dimension (PK), but one that is also interwoven with technology and discipline content. Pedagogical knowledge refers to teachers’ knowledge about general teaching strategies, including many of the models and frameworks mentioned above. Pedagogical content knowledge (PCK) refers to knowledge of specific pedagogies that support development within specific subject areas, while technological pedagogical knowledge refers to knowledge of specific technologies that support the implementation of pedagogies. Technological pedagogical content knowledge (TPaCK) represents a confluence of all three areas, referring to the use of specific technologies to support relevant pedagogies within specific discipline areas.

5.7 – Technological Pedagogical Content Knowledge (TPaCK)

The TPaCK represents an important conceptualisation that reflects the broad areas explored in the CC21 project – technology, pedagogy and the Australian Curriculum. Nonetheless, developing and applying teachers’ understanding of pedagogies presents numerous challenges when this knowledge needs to be developed in ways that support new technology tools and changing curricula. In particular, developing pedagogies across the TPaCK dimensions in the CC21 project involved teachers:

- recognising and understanding the different knowledge domains and how they are addressed in both formal and informal teacher professional learning;
- understanding how dimensions combine to generate new forms of knowledge that address emerging problems;
- seeing the relatively fluid role of pedagogy across the different dimensions; and
- undertaking self-assessment of areas of weakness and implementing strategies to develop knowledge in these areas.
It is important to note that the TPaCK is conceptually illustrated in the form of a three-way Venn diagram, and the intersections represent each of the knowledge dimensions. On the outer areas are the first-level (separate domain) constructs (TK/PK/CK) while in between circle pairs, the second-order constructs are formed (TCK/PCK/TPK). In the middle, the third order construct of TPCK represents the intersection of all areas.

**Exploring the TPaCK in CC21 School Projects**

The following brief case summaries exemplify how CC21 participants explored the use of ICTs as part of their pedagogies and through their school’s innovations. For further details on each school’s involvement in the project, please refer to the school plans on the CC21 website: [http://macictcc212013.wordpress.com/](http://macictcc212013.wordpress.com/).

Teachers at one western primary school explored the use of iPad apps to develop reading fluency (TPK). As teachers noted, this technology can be used effectively to document, evaluate and reflect on student learning:

> Using the Camera and Videolicious apps to record student information has been a great way to track their learning. Students are in the process of ‘publishing’ their information reports by filming a documentary. This has been a good way to focus on reading fluency, as students need to focus on their own fluency during practices to enhance their presentation” (Year 3 Teacher).

Similarly, teachers and students at a northern primary school explored a core set of iPad apps to be used in the development of cross-curricular skills (TPK). Establishing this core set of apps enable both teachers and students across the school to have a common understanding of the technology affordances:

> “Our teachers use Explain Everything as a screen casting tool for modelled lessons as well as giving student feedback orally. Our students use Popplet to organise their ideas on topics and Notablity to create notes and store their digital texts. Our focus is for students and teachers to become experts in the use of our core apps; we plan according to the skills and content that needs to be understood. The use of iPads has certainly enabled increased student engagement and the quality of their work has improved” (School Leader).

Another Western primary school developed of a technology-rich, cross-platform agile learning space to challenge teachers’ pedagogy across subject areas (TPK). The space contains small numbers (usually 2-4) devices across a range of platforms (including video games consoles, Android tablets, iPads, netbooks and other mobile devices). One school leader explained that having so many device categories challenged teachers to rethink their pedagogies:

> “The specific purpose of that room was that I wanted something that challenged the norm, where teachers had to embed the quality teaching elements into their teaching and leaning programs and actually plan and be prepared to go into that room. You can’t walk into that room unprepared and expect to provide for the education that comes with children because you don’t have enough of each of the devices” (Principal).
Another Western Primary School used iPads to effectively implement an Inquiry-Based Learning model that could be employed throughout 5-week integrated units of work in English and Science (TPCK). While still in the early stages of the school’s project, one teacher reflected on the role of technology in supporting IBL-based pedagogies:

I had a fantastic lesson in Inquiry-Based Learning today and my first whole class experience with iPads. Students became masters in their own learning experience. The students were buzzing with discussions as they left the room and did not want to stop for lunch. They were so engaged with the use of technology and real life application. Our Unit will end with planting an Orchard to supply children at school with fruit for the “Crunch & Sip” program (Year 1 Teacher).

A Northern primary school explored and trialled a range of iPad apps for multimodal storytelling in an Australian Curriculum English unit of work (TCK). With multimodality a key component of the new syllabus, teachers evaluated iPads as an appropriate tool to support students’ development of content knowledge and subject-specific skills:

Our CC21 school team focused the project further by looking at Objective C of the English curriculum through digital storytelling. We recruited five more teacher participants for our project that will implement digital storytelling using iPad technology... Well, it’s happening- the kids now have the big picture in their heads and a purpose for their creativity. It will be exciting to see them creating on the iPads. I can see endless possibilities!” (School Leader).

Finally, another Western primary school explored the interpretation creation of multimodal texts through the use of Web 2.0 tools (TCK). One teacher used the tools as an opportunity to discuss textual form and meaning in digital spaces:

“As reading and viewing multimodal texts is an important part of the new English syllabus, I have used these tools to facilitate class discussions about the various features that these digital texts present as well as explored various navigation and reading pathways with my students to enable them to be effective users of these programs. Through analysing these programs, it is my goal to provide a solid foundation for my class to compose their own effective multimodal texts using such web 2.0 tools, giving them ample opportunities to view and evaluate these digital texts from the user’s perspective” (Year 6 teacher).

**Measuring TPaCK dimensions**

To assess teachers’ pedagogical knowledge across the sample of participants in order to understand the intersections between this and the other areas of CC21 (technology and the Australian Curriculum), the CC21 Teacher Professional Learning Questionnaire (TPLQ) incorporated items from The TPaCK Survey (Chai, Koh, & Tsai, 2011) as a 7-point scale instrument measuring each of the TPaCK knowledge dimensions. This survey has been noted for its robust design and the high validity of the constructs. In particular, confirmatory factor analysis (CFI) was used by the
authors to show that each of the knowledge dimensions load on separate factors when conducted with a large sample of Singaporean pre-service teachers. As a result, this instrument was deemed by the researchers to be a valid and reliable measurement of teacher knowledge across the sample of participants.

