



Information and Communication Technology in Educational Policies in Australia and New Zealand

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Abstract

The chapter presents a summary of developments in relation to Information and Communication Technologies (ICT) in educational policies in Australia and New Zealand. It provides important insights into how policy decisions are influenced by the national and local contexts in those countries, and how policies are

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influencing the integration of ICT in teaching and learning in primary and secondary education. Trends and developments are identified through the analysis of policy documents and published research to highlight differences and similarities between the two countries. The chapter indicates that both countries have introduced digital technologies in schooling in ways which reflect learning with digital technologies, and are shown to be influenced by international trends. Both Australia and New Zealand have been developing curriculum to guide the teaching of students to learn about digital technologies, through computational thinking and coding. A key challenge continues to be providing equitable access to opportunities for teachers and students to integrate digital technologies effectively into teaching and learning. However, New Zealand has a nationally funded policy of providing universal access to Broadband Internet to all schools which research has found to correlate with improved achievement in the primary years and similar infrastructure priorities were evident in Australia. A further challenge is building teacher capability with and dispositions about digital technologies for effective implementation of policies in both countries.

Keywords

New Zealand · Australia · ICT policy · Digital technologies

Introduction to ICT in Primary and Secondary Education in Australia and New Zealand

This chapter presents a summary of developments in relation to information and communication technologies (ICTs) in educational policies in Australia and New Zealand. Throughout this chapter, we use ICT and digital technologies synonymously and interchangeably and recognize that ICT and digital technologies are not values-neutral “tools” which can be merely integrated into existing curriculum, pedagogy, and assessment, but are viewed as new and emerging technologies which impact upon curriculum, pedagogy, and assessment.

Subsequent to outlining the contexts of schooling in Australia and New Zealand, recent developments in ICT in schooling in Australia and New Zealand are discussed. Those developments are framed within international trends, challenges, and developments in technology through reference to the *NMC/CoSN Horizon Report: 2016 K-12 Edition* (Adams Becker et al. 2016). Given the dynamic changes in technologies and the implications for policy, recent policy developments are then highlighted. These include policies which respond to challenges relating to infrastructure, governance, curriculum, and expectations for current and future teachers. Relevance of cross-national and worldwide strategies and plans for Australia and New Zealand are then presented, together with a discussion about the challenges and relevance of research for policies on ICT in education in Australia and New Zealand. The chapter concludes with some key perspectives and emerging themes about developments in Australia and New Zealand.

Contexts: Australia and New Zealand

As Sawer et al. (2015) have noted, the contexts of both Australia and New Zealand today have been influenced by British colonization and settlements. They indicate, for example, as well as having the Union Jack and the Southern Cross on their national flags, both countries have inherited Westminster political institutions and that, when the process of federation began in Australia toward the end of the nineteenth century, there was some thought that New Zealand might become the seventh state, geographically separated by the Tasman Sea. Though this did not occur, Sawer et al. (2015) explain that there has been significant policy transfer between the two countries which are democratic nations, but the two countries also differ in terms of their political architecture.

In summary, Australia and New Zealand each has a unique identity and context developed over time through a range of historical, social, cultural, political, environmental, and geographical influences. To illustrate, while acknowledging the influence of British settlement on the democratic systems on education policy and the aims and purpose of education is evident in both countries, this chapter will establish that the educational policy responses are uniquely different. Therefore, directly relevant in this chapter is the understanding that these contexts are being shaped by and responding to technological developments. For example, ICT presents educational challenges and opportunities for addressing issues associated with the geographical isolation which is a feature of both countries, as both Australia and New Zealand have diverse population demographics and are distant from other Organisation for Economic Co-operation and Development (OECD) countries. How each country has responded to those challenges and opportunities is discussed in subsequent sections of this chapter.

Schooling in Australia and New Zealand

To logically follow the previous section which provided a summary of the Australian and New Zealand contexts, schooling in Australia and in New Zealand is briefly discussed in this section. This provides the essential context for the subsequent discussion on recent developments in ICT in schooling in both countries.

Schooling in Australia

Essentially, there are three school systems – government, independent, and catholic schools, located in state (New South Wales, Queensland, Victoria, South Australia, Western Australia, and Tasmania) and territory (Northern Territory and Australian Capital Territory) jurisdictions. According to the Australian Bureau of Statistics (ABS 2016a), in 2015, the number of students enrolled in schools in Australia was 3,750,973. Government schools were the major provider (2,445,130 students – 65% of all students), while the remainder (1,305,843 students – 35% of all students) attended either independent or catholic schools. Of those students, 200,563 students (5.3% of all students) were Aboriginal and Torres Strait Islander students. In 2015, there were 9404 schools (ABS 2016b, c), consisting of 6639 government schools,

1737 catholic schools, and 1028 independent schools. There was a total of 301,572 full-time equivalent (FTE) teaching staff in 2015, consisting of 218,849 female teaching staff and 82,723 male teaching staff (ABS 2016c).

