NSW Department of Education

Use of information and communications technology (ICT) in the teaching and learning of writing

Research report

Centre for Education Statistics and Evaluation

September 2021

NSW GOVERNMENT

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Centre for Education Statistics and Evaluation, September 2021, Sydney, NSW

Please cite this publication as:
Centre for Education Statistics and Evaluation (2021), **Use of information and communications technology (ICT) in the teaching and learning of writing**, NSW Department of Education, education.nsw.gov.au/cese

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Acknowledgements

The authors of this report would like to acknowledge Dr Lisa Kervin, Dr Jessica Mantei and Joanne Rossbridge who provided academic advice critical to the success of the research. We also acknowledge the important role of the literacy team in the Learning and Teaching Directorate, NSW Department of Education, who reviewed the final research report. Particular thanks go to the teachers involved from the 10 research schools who opened their classrooms and gave so much time and careful thought to our research investigations. Special thanks go to all the students involved from the research schools but particularly those who we interviewed. Their perspective added rich insights into the role of ICT in writing.

We acknowledge the homelands of all Aboriginal people and pay our respect to Country.

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Executive summary

Learning to write is an essential part of becoming literate. The challenge in the digital age for teachers and students is how to make the most effective use of all available digital tools to develop and craft quality texts.

There is substantial research identifying the positive potential of information and communications technology (ICT) for teaching and learning, with evidence that technology in the classroom can create a more interactive, engaging, learner-centred environment (Tamim 2011). Moreover, technology can amplify good teaching practice. This project aimed to identify the potential impact of digital technology on written text and on the processes of planning, creating and editing text.

Research method

The aim of this 2018 research project was to identify the current use and potential impact of digital technology on the written product as well as the processes of teaching and learning writing in the primary context. The mixed methods research approach included both qualitative and quantitative methods of data collection and included case studies conducted in 10 NSW primary schools across Years 4 to 6. This case study approach provided insights into the complexity of the digital writing environment within the context of the primary school classrooms.

The research project involved a literature review to understand existing evidence for effective use of ICT in the context of teaching writing. A broad range of qualitative evidence (lesson observations, teaching resources, and teacher and student interviews) was collected throughout the project to provide a rich picture of teaching practices and student behaviour relating to the use of ICT in the classroom. Teachers participated in a research-informed professional learning program. Pre and post project student writing tasks (paper based and digital) provided quantitative information on the impact of the professional learning program and the use of new technologies on students' writing.

Understanding writing pedagogy

A consistent finding in the current research literature is that technology does not embody new pedagogy, but supports existing pedagogical goals and can amplify effective teaching practice. Teacher knowledge is central to effective pedagogy. Teachers draw on and integrate subject and pedagogical knowledge to make decisions about what and how to teach (Shulman 1986). Research by Koehler and Mishra (2009) found that technological knowledge was critical for effective teaching in the context of increasing technological use in the classroom. The technological, pedagogical and content knowledge (TPACK) framework (Koehler and Mishra 2009) was adopted within this project because of its wide use and recognition as a tool for describing and understanding the teaching practice with technology integration. Within the context of teaching writing, teachers draw on knowledge about the craft of writing, available technology applications and effective practice for teaching writing to respond to changing classroom contexts.

The TPACK framework includes the following 3 domains:

- **technological knowledge (TK):** teachers' ways of thinking about and working with all technological tools and resources to support their students' writing
- **pedagogical knowledge (PK):** teachers' deep knowledge about the processes and practices or methods of teaching and learning, specific to literacy
- **content knowledge (CK):** teachers' knowledge of the craft of writing, including both text and visual literacy and multimodal design grammars.

In harnessing these 3 knowledge domains, teachers effectively integrate technology in teaching writing across a range of contexts and cohorts. The review of literature, as summarised in the following paragraphs, confirms the importance of intersecting teacher knowledge for effective teaching of writing.

When teachers have strong integrated knowledge of writing and pedagogy, systematic, explicit and purposeful teaching of writing is evident in their classroom. Knowledge of the teaching cycle for writing provides coherent and systematic scaffolding for teachers and students to create texts (Feez 1999; Derewianka & Jones 2016). Creating texts that are responsive to audience and purpose requires an understanding of the appropriate language and text features (Walsh 2010; Mills & Levido 2011; Kervin 2015; Dalton 2015; Mills & Exley 2014). Teachers draw on grammatical knowledge to explicitly teach students to use language flexibly and creatively across subject areas (Hammond & Gibbons 2005; Humphreys & Macnaught 2015; Christie 2010; Myhill, Jones & Watson 2013; Schleppegrell 2013). With the increasing use of digital technology in writing, explicit scaffolding is recognised as an essential component of successful composition of multimodal texts (Edwards-Groves 2012; Gebhard & Harman 2011; Lea & Street 2006; Zammit 2014; Callow & Orlando 2015).