This instrument measured participants’ knowledge in relation to each of the TPaCK dimensions at the conclusion of the project. When analysing the sample of respondents to the TPLQ, principal components analysis (PCA) was conducted at two stages: first, on thirteen first-order (PK/TK/CK) items; and, second, on ten second-order items (TPK/TCK/PCK). These two stages were necessary to compensate for the relatively small sample size (n=63) and item-to-participants ratios. Both components analyses employed oblique rotation (direct oblimin). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analyses (KMO= 0.778 and 0.833 respectively) and all KMO values for individual items were greater than the acceptable limit of 0.5. Initial analyses were run to obtain eigenvalues for each component. These were checked against scree plots and parallel analysis. Each of the analyses are shown and described further below:

5.8 – Results of Components Analysis – TPaCK Items (first order)

<table>
<thead>
<tr>
<th>Pattern Matrix</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>PK: [I am able to help my students to reflect on their learning strategies.]</td>
<td>.964</td>
</tr>
<tr>
<td>PK: [I am able to help my students to monitor their own learning.]</td>
<td>.961</td>
</tr>
<tr>
<td>PK: [I am able to guide my students to discuss effectively during group work.]</td>
<td>.871</td>
</tr>
<tr>
<td>PK: [I am able to guide my students to adopt appropriate learning strategies.]</td>
<td>.842</td>
</tr>
<tr>
<td>PK: [I am able to stretch my students' thinking by creating challenging tasks for them.]</td>
<td>.688</td>
</tr>
<tr>
<td>TK: [I can learn technology easily.]</td>
<td>.919</td>
</tr>
<tr>
<td>TK: [I have the technical skills to use computers effectively.]</td>
<td>.895</td>
</tr>
<tr>
<td>TK: [I know how to solve my own technical problems when using technology.]</td>
<td>.828</td>
</tr>
<tr>
<td>TK: [I keep up with important new technologies.]</td>
<td>.742</td>
</tr>
<tr>
<td>CK: [I have sufficient knowledge about my teaching subject.]</td>
<td>.912</td>
</tr>
<tr>
<td>CK: [I gain deeper understanding about the content of my teaching subject on my own.]</td>
<td>.752</td>
</tr>
<tr>
<td>CK: [I think about the content of my teaching subject like a subject matter expert.]</td>
<td>.735</td>
</tr>
<tr>
<td>CK: [I am confident to teach the subject matter.]</td>
<td>.531</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 5 iterations.
In the first-order analysis, the scree plot was unambiguous, showing an inflexion justifying the retention of three components. PCA extracted three components with eigenvalues of greater than one, explaining 73.3% of the cumulative variances. 5.9 shows the component loadings after rotation. The items that cluster on the same components suggest that three components shown match the original first-order TPaCK constructs (PK, TK, and CK). As a result the first order components analysis was found to be valid and reliable for the sample of teachers surveyed. The components analysis of the second-order items revealed, however, a lesser degree of discernment by participants in terms of distinctions between the constructs:

5.9 - Results of Components Analysis – TPaCK items (second order)

<table>
<thead>
<tr>
<th>Pattern Matrix</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>TPK: [I am able to facilitate my students to use technology to construct different forms of knowledge representation.]</td>
<td>.915</td>
</tr>
<tr>
<td>TPK: [I am able to facilitate my students to collaborate with each other using technology.]</td>
<td>.908</td>
</tr>
<tr>
<td>TCK: [I can use appropriate technologies (e.g. multimedia resources, simulation) to represent the content of my teaching subject.]</td>
<td>.834</td>
</tr>
<tr>
<td>TCK: [I am able to facilitate my students to use technology to plan and monitor their own learning.]</td>
<td>.817</td>
</tr>
<tr>
<td>TCK: [I can use specialized software to perform inquiry about my teaching subject.]</td>
<td>.814</td>
</tr>
<tr>
<td>TCK: [I know about the technologies that I have to use for the research of content of my teaching subject.]</td>
<td>.764</td>
</tr>
<tr>
<td>TCK: [I am able to use technology to introduce my students to real world scenarios.]</td>
<td>.727</td>
</tr>
<tr>
<td>TCK: [I can use the software that is created specifically for my teaching subject. (e.g., e-dictionary/corpus for language, Geometric sketchpad for Maths; Data loggers for Science).]</td>
<td>.712</td>
</tr>
<tr>
<td>PCK: [Without using technology, I can facilitate meaningful discussion about the content students are learning in my teaching subject.]</td>
<td>.926</td>
</tr>
<tr>
<td>PCK: [Without using technology, I can address the common learning difficulties my students have for my teaching subject.]</td>
<td>.913</td>
</tr>
<tr>
<td>PCK: [Without using technology, I can support students to manage their learning of content for my teaching subject.]</td>
<td>.908</td>
</tr>
<tr>
<td>PCK: [Without using technology, I can engage students in solving real world problem related to my teaching subject.]</td>
<td>.906</td>
</tr>
<tr>
<td>PCK: [Without using technology, I can help my students to understand the content knowledge of my teaching subject through various ways.]</td>
<td>.904</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization

a. Rotation converged in 3 iterations.
For the second-order components analysis, the scree plot was slightly ambiguous, showing inflexions that would justify the retention of either two or three components. However, PCA extracted only two components with eigenvalues of greater than one, explaining 74.5% of cumulative variances. Parallel analysis also supported the retention of only two components. As a result, two components were retained, which included technological content knowledge (TCK) and technological pedagogical knowledge (TPK) constructs loading as one component, while pedagogical content knowledge (PCK) loaded as the second component. As noted in 5.9 the phrase “without using technology” was used at the beginning of all PCK items, which may have led participants to perceive little relationship between the technology-based and non technology-based constructs.

In the summary of their findings, Chai et al. (2011) note:

> The findings seem to suggest that when the TPACK framework is employed to survey pre-service or in-service teachers’ perceived knowledge levels, consideration needs to be given to the specific type of pedagogical approaches they intend to employ... From the perspective of content validity, surveys constructed to assess pre-service teachers’ TPACK should measure more precisely the type of pedagogy that the integration of ICT is intended to achieve (p. 601).

While the CC21 project fostered the development of a wide range of pedagogies, further research that is specific to pedagogies employed by individual participants and/or participants working collaboratively in teams may divulge insights about how technology might be effectively employed to build teachers’ pedagogical knowledge and adapt this knowledge in response to the development of new tools and changing curricula.
Research Question:
“How can teachers be most effectively supported to effectively implement the new Australian Curriculum?”