These data enable a sense of the scale and diversity of schooling, in terms of sectors and school systems, in Australia. States and territories largely have responsibility for schooling in Australia. This can be traced back to British settlement which resulted in separate colonies which became states when the Commonwealth of Australia occurred with federation in 1901. This has created some tensions between the Australian government and state governments in relation to national approaches to education, while recognizing and respecting state authorities and responsibilities. Examples of different schooling resulting from state education policy decision-making and within the different schooling systems (government, independent, and catholic) include different starting ages of students, variations in curriculum, variations in ICT policy, infrastructure and resourcing, and different expectations and pay scales for teachers. Furthermore, individual schools vary in terms of their autonomy and agency in ICT strategic planning, decisions, and practices.

Schooling in New Zealand

In October 2016, there were 796,993 school students enrolled across New Zealand's 2501 schools. The schools vary in size with 186 having fewer than 30 students and 118 with more than 1000 students (Education Counts 2016a). The majority of students (96%) are enrolled in state or state-integrated schools (government funded with a special character). Each school has its own curriculum developed from one or both national curricula documents, and the purpose of both the English medium and Māori medium versions is to "develop the competencies [young people] need for study, work, and lifelong learning and go on to realise their potential" (Ministry of Education 2007, p. 6).

New Zealand has a devolved schooling system. For state and state-integrated schools, the central government sets educational policy such as national curriculum, pays teacher salaries, and allocates funding to schools for operational expenses and buildings. The state funds centralized quality assurance through the Education Review Office and sets accountability standards that focus on literacy and numeracy for primary schools and qualification attainment in secondary schools. Within this framework each school is self-managing with autonomy to set strategic priorities, develop a school curriculum appropriate for their context drawing on the broad national curriculum and manage resources provided through the operational grant. Thus the state has broad guidelines for curriculum and pedagogical approaches, and each school applies these as appropriate to their context. This creates opportunities and challenges for each school to develop their own approach to the integration and teaching of ICT or digital technologies.

Challenges and Opportunities in Integrating the Regions into One Chapter

Given the differences and variations, for example, between jurisdictions, sectors, and school systems in Australia, this presents a significant challenge within this chapter in representing Australia as a single educational entity with a single set of policies.

This task is exacerbated when attempting to construct a discussion about both Australia and New Zealand. However, while, acknowledging this challenge and the limitations associated with this, there is a wonderful opportunity and great value in attempting to provide a comparative exploration of the developments in ICT in schooling in both countries, through considering their policies in ICT in education, the role of research, and emerging perspectives.

Recent Developments in ICT in Schooling in Australia and New Zealand

Fullan, in his William Walker Oration titled *Leadership in a Digital Age* at the 2015 Australian Council of Educational Leaders Conference, highlighted the three big forces now evident – technology, pedagogy, and change knowledge. He argued that “technology outstrips the others in dynamic movement. . .In any case traditional schooling is an outdated failure...The internal challenge is boredom; the external challenge is uncoordinated threat and opportunity” (Fullan 2015, p. 6). Thus, the discussion in this section initially examines trends, challenges, and technologies from an international or “satellite” perspective, highlighting recent trends, challenges, and developments in ICT schooling in Australia and New Zealand.

Trends, Challenges, and Technologies: Horizon Report

In examining international trends, challenges, and technologies, the *NMC/CoSN Horizon Report: 2016 K-12 Edition* (Adams Becker et al. 2016) identified key short-term, midterm, and long-term trends accelerating technology adoption in K-12 education, challenges impeding technology adoption, and important developments in educational technology over three time-to-adoption horizons. As displayed in Fig. 1, the horizons relate to the period from 2016 through until 2020.