When teachers combine knowledge of technology and pedagogy, they can create a learning environment for writing that is engaging and collaborative. Studies show enhanced student engagement and enthusiasm when ICT is introduced into the writing program (Zheng, Warschauer, Lin & Chang 2016). Research identifies the student engagement and learning potential from making connections between students' growing use of digital technology at home for writing at school (Merchant 2007; Kervin & Mantei 2016; Lynch & Redpath 2014; Mills & Levido 2011). When knowledge of technology and pedagogy combine, digital technology can be harnessed to support peer and teacher collaboration during planning, composing and editing phases of writing. Studies note the benefits of student collaboration in writing, evident in student negotiation and joint content building within the digital writing environment (Walsh 2010; Freebody 2007; Doult & Walker 2014; Merchant 2007; Cope & Kalantzis 2015). Digital platforms are used increasingly to provide timely and responsive feedback on written drafts (Doult & Walker 2014; Cope & Kalantzis 2015).

When teachers combine knowledge of technology and writing, they judiciously select the appropriate technology for the writing purpose and can use the technology with flexibility and creativity. With increasing choice of software, teachers need understanding to be able to select the most appropriate tools for their context (Zheng, Warschauer, Lin & Chang 2016; Walsh 2010). Increasingly, digital technology is recognised as a resource that can be used to enhance and transform the way we express meaning (Edwards-Groves 2011, 2012; Zammit 2014; Puentedura 2006).

Impact of professional learning

The design and delivery of professional learning to develop effective writing pedagogy was one of the main objectives of the research. The professional learning model comprised a mix of expert-led workshops and school-based implementation, with knowledgeable mentors guiding teachers as active participants in the research. Feedback from project teachers confirmed the success of this model.

The professional learning provided to teachers reflected the findings of the literature review and supported teachers to develop and integrate technical, pedagogical and writing knowledge. The workshops developed understanding to support the use of the teaching and learning cycle (Feez 1998), explicit teaching of language features appropriate to audience and purpose and the integration of ICT into literacy programs.

The impact of the program of professional learning was evident in student writing samples which included more multimodal elements and tailored use of language. However, the extent of changes in students' writing varied between schools. It is likely that this was due to a number of factors, including specific teaching approaches and school contexts. To be more confident of the extent and nature of the impact, the research would need to be conducted over a longer period of time.

Impact of digital technology

Our research with case study schools showed that digital technology is impacting on all aspects of students' writing processes – planning, composing and editing writing.

Text preparation

- Students – especially high support students – experienced less anxiety and increased motivation to begin writing tasks when using ICT.
- Devices were effectively used to encourage collaborative planning, with students working together to plan digital compositions.
- The use of small whiteboards was an important tool for text preparation regardless of what type of writing task was being attempted.

Text composition

- ICT increased the breadth of literacy taught by enabling additional writing genres to be introduced into lessons (for example, blogs, websites, videos, presentations).
- ICT supported students to imagine a wider audience for their writing (for example, websites and social media platforms) and to immediately understand the purpose of their writing.
- Enhanced engagement in writing was seen across subjects.

Text editing

- Digital platforms supported greater and more effective teacher and peer feedback.
- Teachers and students reported the benefits of collaborative online review and reflection (for example, feedback relating to the written draft can be made alongside the text; teachers and students can review texts together remotely).
- Students valued access to editing tools such as spellchecks and online thesauruses and dictionaries but accessed these after, rather than during, the drafting process.
- The design of assessment rubrics for the new genres in multimodal texts was required to inform and structure peer and teacher feedback.

Cautions

- Students' use of online spellchecks and dictionary references, while increasing the accuracy of their texts, may obscure difficulties with spelling and grammar.
- Explicit teaching of secretarial and grammatical features of writing should occur in parallel with the use of ICT. A variety of apps were used by teachers to support the explicit teaching of grammar, vocabulary and spelling.
- Teachers require both technological fluency and flexibility combined with knowledge of all aspects of the craft of writing to effectively teach writing in the context of ICT.
- Technology that is unreliable or malfunctioning may distract from learning.
- Emerging genres require teachers to work out which language structures and features to explicitly teach.