A changing curriculum is often regarded in education as a catalyst for change in practice. It also represents the context in which change occurs and can provide a shared language for identifying important content to be aligned with relevant tools and pedagogies. As schools throughout the country move towards the implementation of the new Australian Curriculum, educators explore future possibilities, develop strategies for innovation and identify their own learning needs. Throughout school visits, online blog posts, interviews with school leaders and in data and reflections from the Teacher Professional Learning Questionnaire (TPLQ), CC21 researchers investigated each school’s response to the Australian Curriculum. This section reports on the curriculum-related findings and identifies areas of future curriculum development that could be explored.

Core Subject Areas and General Capabilities: Mapping Challenges

While many of the higher-order ICT skills are explicated in the Phase 3 Technologies Curriculum – which itself represents two discrete discipline areas of design and computational thinking – the specification of ICT as a general capability throughout all ACARA publications suggests that ICTs can play a crucial role in enabling students to transfer skills and knowledge from one subject area to another, an idea which is supported in current literature and amongst many education bodies. To investigate this further, the following table canvases statements on ICT skills and technologies specified in the ICT general capabilities components of the core subjects (Maths, English, Science and History). These have been mapped against the revised Bloom’s Taxonomy (Krathwohl, 2002) in order to provide some analysis of the kinds of knowledge afforded by ICTs across the new curriculum:
### 5.10 – General ICT Capabilities and Core Australian Curriculum Subjects

<table>
<thead>
<tr>
<th>Knowledge / Subject</th>
<th>Maths</th>
<th>English</th>
<th>Science</th>
<th>History</th>
<th>Geography</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specified technologies</strong></td>
<td>• Spreadsheets</td>
<td>• Word processing</td>
<td>• Animations</td>
<td>• Online information sources</td>
<td>• Spatial technologies</td>
</tr>
<tr>
<td></td>
<td>• Dynamic geometry software</td>
<td>• Desktop publishing tools</td>
<td>• Simulations</td>
<td>• Online information sources</td>
<td>• Online information sources</td>
</tr>
<tr>
<td></td>
<td>• Algebra software</td>
<td>• Online information sources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Remembering</strong></td>
<td>“Collect and manage data”</td>
<td>“Collect and represent data”</td>
<td>“Locate historical information”</td>
<td>“Locate and select geographical information”</td>
<td></td>
</tr>
<tr>
<td><strong>Understanding</strong></td>
<td>“Research science concepts”</td>
<td>“Process historical information”</td>
<td>“Understand geographical changes produced by the increasing use of technology”</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Applying</strong></td>
<td>“Investigate model concepts and relationships”; “Perform calculations, draw graphs”</td>
<td>“Conduct research online”</td>
<td>“Investigate scientific phenomena”</td>
<td>“Locating and collaborating”</td>
<td>“Exploring the effects of technologies on place”</td>
</tr>
<tr>
<td><strong>Analysing</strong></td>
<td>“Analyse data”</td>
<td>“Analyse and modify multimodal texts”</td>
<td>“Analyse data”</td>
<td>“Analyse historical information; critically analyse evidence and historical facts”</td>
<td></td>
</tr>
<tr>
<td><strong>Evaluating</strong></td>
<td>“Interpret data”; “exchange information and ideas”</td>
<td>“Collaborate and communicate with others electronically”</td>
<td>“Communicate scientific understandings, science ideas, processes and information”</td>
<td>“Discuss and debate to co-construct their knowledge”</td>
<td>“…the effects of technologies…on people’s lives”</td>
</tr>
<tr>
<td><strong>Creating</strong></td>
<td>“Create and communicate mathematical ideas”</td>
<td>“Create print, visual and multimodal texts”; “digital publishing”</td>
<td>“Present and represent their learning”</td>
<td>“Communicate and share geographical information”</td>
<td></td>
</tr>
</tbody>
</table>
Each of the five curriculum areas suggest that critical thinking through the use of ICTs is possible and the knowledge dimensions of applying, analysing and evaluating – all of which are associated with critical thinking – incorporate research, analysis and interpretation of digital information with some evaluative exchange of ideas between learners – for example, through online/face-to-face collaboration and/or discussion. At the same time, as the above table shows, there is very little specified about the kinds of technologies that enable these processes, either separately or in sequence. For example, the English curriculum clearly stipulates the importance of multimodal texts – this is reflected in both the analysing (“analyse and modify multimodal texts”) and creating (“create... multimodal texts” and “digital publishing”) knowledge dimensions for this subject. However, the specified technologies of word processing, desktop publishing and information found online present challenges for teachers in creating meaningful learning experiences with a growing number of multimodal forms.

Teacher Perceptions of Change

When exploring each school’s response to the challenges of the Australian Curriculum, researchers were particularly interested in examining teachers’ perceptions of the challenges. For many of the participants in the project, the Australian Curriculum represents a driving force in changing their own practices, particularly with respect to the use of technology tools and implementation of pedagogies (for example, through the implementation of widely-explored instructional models like Inquiry-Based Learning). In the Term 2 Project Plans, nine of the primary schools indicated a focus on English. Two of these schools opted to use the sample curriculum units provided by the New South Wales Board of Studies, while other schools chose to develop their own units of work that embedded curriculum objectives and outcomes from the new English K-10 syllabus. One primary school chose to integrate a unit of work across the syllabus areas of English and Science, while four high schools chose to collaborate and produce shared Year 7 units of work in the areas of English, Maths, Science and History. Other schools indicated a focus on broader concepts such as literacy, numeracy and the general capabilities of critical and creative thinking. The following cases exemplify some of the teacher perceptions of the challenges and opportunities inherent in the implementation of the Australian Curriculum.

One principal in a Northern primary school saw the requirements of the Australian Curriculum as a validation of her leadership:

I think that the Australian Curriculum has done me as a leader a huge favour because I believe in those general capabilities we can see digital technologies clearly embedded in the English syllabus. It’s no longer just me as a leader saying that this is what I would like. Now, digital technologies are becoming mandatory teaching and learning, so it’s been very good timing leading towards that implementation – and a really good time of change – because we are all in a process of change with the current implementation. It’s helped focus and track those changes.
Similarly, one assistant principal in a Western primary school described the opportunities for change presented by the new curriculum:

We started the school year with looking at both the Quality Teaching framework and twenty-first century skills and how much they're going to impact on our practice. The CC21 project came along and was a great vehicle for changing the curriculum and pedagogy and [for our staff] to realise that we all need to change. We're moving ahead, the curriculum's changing and therefore some of our teaching practices are going to need to change.