In that report, references are made throughout to developments in Australia and New Zealand, such as the following examples:

- **Long-Term Trend: Redesigning Learning Spaces**
“The New Zealand Ministry of Education. . . .has published a set of guidelines and an assessment tool to help schools apply flexible learning spaces into redesigns and new constructions. All schools are required to comply with these standards...” (Adams Becker et al. 2016, p. 8)
- **Midterm Trend: Collaborative Learning**
“...students and teachers in New Zealand...are using platforms such as WhatsApp to establish an online partnership to bring forth a greater understanding and perspective of the importance of each culture to one another.” (Adams Becker et al. 2016, p. 12)
- **Midterm Trend: Deeper Learning Approaches**
“New Tech Network is working with over 100 schools, districts, and communities across the US and Australia to implement PBL in public schools and offer professional development in facilitating meaningful projects. . . .” (Adams Becker et al. 2016, p. 15)

| Challenges | Trends | | | | |
|--|--|--|--|------|------|
| | Short-Term (one year or less) | Mid-Term (two to three years) | Far-Term (four to five years) | | |
| Solvable: Those that we understand and know how to solve <ul style="list-style-type: none"> ➢ Authentic Learning Experiences ➢ Rethinking the Roles of Teachers | <ul style="list-style-type: none"> ➢ Coding as a Literacy ➢ Students as Creators | <ul style="list-style-type: none"> ➢ Collaborative Learning ➢ Deeper Learning Approaches | <ul style="list-style-type: none"> ➢ Redesigning Learning Spaces ➢ Rethinking How Schools Work | | |
| | 2016 | 2017 | 2018 | 2019 | 2020 |
| Difficult: Those that we understand but for which solutions are elusive | Developments in Technology | | | | |
| | Near-Term (one year or less) | Mid-Term (two to three years) | Far-Term (four to five years) | | |
| <ul style="list-style-type: none"> ➢ Advancing Digital Equity ➢ Scaling Teaching Innovations | <ul style="list-style-type: none"> ➢ Makerspaces ➢ Online Learning | <ul style="list-style-type: none"> ➢ Robotics ➢ Virtual Reality | <ul style="list-style-type: none"> ➢ Artificial Intelligence ➢ Wearable Technology | | |
| Wicked: Those that are complex to even define, much less address <ul style="list-style-type: none"> ➢ Achievement Gap ➢ Personalizing Learning | | | | | |

Fig. 1 Trends, challenges, and technology developments in K-12 education (Adapted from Adams Becker et al. 2016, p. 2)

• **Short-Term Trend: Coding as a Literacy**

“Australian parliament members are working to ensure coding is taught at all primary schools. . .by 2020. (Adams Becker et al. 2016, p. 17)

Trends, Challenges, and Technologies: Australia

Key trends, challenges, and technologies in schooling in Australia include ICT resources in schools and the take-up of digital technologies, implications for curriculum, and the changing knowledge base of future and current teachers to develop and demonstrate technological pedagogical and content knowledge (TPACK) (Misra and Kohler 2006).

In relation to ICT resources in Australian schools, Thomson (2015) reported that “. . .on average, every three students have access to one computer, compared to the international mean of 18 per computer” (Thomson 2015, p. 12) and that there were little variations between jurisdictions, though this ranged from 1:1 ratio in the Northern Territory up to 4:1 in New South Wales. Almost a decade earlier, White

(2008) had also highlighted the substantial provision and take-up of and access to technologies by students in schools and in their homes. Importantly, White (2008) observed that major networking initiatives had been undertaken to improve technology infrastructure in Australian schools so that learning can be designed in the future that enables students to learn anywhere at anytime.

The implications of ICT for curriculum can be conceptualized according to two distinctive considerations in Australia. Firstly, it can be conceptualized as learning and teaching *with* digital technologies. That is, ICT enables teaching and learning experiences to be designed to enable students to access, share, revise, and create learning content using digital technologies. Secondly, it can be conceptualized as learning *about* digital technologies. This is evident through *The Australian Curriculum: Technologies Learning Area* (ACARA 2016a) consisting of two subjects, namely, *Design and Technologies* (ACARA 2016b) and *Digital Technologies* (ACARA 2016c), to be taught to all students from Prep to Year 10. Furthermore, *The Australian Curriculum* (ACARA 2016d) requires students to develop the ICT capability (ACARA 2016e) as one of seven general capabilities expected to be developed across all learning areas.

Both learning *with* and learning *about* digital technologies present new expectations for future teachers. This has been highlighted at the *Queensland Digital Technologies Summit 2016: Initial Teacher Education* (Finger et al. 2016). For example, the Digital Technologies Summit identified initial teacher education strategies (Finger et al. 2016) required for teacher graduates to develop the competencies *with* and dispositions *about* digital technologies required to demonstrate the Australian Institute for Teaching and School Leadership (AITSL) (AITSL 2011a, b) professional standards at the graduate level.