Chapter 1: **Introduction**

The integration of ICT has positive potential for teaching and learning of writing. In a digital age, ICT has increasing prevalence in all aspects of teachers' and students' lives both in the classroom and at home. This project aimed to inform current discussion around the use of ICT for writing and to identify ways to support students and teachers to make the most effective use of all available digital tools to develop and craft quality texts. It was prompted partly by the introduction of online testing in Australia within the National Assessment Program – Literacy and Numeracy (NAPLAN). Since 2017, these tests have been moving from a traditional pen-paper format to an online delivery system, such as a computer workstation, laptop and/or tablet. In response to concerns relating to the validity, comparability, equity and fairness of such assessments, the Centre for Education Statistics and Evaluation (CESE) conducted a study into the online testing of writing (CESE 2017). The study identified potential impacts of digital technology on both the quality of written texts as well as the writing process, and called for further research to investigate how the teaching and learning of writing can be enriched using new technologies to further develop students' writing skills.

A mixed-methods design with 10 participating schools was used to examine: (a) the use of ICT in primary classrooms to support writing; (b) the influence of ICT on the teaching and learning of writing in primary school classrooms; and (c) the impact a program of professional learning for teachers has on enhancing student writing skills.

Contextual framing for this investigation was enhanced by research conducted concurrently by CESE into ICT usage in schools (CESE 2018). Findings from CESE's research point to the complex patterns of ICT use and potential associations between types of ICT use and student outcomes (that is, NAPLAN scores). This research project provided an opportunity to explore the use of digital technology within the specific context of teaching writing.

1.1 Definitions

Technology

For the purposes of this research, **technology** is understood to be the application of scientific knowledge for practical purposes, relating especially to educational use (particularly the teaching and learning of writing) within primary classrooms. The term applies equally to traditional, analogue tools as well as to contemporary digital platforms; references to **ICT**, **digital technologies**, **new** and **21st century technologies** are used interchangeably.

Information and communications technology (ICT)

ICT includes hardware and personal digital devices, software, and systems that manage, store, process, create, produce and communicate information. Information and communications technology capability is one of the general capabilities within the NSW Education Standards Authority (NESA) syllabuses 'where students learn to use ICT effectively and appropriately when investigating, creating and communicating ideas and information' (NESA 2021).

Writing

Writing itself is understood to be part of a suite of literacy skills. Learning to write is an essential part of becoming literate. Successful writing combines skills relating to the composition and crafting of texts, also referred to as the authorial and secretarial dimensions of writing (Peters & Smith 1993).

> "Authorial dimensions consider the composition of ideas and information communicated through the text, while the secretarial dimensions take account of the surface features and conventions of writing that allow a writer to accurately record written messages."
>
> **(Mackenzie, Scull & Bowles 2015, p. 569)**

The general capabilities in the Australian Curriculum materials state that literacy 'involves students in listening to, reading, viewing, speaking, writing and creating oral, print, visual and digital texts, and using and modifying language for different purposes in a range of contexts' (Australian Curriculum, Assessment and Reporting Authority (ACARA) 2017). Writing as a contextual activity is thus responsive to the complexities of the time and space in which it is situated (Mills & Exley 2014; Comber, Kervin & Woods 2017).

1.2 Understanding writing in the digital environment

Historically, the forms and functions of literacy and the teaching of related literacy skills have been determined by continuously changing forces within society, influenced by the technologies available at the time (Cammack, D et al. (2004); Freebody 2007). During most of the 20th century, writing was traditionally taught through the use of paper and pencil, a technology that remained unchanged over time with a singular function evident from its design (Koehler, Mishra & Cain 2013).

During the 21st century, however, there have been dramatic changes occurring within the field of digital technologies which have enabled new configurations of image and writing on screen (Kress 2003; Knobel & Lankshear 2006; Freebody 2007; Edwards-Groves 2012; Doult & Walker 2014; Burnett & Merchant 2015). Unlike their traditional counterparts, digital technologies are much less stable, being subject to constant transformation in both design and capability, and characterised by increasingly complex functionality.