Another Northern high school teacher explained the complex culture of the school environment with the implementation of new curriculum. As she relates, the responses within the school differ; while some teachers see the new curriculum as an opportunity to change practice in a range of areas, others are more intent on simply doing what is necessary in the short term:

I think that particularly this year, because we've got the national curriculum coming in next year, there are the teachers who have said, “I'm just going to keep doing my thing,” and, “Oh, the national curriculum... okay. Well, I'll do that, but I'm not going to do any more. That's enough of a change for me.” Fair enough, it is a big change.

Some schools were especially interested in exploring the new technology tools that could be aligned to new curriculum content. One Northern primary school teacher describes the implementation of a core set of iPad apps that effectively align to areas of the new curriculum:

Students in Stage 3 will be using Popplet, Keynote, Pages, iMovie and Face Talk to create a poverty campaign that supports and reflects learning in for these English objectives. We are adapting a sample unit from the Board of Studies (BOS) site on Global Connections. Staff also plan to trial the Program Builder provided by the BOS when planning and programming. Our Stage 3 teachers are developing their professional learning in 21st pedagogy by blogging [about their learning]. Later this week our Stage 3 teachers will begin developing their personalised learning plans. Today Year 5 received their iPads and were busy exploring the core apps that are available to them. Creative and innovative times are ahead!

Finally, the importance of collaborative planning to address new curriculum requirements was emphasised by one western primary school principal. As she relates, collaboration between school leaders plays an important role in the implementation of the new curriculum:

Team teaching has been the advantage of the [integrated] unit... because originally it was just the CC21 project people taking it on... and part of it, we said earlier, was about technology... but also because it added that Australian Curriculum view... and we really wanted to get into that. The lovely thing was that you've just happened to touch the whole school... because they [CC21 participants] just happened to be team leaders... and when the others [teachers not in CC21] had heard about it, they just came on board with it...
Measuring Teachers’ Efficacy with the Australian Curriculum

The TPQL explored content knowledge (CK) as the area most closely related to the implementation of the new curriculum – that is, the direct knowledge of each teacher’s discipline areas. However, given the complexities of implementing new syllabus skills and content, the intersections between CK and other the knowledge dimensions of technology and pedagogy (such as pedagogical content knowledge, or PCK) represent areas that warrant further investigation. In particular, findings from components analysis (for further information, see the PCA section of the Pedagogy findings) suggest that while teachers see first-order constructs (PK/CK/TK) as separate, technology-related constructs all loaded as a second component when principal components analysis (PCA) was conducted on second- and third-order knowledge items. CC21 was an opportunity to try new technology tools and pedagogies in response to the challenges of the Australian Curriculum and teachers saw pedagogy and technology as key components in the implementation of the new curriculum.

To better understand the complexities of teacher knowledge and the Australian Curriculum, component scores from PCA were generated using the regression method using coefficients as weights rather than using the factor loadings. Teachers typically reported higher levels of content knowledge than other roles. By contrast, principals and school executive reported lower levels of CK. 5.13 shows the means plot for pedagogical content knowledge (PCK), which represents the knowledge of selecting and applying pedagogies relevant to specific content areas. Figures 5.11 and 5.12 show histograms for CK and PCK for the entire sample of respondents to the TPLQ:

5.11 – Histogram for Component Score CK
Component scores for both CK and PCK were negatively skewed, with more of the sample reporting higher levels of PCK and a fairly even distribution of participants in their CK.
Research Question:
“What are the contextual constraints that impact on teacher use of ICT as part of implementing the new curriculum?”

Twenty-first century schools are complex social environments. Teachers have to juggle a wide range of commitments and responsibilities that range from teaching, administration and reporting to national compliance, emotional support for their colleagues and students, an ongoing duty of care and a need to stay current with ideas and research. Increasingly, schools and systems are describing the phenomenon of “24/7 compliance,” where schools are expected to meet state- and national requirements for programming, registration and certification. Each school is resourced differently and school leaders and teachers work within these allocations to maximize learning. Socio-economic factors often influence the opportunities of students, while other external pressures like the Higher School Certificate impact on the workload and stress levels of teachers at specific times of the year. Students’ home environment – an area over which individual teachers and schools may have little control – also substantially shapes their learning, wellbeing and opportunities.

As they work within this complex environment to meet their students’ needs and improve learning outcomes, teachers also address their own learning needs in relation to emerging technology tools. Teachers’ use of ICTs are shaped by the environment in which they work and their beliefs and actions. However, traditional professional development programs have often been conceived and structured as one-off staff training days, where most (if not all) teachers are subjected to the same learning regardless of their needs or context. By contrast, CC21 aimed to work with the complex school environments by exploring teacher professional learning as:

- **anywhere/anytime** – employing both face-to-face and online modes, through structured and unstructured time;
- **just-in-time** – exploring learning outcomes in response to challenges emerging during the implementation of each school’s innovation;
- **focused** – emphasizing learning directly relevant to each school’s project; and
- **collaborative** – emphasizing learning within school project teams and between school teams.

This view of teacher professional learning enabled researchers to examine the unique context of each school and the impact of key contextual constraints identified. Throughout school visits, blog posts and interviews, a number of themes on contextual constraints emerged, including:
• the importance of adequate time, especially the provision of release time
• balance between structured and unstructured time
• the importance of evidence-based direction – esp. setting goals supported by research and school-based policies but balanced with teacher autonomy to try new ideas;
• leadership informed by innovation within the school and ideas from current minds in education;
• appropriate access to technology tools, including online tools and spaces for collaboration within and between schools;
• appropriate access to technology infrastructure, incl. wireless access to the internet; and
• troubleshooting technical issues involving infrastructure, hardware and software.

Exploring Support Structures in CC21

Of the seventeen participating schools, fourteen schools used project funding for teacher release time. Most of these schools reported the importance of accessing teacher release to enable collaborative planning, professional learning and evidence-based data gathering. While some schools chose to implement this release as whole days for participating teachers, others chose to break up release time into smaller components. For example, one Northern primary school released an iPad expert teacher every Thursday to team-teach with other participants throughout the day. As the teacher released noted:

I think that it’s the smartest way to do it... we’re a small school and we had a certain number of participants from our team... and also, I still have a class... so it’s good when I can say that Thursday I’m off... it’s quite nice to be able to have that block of release... and while the sessions are 45-60 minutes for each class, because I’m released the whole session, we’ve run over time quite a few times, but the teachers are willing to keep going – and I have the option to stay which is really nice.... and also as a practicality... packing the iPads up and taking them to the next class... you know, it’s just nice to have that day to focus on.