In relation to current teachers, Thomson (2015) drew upon the finding from the *International Computer and Information Literacy Study* (ICILS) (Fraillon et al. 2013) that the most problematic obstacle related to ICT skills of teachers. For example, in the ICILS, the Australian ICT coordinators who were surveyed reported that “75 per cent of Year 8 students attend schools in which the biggest problem reported was the lack of ICT skills among teachers” (Thomson 2015, p. 12). Consequently, there is evidence of increased attention, and research is evident in relation to TPACK in ITE programs and professional learning for teachers as technological knowledge (TK) is being considered important for teachers to develop and demonstrate, along with pedagogical knowledge (PK) and content knowledge (CK).

Trends, Challenges, and Technologies: New Zealand

Key trends, challenges, and technologies in schooling in New Zealand are summarized as being the development of learning spaces through redesigning physical spaces, Bring Your Own Device (BYOD) and mobile devices initiatives, the challenge of equity in relation to access to digital devices, implications for curriculum, and the use of data analytics.

As referred to in the *NMC/CoSN Horizon Report: 2016 K-12 Edition* (Adams Becker et al. 2016), the New Zealand government has prioritized modernizing of

school classrooms across the country, due to the age of existing classrooms, population growth, and the Christchurch earthquakes of 2010 and 2011. The development of *learning spaces* as opposed to classrooms has been a focus since 2010, underpinned by the notion that schooling in a digital age should look different to schooling in an industrial age (Ministry of Education 2015a). The changes in physical learning spaces are underpinned by the notion that teaching and learning at school should be differentiated and responsive to the needs of the students, rather than focused on a teacher delivering a one-size-fits-all curriculum (Ministry of Education 2015a). Increasing access to resources through digital devices can enable the implementation of student-centered pedagogical practices (Hannafin et al. 1997). The central funding of new or altered physical spaces in which teachers collaboratively teach cohorts of up to 120 students reflects the aim that teaching will be more personalized for the students. This is a significant trend in primary schools, particularly for children aged 8–12, with walls being knocked down between existing classrooms and teachers developing ways to work collaboratively. A similar trend is occurring in some secondary schools, with a number exploring flexible timetabling with longer scheduled classes and open plan spaces. These policy directions have not yet been evaluated.

A current trend in New Zealand secondary schools is the introduction of BYOD policies. The majority of secondary schools either allow or require students to bring a device which connects with the school's Wi-Fi for learning and make use of tools such as Google Classroom and subject-specific tools for learning (Johnson et al. 2014). This is complemented by the current ICT focus in New Zealand on the infusion of mobile devices within teaching and learning. In primary schools in New Zealand, mobile digital devices are more likely to be purchased or leased by the school with touch screens being used by younger children and netbooks by older children (Johnson et al. 2014). While some schools have a dedicated one device per student policy, the majority provide access to shared devices that children can use for learning. Interactive whiteboards continue to be utilized in some primary classrooms, although these appear to be losing popularity with the evolving pedagogy and availability of large flat-screens with functions such as Chrome casting.

A significant challenge is equitable access to digital devices for learning. Primary schools in low socioeconomic contexts purchase fewer devices than those in higher socioeconomic contexts. In some low socioeconomic contexts, trusts, such as Manaiakalani (Jesson et al. 2015), have been established to assist families purchase or lease netbooks for learning at home and school. However, equitable access to devices and the Internet at home across the country is a challenge in the current context.

A further challenge is teaching a curriculum that enables students to become digitally competent. ICT are embedded in the technology learning area of the New Zealand Curriculum (Ministry of Education 2007). Each school develops their own curriculum from the national document and determines the extent that computing and digital technologies are taught across the school. The teaching of coding is not explicit or required in the existing flexible national curriculum, although this is being introduced in 2018 (Ministry of Education 2017). In recent

years, coding clubs have been introduced to some primary schools as an option or extracurricular activity, and there has been a growth in robotics taught as part of the technology curriculum to 10–13-year-olds. Some primary schools have been exploring the teaching of computer programming, usually introduced by a teacher with a passion for coding (Falloon 2016).

Computing is offered as a subject in New Zealand secondary schools and can contribute to national qualifications for students in their final years at school. In 2015, out of 524 secondary schools, 79 taught computer science/programming, 242 taught computer studies, and 222 taught ICT. Less than 1% of students attending secondary school were studying computer science/programming (Education Counts 2016b). However, this may increase as a digital technologies strand within the national curriculum is being developed with an emphasis on computer programming for implementation in 2018 (Ministry of Education 2016b).

The use of data analytics is emerging in New Zealand schools. While data are predominantly used for accountability purposes, such as the evaluation of teacher and school effectiveness, the opportunities for broader use of digital data are being explored (Sutherland 2015). Teachers are increasingly using student achievement data to inform their teaching programs and pedagogical decisions, and principals are analyzing a range of digital data to inform school policy and decision-making. A challenge in developing the use of data is the availability of appropriate analytical tools and knowledge of how to maximize this resource.