Such changes have altered pedagogical practices developed within schools as teachers seek to take advantage of new technologies and to acknowledge the ICT skills and expertise that students develop out of school (Burnett & Merchant 2015; Kervin & Mantei 2016). Adoption of elements of multimodal literacies, where meaning can be represented through different sign systems, including image, sound gaze, gesture and movement, (Walsh 2010; Edwards-Groves 2011) has further challenged established notions of what constitutes writing.[1]

Perhaps one of the greatest challenges is that changes to literacy are not limited by technology but rather by our ability to adapt and acquire the new literacies that emerge with increasing rapidity (Cammack, D et al. 2004). 'The "new" of the future is constantly replacing the "new" of now' (Walsh 2010, p. 212), resulting in uncertainty about the impact on children growing up in a changing digital environment. The constant development of new applications available for digital technology continues to challenge existing practice, offering both opportunities and constraints to educators (Burnett, Merchant, Pahl & Rowsell 2014; Comber, Kervin & Woods 2017).

Writing in the digital environment is, therefore, impacted by continual change and transformation.

1 Multimodality (Halliday 1978) is also now widely understood to refer to the range of modes used in spoken, handwritten or on-screen texts, as well as modal combinations within digital media – for example, moving images accompanied by sound. It is in this sense that reference to **multimodal** texts occurs within this project.

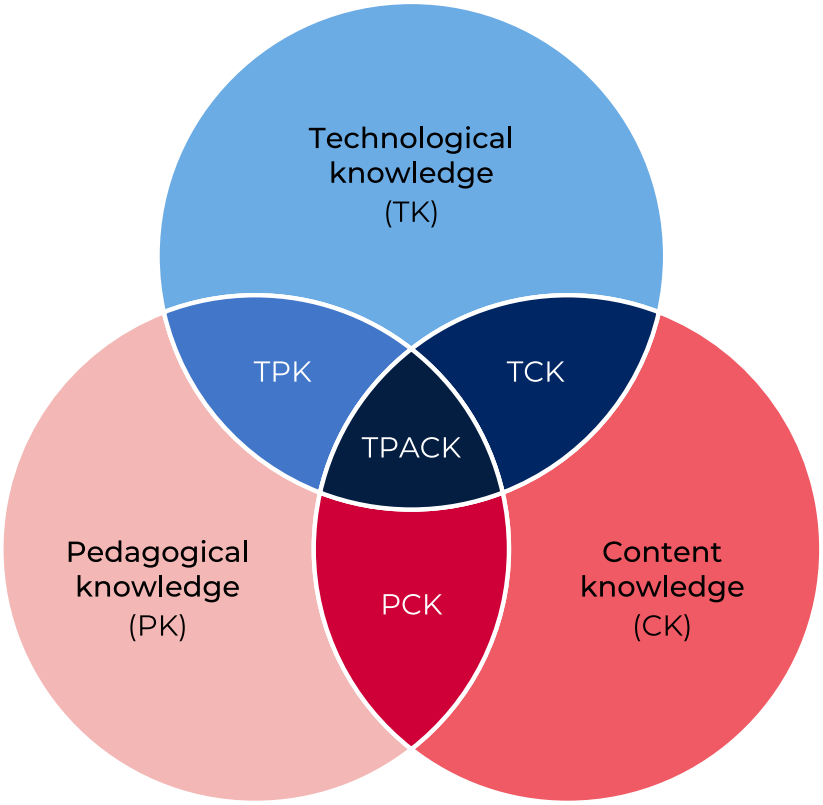
1.3 Theoretical foundations

This study is informed by a teacher knowledge framework for technology integration known as TPACK (Koehler & Mishra 2009), an acronym that stands for technological, pedagogical and content knowledge. Recognising that teachers operate within 'highly complex, dynamic classroom contexts' that require them to 'constantly shift and evolve their understanding', the authors identify that effective teaching draws on integrated knowledge from different domains, including 'knowledge of student thinking and learning; knowledge of subject matter; and increasingly, knowledge of technology' (Koehler, Mishra & Cain 2013, p. 13). The 3 overlapping sections of the framework (Figure 1) are used to represent the unique context of the particular classroom and school; it is within the shaded intersections where significant interactions between and among these bodies of knowledge occur.

Figure 1

The TPACK framework and its knowledge components

(Koehler & Mishra, 2009)



So, for example, the area between technological and pedagogical knowledge is labelled TPK, and includes an understanding of how learning and teaching within a given classroom can change when particular technologies are used in particular ways. The central shaded area, TPACK, represents more than a teacher's knowledge of the 3 individual components. Rather, it is the understanding that emerges from the ongoing interactions between all 3 bodies of knowledge in relation to particular students within the school setting.