Other schools also noted the need to be flexible in the use of release time while ensuring that teacher release benefits the wider school community, as one Assistant Principal notes:

...so we’re spending a lot of money on professional learning... the big cost of course is the casual release... $415 a day and that’s the huge cost for us. We try to be creative with splitting classes... like today, I split two classes and a couple of teachers made comments about that... and I said “ok, well if you have a better idea, let me know”... so we try the whole give and take a little bit... and as far as our push towards being ready for the [Australian Curriculum] English syllabus next year...
Teacher leaders in particular noted the importance of release time for them to work with willing teachers:

There’s very few like me who actually get the release and the responsibility to do that professional development with teachers. There are fantastic teachers in other schools who are doing amazing stuff with technology, who are applying things in ways that I haven’t been doing, but they don’t have the time.

The Teacher Professional Learning Questionnaire (TPLQ) also explored time as a support structure, with ten items rated in importance by respondents through a 7-point scale on the use of professional learning time in different contexts. To understand relationships between the items, principal components analysis (PCA) was conducted, employing oblique rotation (direct oblimin). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis (KMO = 0.727) and all KMO values for individual items were greater than 0.50. An initial analysis was run to obtain eigenvalues for each factor in the data. Three factors had eigenvalues greater than one and in combination explained 69.11% of the variance. The scree plot was unambiguous, showing an inflexion justifying the retention of three factors. CC21 researchers retained three factors because the third component, though limited to one item, accounted for 10.23% of the variance. 5.13 shows the component loadings after rotation. The items that cluster suggest that Component 1 is time spent on preparation and planning within the immediate school environment, Component 2 is time spent networking and planning beyond the immediate school environment and Component 3 is traditional structured professional development (PD) days beyond the immediate school environment:

5.13 – Results of Components Analysis – Time-Related Support Structures

| Pattern Matrix | Component  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Importance of support structures: [Unstructured professional development days in my own school (e.g. a planning day with colleagues)]</td>
<td>.874</td>
</tr>
<tr>
<td>Importance of support structures: [Release time from class]</td>
<td>.789</td>
</tr>
<tr>
<td>Importance of support structures: [Structured professional development days in my own school (e.g. staff training day)]</td>
<td>.737</td>
</tr>
<tr>
<td>Importance of support structures: [Unstructured meeting time with leaders to discuss concerns face-to-face in my school]</td>
<td>.722</td>
</tr>
<tr>
<td>Importance of support structures: [Unstructured meeting time to share ideas face-to-face with colleagues in my school]</td>
<td>.703</td>
</tr>
</tbody>
</table>
The pattern matrix suggests that teachers perceived time spent on professional learning time in three different contexts; each context reflected the locus of professional activity and interaction related to teachers’ learning. As shown, unstructured time was generally perceived to be more important to professional learning, particularly in terms of interactions with colleagues both within and beyond the school environment.

The TPLQ also explored a range of other support structures in addition to those that were time-related. These structures included access to technology tools and infrastructure, the role of leadership and the importance of guiding policies (especially in relation to the use of technology). Similarly, PCA was conducted with oblique rotation, showing a KMO = 0.661 and all individual KMO values greater than 0.50. Eigenvalues of greater than one were extracted for four components and, in combination; these explained 71.87% of total variance. The scree plot was slightly ambiguous, suggesting the retention of either two or four factors. However, parallel analysis of randomised eigenvalues supported the retention of four factors. CC21 researchers retained four factors. 5.14 shows the component loadings after rotation. The items that cluster suggest that Component 1 is evidence-based direction, Component 2 is inspired leadership, Component 3 is the role of collaborative technology tools and Component 4 is access to adequate technology infrastructure (e.g. internet access):

<table>
<thead>
<tr>
<th>Importance of support structures:</th>
<th>Component 1</th>
<th>Component 2</th>
<th>Component 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson preparation time (e.g. designated free period in timetable)</td>
<td>.488</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unstructured meeting time to share ideas with colleagues face-to-face outside of my school</td>
<td>.893</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listening to a guest visitor during a professional development day or staff meeting</td>
<td>.705</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unstructured professional development days outside of my own school (e.g. a planning day with colleagues from other schools)</td>
<td>.642</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structured professional development days outside of my own school (e.g. one-day course)</td>
<td>.827</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 21 iterations.
## 5.14 Results of Components Analysis – Other Support Structures

### Pattern Matrix

<table>
<thead>
<tr>
<th>Importance of support structures:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaders who set a clear direction in the school for teachers to follow</td>
<td>.819</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research papers that I have searched for and accessed</td>
<td>.788</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A clear policy about how staff and students in the school should communicate online</td>
<td>.728</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research papers that have been shared with me by other teachers</td>
<td>.710</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The freedom to try new technology tools with my own students</td>
<td>.625</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaders whose ideas are drawn from the innovations of other teachers in the school</td>
<td>.901</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaders whose ideas are drawn from current minds in education (e.g. Lane Clark, John Hattie or Stephen Heppell)</td>
<td></td>
<td>.883</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online spaces for sharing ideas between schools (e.g. shared blog)</td>
<td></td>
<td></td>
<td>.822</td>
<td></td>
</tr>
<tr>
<td>Software that lets me collaborate with colleagues both face-to-face and online (e.g. Google Docs)</td>
<td></td>
<td></td>
<td></td>
<td>.804</td>
</tr>
<tr>
<td>Access to the Internet in the staff room</td>
<td></td>
<td></td>
<td></td>
<td>.835</td>
</tr>
<tr>
<td>Access to the Internet in my own classroom(s)</td>
<td></td>
<td></td>
<td></td>
<td>.779</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 8 iterations.
The component analysis shown in 5.14 provides some insights that are reflected elsewhere in project findings. The importance of evidence-based direction is reflected in Component 1, which includes setting clear directions and policies and drawing on current research while allowing for individual teacher autonomy. The high loadings shown in Component 2 reflect the importance of leadership that draws on current ideas and innovations rather than drawing directly on research. Separate to the research items loading in the first component, this component appeared to be more closely related to the role of educators within and beyond the school who inspire leadership. These findings are illustrated further, for example, in one teacher’s evaluation of Lane Clark, an IBL educator:

[Lane Clark] speaks to me... like, when I listen to her, there’s something about what she says and what she does that resonates with me... and I think that that is something that’s poignant in relation to teachers and moving them... It [the pedagogy] has to speak to them... it has to hit them in terms of their moral purpose and if the person speaking to them resonates with what they’re doing and why they do what they do, and perhaps forces them to challenge some of those things that they themselves weren’t quite comfortable with about their practice... that’s what pushes people forward.