Recent Developments in Policies on ICT in Australia and New Zealand

In this section, some of the recent developments in policies are discussed, within the context of understanding the contexts summarized earlier and the trends, challenges, and developments in technology.

ICT Policy Developments in Australia

ICT policy developments in Australia can be traced back to the 1980s as personal computers started to appear in schools and then revised as the Internet appeared during the mid-1990s. For example, in Queensland, Australia, the initial policy was *Computers in the Curriculum* (Department of Education, Queensland 1983) and was revised substantially with *Schooling 2001* (Education Qld 1997), which envisaged every classroom being connected to the Internet. More recent developments in that jurisdiction include the Smart Classrooms strategy designed to provide “direction for harnessing the learning and business potential of ICT now and into the future” (Qld Government 2016). That strategy is conceptualized according to four ICT eLearning drivers, i.e.:

- Working Digitally (e.g., OneSchool, OnePortal, Dream Factory) – outlines how schools use digital technology to move from traditional to transformational ways of working

- Developing Professionals (e.g., Digital Practice Guide, OneChannel) – articulates expectations for teacher and leader capabilities
- Enabling Learners (e.g., The Learning Place – Student Spaces and Staff Spaces) – focuses on addressing learners’ needs through effective learning environments
- Harnessing the Enterprise Platform (e.g., Managed Internet Service, Websites for Schools, Computers for Teachers) – focuses on the processes, systems, and practices to develop and maintain effective learning and business productivity (Queensland Government 2016)

Similar examples can be identified within the other jurisdictions, and more recent policy responses have tended to reflect dynamic, and often disruptive, transformational technological changes, such as the emergence of laptop programs, mobile devices, social media, and BYOD initiatives. Many policies and curriculum have needed to ensure that the implications of learning *with* and *about* ICT are appropriately responding to those technological changes. Moreover, these challenges have required a collaborative approach at the national level. The *Digital Technologies Hub* (Education Services Australia 2017) is a tangible example of a national approach in providing “learning resources and services for teachers, students, school leaders and parents” (p. 1), support “the implementation of quality Digital Technologies programs and curriculum in schools” (p. 1), and to leverage “events and activities offered by education jurisdictions, industry and other providers” (p. 1).

To illustrate, all Australian education ministers were signatories of the *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA 2008). This declaration sought “to achieve the highest possible level of collaboration with the government, Catholic and independent school sectors and across and between all levels of government” (MCEETYA 2008, p. 5). That declaration stated that, “In this digital age, young people need to be highly skilled in the use of ICT. While schools already employ these technologies in learning, there is a need to increase their effectiveness significantly over the next decade” (MCEETYA 2008, p. 5).

Subsequently, Lloyd et al. (2016) have noted that the Melbourne Declaration has led directly to the development of *The Australian Curriculum* (ACARA 2016d), which includes the ICT capability to be developed across all learning areas (ACARA 2016e). As discussed earlier, *The Australian Curriculum: Technologies Learning Area* (ACARA 2016a) has become an approved curriculum and includes *Design and Technologies* (ACARA 2016b) and *Digital Technologies* (ACARA 2016c) subject areas. They also refer to the *Australian Professional Standards for Teachers* (AITSL 2011a), which outlines expectations across four career stages – graduate, proficient, highly accomplished, and lead teacher. In referring to those *Australian Professional Standards for Teachers*, they acknowledge that while there is “no formal nationally-accepted ICT Professional Development Strategy for Teachers in Australia... many Standards can be demonstrated through the meaningful use of ICT in the classroom” (Lloyd et al. 2016, p. 25). Importantly, in relation to future teachers, all initial teacher education (ITE) programs in Australia must be approved and reviewed through program accreditation processes informed by those professional standards.

In summary, recent ICT policy developments in Australia find expression both at the national level and within jurisdictions, with significant implications for learning *with* ICT through the development of ICT capability across all learning areas and learning *about* digital technologies through the technologies learning area and its subjects, namely, Design and Technologies and Digital Technologies. In addition, informed by the *Australian Professional Standards for Teachers* (AITSL 2011a), there are expectations for current and future teachers to develop and demonstrate the efficacy to design and implement learning experiences for students to learn *with* and *about* ICT.