> "Each situation presented to teachers is a unique combination of these three factors, and accordingly, there is no single technological solution that applies for every teacher, every course, or every view of teaching. Rather, solutions lie in the ability of a teacher to flexibly navigate the spaces defined by the three elements of content, pedagogy, and technology, and the complex interactions among these elements in specific contexts."
>
> **(Koehler, Mishra & Cain 2013, p. 17)**

The TPACK model, as adopted within this project, sees **content** relating to the craft of writing, both within the subject English and across the curriculum; **pedagogy** relating to the most effective ways to support students to learn to write and write to learn; and **technology** relating to those tools and resources that best support students' writing. More details of the model's application is provided in the next section where it is used to organise the literature review findings.

1.4 What does the literature tell us about effective pedagogy for the teaching of writing supported by ICT?

The literature review identified effective use of ICT in the context of teaching writing and models of effective writing pedagogy to inform the project and intervention design. Research was limited to countries where English is the language of instruction in schools, to upper primary and secondary teaching contexts, and to research conducted since 2009. The search domains included literacy, writing, multimodal, digital texts, technology, ICT, pedagogy, teaching and assessment.

The review of the literature has identified the timely nature of this project – there is widespread recognition of the need for more research into the ways teachers are responding to opportunities and constraints offered by the constantly changing digital environment. A key message throughout the literature is that technology does not embody new pedagogy but should support existing pedagogical goals. Teachers might therefore move away from a binary perspective ('is paper or screen best?') in favour of a more flexible approach to suit the particular purposes of the task ('should I use paper or tablet, or both, for this stage of writing?'). Effective pedagogy needs to be responsive to the context of the classroom, including in this instance the available technology, the experience and confidence of the teacher, and the strengths and needs of the students. Teacher knowledge is central to effective pedagogy and forms the basis of the TPACK framework (Koehler & Mishra 2009), which informs this study.

For the purposes of this research into writing supported by ICT, the TPACK framework (Figure 1, page 13) is understood to include the following components:

- **technological knowledge (TK)** as teachers' ways of thinking about and working with all technological tools and resources to support their students' writing, and applying their knowledge productively, so as to 'recognise when information technology can assist or impede the achievement of a goal, and to continually adapt to changes in information technology' (Koehler, Mishra & Cain 2013, p. 15)
- **pedagogical knowledge (PK)** as teachers' deep knowledge about the processes and practices or methods of teaching and learning, including understanding of how students learn to write and write to learn, general classroom management skills, lesson planning and assessment of students' written texts
- **content knowledge (CK)** as teachers' knowledge of the craft of writing: at text, sentence and word level, including knowledge of grammar, textual devices, punctuation and spelling, as well as knowledge of visual literacy and multimodal design grammars; and content knowledge of curriculum subjects' writing requirements.

As already discussed, the most useful, nuanced information can be found in the overlapping areas between each component. Findings from the review of literature will therefore be documented as they relate to the main intersections within the framework.

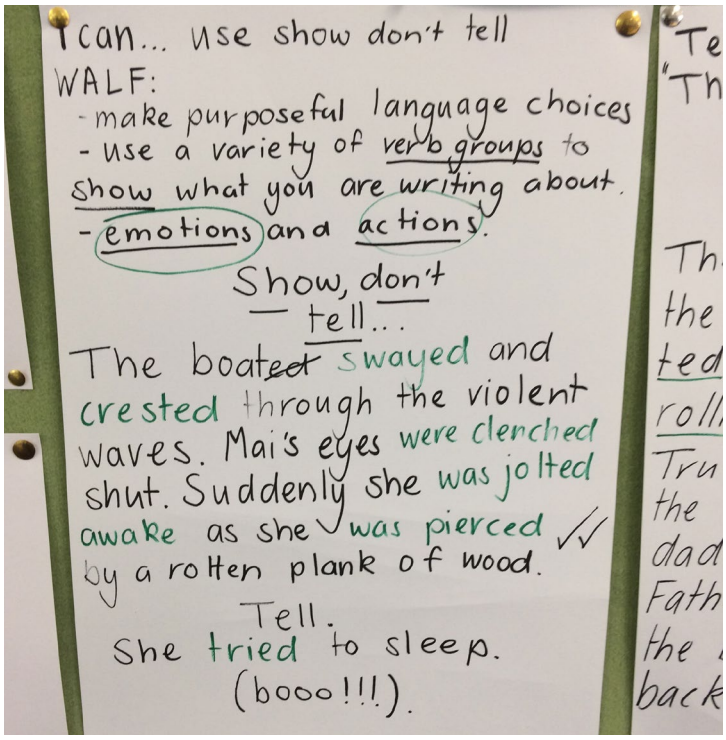
1.4.1 Research relating to pedagogical content knowledge (PCK)