The items loading in Component 3 reflected the importance of technology tools that enable sharing within and between school communities. Given the project’s emphasis on the use of these kinds of tools, their loading as a component separate to technology infrastructure (Component 4) was not surprising. To illustrate the role of collaborative tools further, one school assistant principal described the potential of Google Apps for Education, with two members of his executive team having used Google Forms for a staff survey. Both of these leaders were keen to see this technology used as the basis of creating and sharing resources through a “learning alliance” of schools in the local area:

...and that’s where we see the learning alliance [going] of the four schools being able to use this technology... [our Deputy Principal] might be able to send something out and they can be there on the same document... sitting at their own desk... collaborating in real time... so we've talked about that [technology] as an important part of getting that learning alliance happening... and I mentioned that we pushed [the staff] hard a little bit and now we’re just sitting until we get really going...

In addition to the time and support constraints, a majority of schools encountered technical difficulties during the integration of technology into classrooms. These included problems with wireless Internet nodes and compatibility of various software and hardware. One participant remarked that for their Northern primary school unreliable wireless internet access was quite problematic: “our biggest hiccup so far has been our wireless playing up and being intermittent, though hopefully that’s resolved now as IT support came out today.”

At the outset of the project, a number of schools found staff had varying levels of competence with various types of technology and programs were yet to incorporate new Australian curriculum components. This was further supported by
the post-project teacher survey data, reported in Profile of Active Participants. One northern high school’s project plan highlights this varying competence level and the unexplored potential of spreadsheets in their mathematics faculty:

At present, ICT is used inconsistently across the faculty. Most teachers are comfortable using Excel, Geogebra and mathletics. Some teachers use YouTube clips and Clickview. Students in Year 7 complete ICT4U but Excel is not then being used as a tool for teaching and learning for students beyond year 7 by many teachers.

Compatibility was another issue faced by schools. One Northern secondary school in particular chose to implement a Bring Your Own Device (BYOD) model by encouraging parents to allow their children to bring in technology to assist with learning in the classroom. Although the school’s device agnostic view allowed for inclusive access to learning tools, it resulted in an increased demand on teachers’ professional learning and troubleshooting. Additionally, the limited number of free, cross-platform apps meant that its implementation encountered many hitches. Although schools had existing technology access, some classroom had yet to benefit from the technology. A northern primary school with existing technology facilities remarked that integration of tools in learning was not as effective as it could be: “currently, the use of technology, although widespread and generally positive, is not always a natural choice of learning tool.”

Some teachers also commented on the need to evaluate lessons to ensure technology had not been used as a ‘tack-on’ and that it should be effectively integrated with content and pedagogy of the lesson to enhance learning, stating “one of our challenges was to remember to use technology when it’s the best tool rather than trying to create a lesson around the technology.” These findings suggest that while twenty-first century schools are complex environments, many teachers work effectively within these environments through self-managed, school-developed models that balance learning within the immediate school environment with networking beyond it. They understand and appreciate the importance of clear direction, evidence-based practice and leadership, while also appreciating leaders who are inspired by current minds and innovative ideas.
TECHNOLOGY

Research Question:
“How can contemporary technologies be most effectively used to support learning and teaching?”

Technology was a substantial component of the CC21 project. As participants explored the links between technology, pedagogy and the Australian Curriculum, they employed current web tools and devices to share their findings and document their learning. As noted in the Project Funds page, many schools saw CC21 as an opportunity to purchase and trial new devices (in particular, iPads). This section reports on participants’ use of technology to support their professional learning throughout the project and into the future.

CC21 Participants typically use technology devices for learning that fall into the four categories shown in 5.15. As indicated, the most common devices used are smartphones and laptop computers, followed by tablets and desktop computers. Desktops (used by 65.1% of participants) represent the least commonly used technology device. With a considerable component of CC21 school funding being spent on iPads, tablets represent a growth area that will likely change the nature of future professional learning, particularly as teachers opt for more mobile devices.

5.15 – Device ownership: CC21 participants

<table>
<thead>
<tr>
<th>Devices owned</th>
<th>(%) Used by participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smartphones</td>
<td>93.7</td>
</tr>
<tr>
<td>Laptops</td>
<td>93.7</td>
</tr>
<tr>
<td>Desktops</td>
<td>65.1</td>
</tr>
<tr>
<td>Tablets</td>
<td>81.0</td>
</tr>
</tbody>
</table>

5.16 shows the distribution of the sample mean for time spent online for professional learning in several categories. Across the data set, active participants reported spending, on average, 12.1 hours per week online to support their own professional learning. This time (in equivalent minutes) was distributed across the categories shown. As indicated, “Reading information online” and “Watching or listening to audio and/or video content” were the categories in which teachers spent most of their time online for professional learning. However, “Sharing information with people” still involved an average of 88 minutes per week of time spent online. While “Creating your own content” involved the least amount of time spent online (59 minutes per week), co-creating content (which involved working collaboratively with colleagues and editing one another’s work rather than working solely) was slightly higher (63 minutes per week).
In the Professional Learning Questionnaire, participants were asked to indicate the relative contribution made by categories of people and organisations to their own professional learning (with each category as a percentage of the whole contribution made). 5.17 shows the distribution of the contributions made by each category. As shown, “Teachers in my school” (30.6%) were regarded as making the largest contribution to participants’ professional learning, followed by the “System in which I work” (18.3%) and “State-based organisations,” including organisations such as the NSW Institute of Teachers and the English Teachers Association (14.2%). By contrast, national organisations such as the Australian Curriculum and Reporting Authority (ACARA) and the Australian Institute of Teaching and School Leadership (AITSL) represented 10.6% of the overall contribution made. Some teachers acknowledged the contribution of “Software and hardware companies” that run education programs (6.5%), while “Bloggers I follow” (4%) and “Social media pages” (3.1%) were regarded as making relatively little contribution. Nonetheless, “Educators I follow on social media” represented a sizable component (12.8%); this component arguably reflects the growing global influence by contrast to the local and state-based contexts. Given the requirement for teachers to respond to the challenges of the Australian Curriculum, national organisations would, likewise, be expected to make a larger contribution to teacher professional learning in the future.
Sharing information online now accounts for a considerable component of teachers’ professional learning. Participants were asked to indicate the categories of people and organisations in which they share information online for the purposes of professional learning. The bar chart in 5.18 shows the frequencies of sharing recorded in each category. As shown, “Teachers in my school” (n=63) and “Educators within my system” (n=52) were the highest categories for information shared online, followed by “Students in my school” (n=41). These categories represent the local and system contexts that are similarly reflected in 5.17. By contrast, substantially fewer teachers shared information in the categories of “National organisations” (n=8), “Open social networks” (n=9) and “Anyone publicly on the web” (n=6). However, “Friends on closed social networks” (n=24) suggests that participants were more comfortable in closed contexts.