ICT Policy Developments in New Zealand

ICT policy developments in New Zealand have enabled technological innovation to overcome barriers of access to learning within rural New Zealand. Regional networks established in the 1990s, such as OtagoNet, have enabled the sharing of teachers and resources across schools for students attending rural schools (Barbour and Wenmoth 2013). This began as video-conferencing and has evolved to use a variety of ICT and a brokerage system whereby school networks can offer to teach a course and, in return, their students can access courses on the network. Urban networks such as the Wellington Loop have enabled the development of infrastructure and technical support across clusters of school (Barbour and Wenmoth 2013). These regional initiatives have informed current policy directions.

A national infrastructure development of laying fiber cable across the country included providing ultrafast broadband or rural broadband to every school in New Zealand by 2015 and the establishment of the *Network for Learning* (Crown Fibre Holdings n.d.). *Network for Learning* was established to manage the rollout of broadband to schools, and part of the function of this initiative has been to develop a repository or shared space, where teachers can share and evaluate digital resources. This innovation aimed to improve network capability and reduce geographical and socioeconomic inequities in Internet access between schools. Research suggests that the introduction of broadband is correlated to improved achievement in primary schools (Grimes and Townsend 2017). While the government developed the infrastructure to enable broadband access, the development of ICT policy for teaching and learning in New Zealand is the responsibility of the leadership or governance of individual schools; there are no national policies on how digital technologies should be used for teaching and learning apart from a brief statement in the national curriculum about how ICT can support teaching and learning (Ministry of Education 2007). The ICT policy developments are currently focused within and across groups of schools.

The devolved system of governance, introduced in 1989, included a model in which individual schools competed for student enrolments. This model sometimes skewed school-based decisions to consider the marketing potential or impact on the perceived image of the school to attract students and in some cases limited collaboration between schools who perceived themselves to be in competition (Wylie 2012). A current political direction in New Zealand is to increase collaboration across schools by encouraging networks of schools in a similar context to form

communities of learning (Ministry of Education 2016a). This national policy direction has implications for the development of ICT policies and sharing of resources across clusters of schools in a way that supports and enhances the earlier regional initiatives.

Both Australia and New Zealand have a strong history in distance education for rural and isolated students. E-learning is an area that is rapidly evolving and provided some pioneering work within the use of technologies for learning at school. A policy change on the horizon in New Zealand is the introduction of communities of online learning (COOL) schools (Ministry of Education 2016c). Currently, there is one national distance education school that is fully funded by the government that was originally established for the education of rural and isolated students, but over time the students enrolled have changed to include a wider demographic (Barbour and Wenmoth 2013).

Cyber safety is taught in most schools under the Health or Hauora learning area of New Zealand Curriculum (Ministry of Education 2007). This is embedded within learning about personal safety such as the “keeping ourselves safe” program offered by the New Zealand Police (New Zealand Police n.d.) and through advice and resources developed by NetSafe, an independent national organization (Netsafe n.d.).

In contrast to Australia, New Zealand does not have explicit accountability requirements for teachers to use digital technologies or ICT in their teaching practice. The professional standards which guide primary and secondary teacher evaluation for certification purposes have one reference, i.e., that teachers will “select teaching approaches, resources, technologies and learning and assessment activities that are inclusive and effective for diverse ākonga (learners)” (Education Council 2015, Criteria 9ii). However, it would be difficult to meet the range of criteria without using the digital technologies that are infused into the work of a teacher. For example, the professional standards state that fully certified teachers are able to “analyse assessment information” (Criteria 11) which in most schools would include analyzing digital data integrated into a student management system. Therefore digital technologies while not explicit within professional standards are implicit.

Relevance of Cross-National and Worldwide Strategies and Plans for Australia and New Zealand

The discourse about education within Australia has increasingly been influenced by international and jurisdictional comparisons being conveyed through, in particular, analysis of the performance of Australian students in the 2015 *OECD Programme for International Student Assessment (PISA)* (OECD 2016), *Trends in International Mathematics and Science Study (TIMSS)* (see Thomson et al. 2016), *International Computer and Information Literacy Study (ICILS)* (see Fraillon et al. 2013), the *National Assessment Program – Literacy and Numeracy* and the *National Assessment Program – ICT Literacy* (ACARA 2012). These will continue to be important, but a wider agenda is needed that encompasses a broader and deeper curriculum for young Australians than these areas measured by these testing programs.

New Zealand national policies are also influenced by international trends including student achievement in PISA and TIMSS. The development of learning environment policy is attributed to OECD reports (2006, 2013). The introduction of the digital technologies curriculum drew on curriculum developed and implemented in Australia and England (Bell et al. 2014). Strategies and plans at a school level are influenced from regional experiences and can reflect the unique context of the schooling environment (Barbour and Wenmoth 2013).