5.18 – Participant Sharing Online

To show one possible representation of the extent to which participants shared information online, a sharing index was created. This index reflects the number of categories (of the nine included in the questionnaire and shown in 5.18) indicated by each participant, with a higher index representing more categories. For example, a participant who indicated four of the available categories scored an index of 4/9, or 0.44, while a participant indicating all nine categories scored an index of 9/9, or 1. The scatter plots in Figures 5.19 and 5.20 show the relationship between the sharing index, experience (years) and age (years). As shown in 5.19, there appears to be no statistically significant relationship between the participant’s age and the number of categories in which they share information online. 5.20 shows a very slight negative correlation in the relationship between teaching experience and the number of sharing categories.
5.19 and 5.20 – Sharing Index vs. Age and Experience (Years)

Scatterplot of Sharing Index vs Age

Scatterplot of Sharing Index vs Experience (years)
Finally, teachers were asked in the questionnaire to rate their technology knowledge (TK) on a 7-point scale (strongly disagree – strongly agree) in relation to the following items:

- TK1 - I have the technical skills to use computers effectively;
- TK2 - I can learn technology easily;
- TK3 - I know how to solve my own technical problems when using technology; and
- TK4 - I keep up with important new technologies.

The histograms shown in 5.21 illustrate the shape of distribution for each TK-specific item. As shown, each item exhibits a normal bell curve distribution, with TK3 (ability to solve problems independently with technology) showing the lowest mean and largest standard deviation.

**5.21 – Participants’ Technology Knowledge (TK) by Role**
Of the seventeen participating schools, nine used project funding for the purchase of new hardware devices. Of these, six schools purchased iPads as part of their project. As tabled here, iPads represented the very large majority ($25,961 or 20.5%) of overall funding spent. For most of these schools, iPads were employed in a variety of configurations including one iPad per classroom, 4-8 iPads shared across the classroom – one per group and, where possible, a whole class set. Two schools indicated future intentions to deploy iPads in a whole-year 1:1 program, while one school encouraged parents to consider iPads as part of a whole-year BYOD program.

5.22 Top five devices purchased with CC21 funds

<table>
<thead>
<tr>
<th>Device</th>
<th>Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPads</td>
<td>$25,961</td>
</tr>
<tr>
<td>Apple TVs</td>
<td>$3,368</td>
</tr>
<tr>
<td>Robotics kits</td>
<td>$1,950</td>
</tr>
<tr>
<td>Macbooks</td>
<td>$2,665</td>
</tr>
<tr>
<td>iPods</td>
<td>$760</td>
</tr>
</tbody>
</table>

Likewise, iPads were employed in classroom teaching for diverse purposes including the use of literacy applications, collaborative writing, filmed reading, creating multimodal texts, video editing. One teacher described the attitude staff had towards entrusting younger students with iPads:

I said, ‘give the kids the iPads... let them take them out and film things.’ And we had a couple of teachers who said ‘oh no – they’ll drop them... they’ll hurt them!’ But at our Easter Hat Parade we had three toddlers sitting ALL with iPads filming... their OWN iPads... and the teachers saw them and I said, ‘if these parents are entrusting their own iPad into the hands of their three year olds, surely you can entrust the school’s iPads into your students’ hands...’ and that was a bit of an eye opener for them...’
Another school leader cited the mobility benefits of iPads, noting that they were suited to field-based research. She described a Inquiry-Based Learning (IBL) project where students used iPads to document their learning:

...the children have actually had to go out and survey people... they've gone through the gardens with iPads and looked at classifying the bugs and insects... the program was very heavily Science-based but they [the kids] did a lot of literacy with it... writing information... and we just got the iPads this term... so it's been learning to use them... so we found a lot of things were possible.. and there was a lot of inquiry learning. So, for my particular part, I'm at the tail end of the project now where we've done the financing getting the community and writing letters for donations... so it looks like we're about to go ahead and do the planting! One teacher described how iPads were being used to enable Inquiry-Based Learning (IBL) in the area of Stage 3 Science. As she noted, the mobility of iPads made them well-suited to gathering real world data and documenting learning:

On the other hand, several school leaders and teachers acknowledged that iPads are still limited in their affordances and may not be the best device to select for a 1:1 school program. Many schools used iPads in combination with more traditional forms of computing such as desktop and laptop computers.

In relation to the dominant use of iPads in a school environment, one principal noted:

I'm not too keen on the idea of schools that have taken on the whole iPad, one for every child. It has a limitation as a device. We have a certain number of them here, but we have an affordable device [a netbook] that has also limitations as the “one device.” However, I can buy a lot more of those for $100 each than I can in iPads. So it just depends how strategically you support teachers and how do they feel that they can embrace this... and how it can enhance their teaching. It's about strategically all of those things lining it up so people have the most support they can, because when people are supported, they'll give it a go.

Another principal reinforced the need for a mix of devices in the classroom, citing the benefits of netbooks:

I know that the senior classes at the moment have got one bank of 8-9 netbooks and they're certainly saying to me that we need a lot more than that... that we need at least double for working in the classroom. The netbooks at the moment are for Years 2-6. So, I would also like to see them brought right from Kindergarten right through to Year 6. I think that there needs to be a mix of both because I think that both of them have different applications and uses and I certainly see that [mix] progressing into the future.
From the project plan and school blogs, iPads were used in almost all of the schools involved in CC21 project as it was mentioned in 15 of the 17 school blogs. Edmodo and Popplet, a web 2.0 tool and tablet app respectively, were also popular tools with roughly a third of participating schools mentioning their use. Eight schools also mentioned the use of the Board of Studies Program Builder, demonstrating teachers making use of the free service provided by the Board of Studies to assist with collaborative programming with the Australian curriculum.

It is of interest that the three schools that mentioned the widest variety of technology in their blogs were all from the Western Sydney region. As this data was collected from blog entries and project plans, the number of technologies may be influenced by the amount of blog posts published by the school. Although this may be the case, researchers note that the leadership within these schools were committed to implementing technology within their school and collaborated and supported the needs of their staff through the implementation process. One principal discusses the innovation in the philosophy of his school.

> For here it’s always been we will trial, we will change, we will innovate just why our banner statement says innovation, excellence, success because that’s what we’re about. (...) The young teachers are driving the programs in the school. The more experienced teachers are saying yeah you know what, I like this. We haven’t heard that issue, they just embraced the technology.

All schools chose their suite of technologies according to the needs of the individual schools and as a result some schools used more technology than others. However, it is important to note that the value of technology in a school should not be counted by the amount or variety it has, rather the effectiveness of whether it meets the needs of the school should be considered. Additionally, as participants were not explicitly asked to provide a comprehensive list of software and hardware used, thus researchers were only able to report on the number of technology schools had mentioned in blogs or their project plan and not how many were used.

In terms of the participating schools, iPads reflect important area for future research. The interest in iPads as a tool to enhance learning is of particular interest in Department of Education and Communities (DEC) schools, where iPads have not been formally supported by system leaders and IT infrastructure. The CC21 project therefore represents an important opportunity for participating teachers to innovate with newer technologies.
In the twenty-first century, education represents a global community of teachers, parents, students, researchers, governments and key organisations. Classroom strategies, teaching resources, study findings and communities are easily found online. Teacher bloggers reflect their classroom practice - what worked well and what needed improvement. State-wide organisations like the Department of Education and Communities (DEC) provide access to resources like Scootle, a vast repository of lesson plans, resources and other teaching ideas. To meet increasingly national agendas, organisations like the Australian Institute for Teaching and School Leadership (AITSL) explain and demonstrate capabilities through their Illustrations, dozens of videos that demonstrate best practice in action. Tools like Google Scholar provide instant access to relevant research, and many scholarly journals now provide open access to peer-reviewed educational studies from around the world. Perhaps more than at any time in history, educators are able to draw on evidence from a wide range of freely available sources to inform their practice now and into the future. Throughout the CC21 project, researchers explored how evidence-based approaches to learning technology innovation could influence teacher practice. Findings suggested a number of relevant themes that could be explored in future research:

- shared community blogs to enable transparency of practice within and between school communities;
- tools for gathering data and interpreting findings for collaborative planning; and
- the importance of research to inform school leadership decisions and teacher actions.

Community Blog

A shared online space for all participants, the CC21 community blog encouraged all participants to record their school’s progress from their perspective. Some blog posts were focused on weekly themes that had been explored in face-to-face workshops, while other posts were more open-ended. Participants were all encouraged to share their own stories. For classroom teachers, these stories often involved describing and reflecting on lessons with new technologies. For school leaders, stories often took the form of open reflection on key decisions made by
their leadership teams. For example, one school leader used a blog post to reflect on the development of the school’s project for CC21:

It was really interesting working on finalising our project plan earlier this week. We had already put together a plan and timeline of what we hoped to achieve by participating in this project, and completing this project plan gave us the opportunity to add more depth to this. Our school has a unique context. The use of technology is embedded in all that we do and we have access to an amazing array of technological devices. Our main focus of Inquiry Based Learning is going to provide us with the opportunity to further develop our use of technology. Self-assessment & peer assessment is an area our staff has identified as an area of weakness. Participation in this project is going to allow us to address this area of assessment, which is going to be of benefit to our students.

Tools for gathering data and collaborative planning

Several schools chose to incorporate surveying into their project plan development. For these school leaders, surveying tools like Google Forms and SurveyMonkey were used to evaluate areas such as teachers’ areas of weakness with technology, the school community’s thoughts on key leadership decisions, information used to support school infrastructure and ideas to be explored in future staff development days. For example, one northern high school used a survey to inform future decisions about a bring your own device (BYOD) program for technology devices in Year 7. One northern primary school used surveying to examine how teachers were exploring creativity in the classroom:

There are many different ways of valuing creativity in the classroom and knowing what it should look like. It is a hard thing to teach too, as creativity is a ‘whole-brain’ process. This was particularly evident in responses students provided for the survey we conducted, showing that they could not always define creativity or recognise opportunities for creativity in the classroom.

Scholarly Readings

Some schools emphasised the importance of using research to inform leadership decisions. For many of their participants, research was described as an iterative process that could be used at any stage in the development of ideas and resources or as the basis of planning or staff development. One northern high school teacher reflected on the importance of research in the development of twenty-first century learning spaces:

One such conversation was with our deputy principal, who was extremely encouraging of our idea to change one of our English classrooms into a more flexible ‘21st Century Learning space’. On his advice I have since visited Andrew Churches Edorigami website, which has a number of articles on what a 21st Century learning space looks like and the pedagogy behind it... our team can investigate possibilities for our room.
Similarly, one western primary school underscored the importance of empirical studies, citing the significance of one article on self-directed learning as a key component in the development of the school's project plan:

The article also focuses on students' ability to self-assess their own learning needs in order to carry out activities to inquire and discover about things they want to know. In saying this self-directed learning examines how students explore and take ownership of their work in small groups or as individuals. Motivation is a highly successful key for self-directed learning. Positive motivation enables a student to initiate effort to carry out the tasks, to find resources and persist when having difficulty.
CONCLUSION

This report has sought to convey the success Connected Communities 21, a model for teacher professional learning that promotes self-managed change in relation to the areas of pedagogy, technology and a new curriculum. Each of these areas reveals a number of challenges that are faced by all schools in the twenty-first century. As the findings suggest, each school responds differently to the challenges faced, based on their own perceived needs and interests. While these findings suggest that there can be no “one-size-fits-all” approach to innovation, further research is warranted. In particular, how schools manage change is warranted. In particular, how schools approach pedagogy when exploring new technologies and the impact of leadership styles on both the scale and nature of innovation are areas for further research.

The twenty-first century has challenged school leaders with changing local, national and global contexts. Such challenges will only continue, with a growing number of pressures such as implementing new curricula and skilling teachers in evidence-based pedagogies while making meaningful use of new and rapidly changing technology tools. Many of the support mechanisms that exist in schools still reflect traditional face-to-face structures like the one-day training program and afternoon staff meeting. However, with numerous opportunities to explore digital tools for more personalised learning around the needs of the individual learner, school leaders need to be more aware of future possibilities than ever before. This study has investigated some of the ways that school leaders are responding to the challenges they face in the twenty-first century. As they continue to explore the possibilities – now and into the future – school leaders should be acutely aware of their responsibilities as leaders of learning in the digital age.
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