Challenges and Relevance of Research for Policies on ICT in Education in Australia and New Zealand

The interface between research, policy, and practice underpins research for policies on ICT in education. Research can provide guidance for informing policies in Australia and New Zealand in a digital age.

Challenges and Recommendations for Policies on ICT in Australia

Thomson (2015) appropriately asks the central questions: Where to from here? and “Is Australia on track to realise the aims of almost a decade ago, to ensure that ‘young people need to be highly skilled in the use of ICT’?” (Thomson 2015, p. 16). She highlights a range of comparative performances with other countries as well as historical data and trends to indicate that much has yet to be done to address differences in outcomes associated with socioeconomic disadvantage, challenges associated with attracting female students to ICT courses, and building student confidence in their ability to perform higher level ICT tasks. That is, Thomson uses research to critique policy in her suggestion that “Our education system could well be creating basically proficient ICT users but very few technicians, innovators or developers” (Thomson 2015, p. 16). In addition, she cited Livingstone (2015) who has argued that:

...for Australia to succeed in a digital age, we should be starting the digital education of our students in the beginning years of primary school, introducing skills such as computational thinking, problem solving and computer coding. This is a giant leap from where Australia is now, and will require determined policy and a great deal of teacher professional development (Livingstone 2015, cited in Thomson 2015, p. 17)

The recent developments in terms of curriculum and expectations for future and current teachers appear to be largely “on track” to meet the challenges. For example, the Digital Technologies (ACARA 2016c) requires teachers to implement a project-based learning approach in which students from Prep to Year 10 (5–15-year-olds) develop systems thinking, computational thinking, and design thinking to create digital solutions to real-world problems. Thus, in Australia, there is momentum and an appetite for key stakeholders to collaboratively enable future and current teachers to develop the competencies with and dispositions about digital technologies needed in a digital age (Finger et al. 2016). The interface between research, policy, and

practice in Australia requires focused attention on the role of research to inform both policy and practice, particularly in relation to ICT infrastructure and resourcing which provides guidance in relation to access and meaningful use of new and emerging digital technologies for teaching and learning, curriculum design, implementation and review, and building teacher capabilities for a digital age.

Challenges and Recommendations for Policies on ICT in New Zealand

A challenge and ideal in New Zealand is to have an equitable education system that narrows or closes digital divides (Starkey et al. 2017). While New Zealand students achieve comparatively well in the PISA research, there is a significant difference in academic achievement between advantaged and disadvantaged students (OECD 2016). These differences could widen given the current funding and devolved governance model within New Zealand (Wylie 2012).

While central policy has led to ultrafast broadband being made available to all schools, how this is used and the purchase of technology to access the Internet is decided independently at each school. Research has identified that schools with a higher proportion of disadvantaged students report spending more on digital technologies for student learning and less on teacher professional learning than those with a lower proportion of disadvantaged students (Johnson et al. 2014). The potential for digital divides to widen should be considered in educational policy and could be mitigated through targeted funding and curriculum design such as developing a profile of digital competence for learners and the deliberate teaching to enable all young people to leave school with the digital competence to be active participants in society (Starkey et al. 2017).

Perspectives for Developments in Australia and New Zealand and Emerging Themes/Perspectives

In Australia, learning *with* and *about* digital technologies is a useful conceptualization for understanding teaching and learning expectations for teachers and students and the design of curriculum discussed earlier in this chapter. Of direct relevance is *The Australian Curriculum: Technologies Learning Area* (ACARA 2016a), the *Design and Technologies* (ACARA 2016b) and *Digital Technologies* (ACARA 2016c) subject areas, and the ICT capability (ACARA 2016e) expected to be developed by students within all learning areas. It was established that these present new expectations for many teachers, as, for example, the *Digital Technologies* subject area is being introduced for the first time and is being mandated in Prep–Year 10. These developments in Australia are integral to the Science, Technology, Engineering and Mathematics (STEM) agenda in Australia. That STEM agenda and vision are being expanded to include digital literacy through concrete strategic planning, strategies, and funding support articulated in Australia's *National Innovation and Science Agenda* (Australian Government, Department of Education and Training 2016) termed *Inspiring all Australians in digital literacy and STEM* (Australian Government, Department of Education and Training 2016), which involves:

- Upskilling our teachers to be able to implement *The Australian Curriculum: Digital Technologies*
- Upskilling our students, through various computing and coding challenges, computer science summer school, and focusing on underrepresented students in STEM subjects, such as female students
- Facilitating partnerships with industry
- Digital Literacy School Grants, which schools and other organizations can apply for to facilitate the implementation of *The Australian Curriculum: Digital Technologies*
- Engaging in the early years, through providing funding of \$14 million over 4 years to promote positive STEM learning experiences with children aged 3–5 years
- Funding of \$112.2 million for *Inspiring all Australians in digital literacy and STEM* (Australian Government, Department of Education and Training 2016)

In New Zealand, all schools have reliable fast Internet access, and the focus is now on how digital technologies are integrated or infused into education (Ministry of Education 2015b). A review of STEM education and the resulting strategic plan (New Zealand Government 2014) has led to strengthening the place of digital technologies in the national curriculum which will place an emphasis on coding and computational thinking to be implemented in 2018–2019 (Ministry of Education 2017). The government has released contestable funding of 1 million dollars to support schools to pilot learning programs teaching coding to enable each school to consider how they might integrate this aspect of the curriculum into their technology programs. This places a significant challenge particularly within primary schools where teachers usually teach all aspects of a curriculum and have limited experience of computational thinking or coding.

Conclusion

To conclude this chapter, we emphasize the variation and similarities across the contexts within New Zealand and Australia and how this influences ICT policies. Both countries are influenced by international trends, and attention is given to their rankings within international tests, such as PISA and TIMSS. At the political and policy level, tensions and contradictions are evident in relation to this, for example, with some reductive policy advocacy more suited to an analogue world. Rather, we suggest that there are policy responses occurring in response to the dynamic opportunities and challenges presented by new and emerging ICT.

As outlined earlier, within Australia various national and jurisdiction policies are currently shaping how students learn *with* and *about* ICT. The last decade of curriculum developments in this regard has been largely informed by the *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA 2008), which involved collaboration between all education ministers and across all systems of schooling in Australia, i.e., state, catholic, and independent schools. Guided by that

framework and within the context of competitive federalism, *The Australian Curriculum* (ACARA 2016d) has been developed with a new *Technologies Learning Area* (ACARA 2016a) developed, consisting of the two subject areas, namely, *Design and Technologies* (ACARA 2016b) and *Digital Technologies* (ACARA 2016c). The various state and territory jurisdictions in Australia are at varying phases of implementing this. Furthermore, within *The Australian Curriculum*, the ICT capability is a general capability to be developed across all learning areas. The policy and curriculum implications in Australia also are reflected appropriately in expectations for current and future teachers articulated in the *Australian Professional Standards for Teachers* (AITSL 2011a). There are significant implications for upskilling Australia's teachers and students explicitly articulated in Australia's *National Innovation and Science Agenda* (Australian Government, Department of Education and Training 2016).

In New Zealand, national policies guide the development of infrastructure and individual schooling policies to enable the development of the use of ICT within teaching, learning, and curriculum. For example, a national policy prioritized the provision of fast broadband Internet connection to schools across New Zealand which created the context for increasing the use of the Internet within learning programs. Evaluation of this policy identified a positive correlation between the introduction of fast broadband and student achievement within primary schools (Grimes and Townsend 2017).

National policies in New Zealand do not specify which ICTs should be used for teaching and learning or how they should be used although the national curriculum does outline why they should be used (Ministry of Education 2007). Likewise, ICT use is not explicit in teacher standards; instead it is implicit as it would be difficult for teachers to meet quality assurance measures without using digital technologies. Therefore it is the responsibility of the individual school to make the decision about the use of ICTs for teaching and learning and justify their policies to the Education Review Office. Research from New Zealand that explores policy and implementation is focused on access to technologies which reflects equity concerns.

A current development within both New Zealand and Australian policy is the introduction of computational thinking and coding named as "digital technologies" as part of technology learning across levels within the respective national curricular. This is in the early stages of implementation with Australia ahead of New Zealand. The need for teacher professional learning has been recognized in both countries, and this is being supported through allocated funding. The outcomes of this policy have not yet been evaluated.

Key ideas from ICT policies and implementation in Australia and New Zealand include the importance of context when considering whether ICT needs to be explicit or implicit within policy. The provision of broadband Internet access appears to make a difference to student learning at the primary school level. The changing expectations of teachers and school leaders to prepare students to be active and successful citizens in the world today and in the future present both challenges and opportunities which require active collaboration of research, policy, and practice within and across both countries.

When we consider, with increased life expectancies, that students entering schools in Australia and New Zealand in 2017 are likely to complete their schooling in 2029, and some might be alive beyond this century, this is critically important policy work. There are significant implications for curriculum, in relation to learning and teaching *with* and *about* digital technologies, and for the professional expertise of a teacher in a digital age.

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