Effective pedagogical practices for teaching writing include:

- **A coherent and systematic sequence for the teaching and learning of writing.** As a way of supporting teachers to develop effective pedagogies for writing in a digital environment, various models have been designed to clarify the process of learning to write and writing to learn, offering systematic support in the creation of independent texts (Feez 1999; Derewianka & Jones 2016).
- **A teaching focus on the effects of audience and purpose on writing.** Changes in technologies have generated capacities for the production of different kinds of texts in response to a broader range of audiences and purposes. Creating texts appropriate to audience requires an understanding of text features including language, design, layout, structure, image and graphics (Walsh 2010; Mills & Levido 2011; Kervin 2015; Dalton 2015; Mills & Exley 2014).
- **An explicit focus on the teaching and learning of language conventions and grammatical skills.** Writing promotes learning across the curriculum, with explicit instruction on the characteristics of different text structures appropriate to particular subject disciplines (Figure 2). Studies confirm that teachers need an expanded knowledge of all aspects of the writing process to encompass the full range of traditional and design grammars used in various media. Text creators of both paper-based and online media should be supported in their choices around language (Hammond & Gibbons 2005; Humphreys & Macnaught 2015; Christie 2010; Myhill, Jones, & Watson 2013; Schleppegrell 2013).

Figure 2

Wall chart teaching effective use of verb groups (school 4)



1.4.2 Research relating to technological peadgogical knowledge (TPK)

Effective practices for teaching about ICT include:

- **Creating a learning environment that promotes student engagement.** Studies note enhanced engagement and enthusiasm when ICT was introduced into the writing program. For example, a meta-analysis by Zheng, Warschauer, Lin & Chang (2016) found student academic achievement increased with laptop programs. Students of lower ability were particularly successful, losing their reluctance to write and producing better results.
- **Linking home and school literacy practices.** Research acknowledges that students now engage with a growing range of texts in order to communicate with family and peers, and the opportunity to bring personal devices to school can provide the flexibility for students to engage as producers of digital texts. However, it is noted that a willingness to experiment with new and emerging technologies does not always indicate that young people are using these platforms effectively (Merchant 2007; Kervin & Mantei 2016; Lynch & Redpath 2014; Mills & Levido 2011).
- **Explicit, targeted teaching.** Effective scaffolding of multimodal tasks is widely recognised as an essential component of successful learning in digital literacies. As in other aspects of the curriculum, optimal results occur where learning outcomes are clearly communicated and students are supported to succeed (Edwards-Groves 2012; Gebhard & Harman 2011; Lea & Street 2006; Zammit 2014; Callow & Orlando 2015).

- **Effective collaboration** is seen as part of effective pedagogy. Studies note evidence of student negotiation and joint content building within the digital environment, as well as the development of some peer-supported learning about ICT skills. Teachers also benefit from the sharing of ideas and skills related to ICT through professional learning and peer support. Research into student collaboration around the use of screens suggests changes may be needed in the spaces that have traditionally been organised for engaging in writing (Walsh 2010; Freebody 2007; Doult & Walker 2014; Merchant 2007; Cope & Kalantzis 2015).

Figure 3

Students use floor space to collaborate over the construction of a geography blog

- **The provision of timely and responsive feedback.** Digital platforms are seen by teachers and students as increasingly useful for the provision of peer and teacher comments on written drafts. Emergent peer coaching practices were also noted as contributing to students' improvement in writing (Doult & Walker 2014; Cope & Kalantzis 2015).
- **The setting of meaningful and practicable assessments.** New assessment rubrics are needed to capture the features of digital texts and the collaborative planning, composing and editing processes afforded by ICT in writing. Traditional writing assessments focusing on the final text students produce independently and are not able to capture the features of multimodal and digital texts. Effective assessment of digital texts would provide meaningful feedback to teachers and students on their use of ICT in creating text (Cammack et al. 2004; Sutherland et al. 2004; Wyatt Smith & Kimber 2009; Towndrow, Nelson & Yusuf 2013).

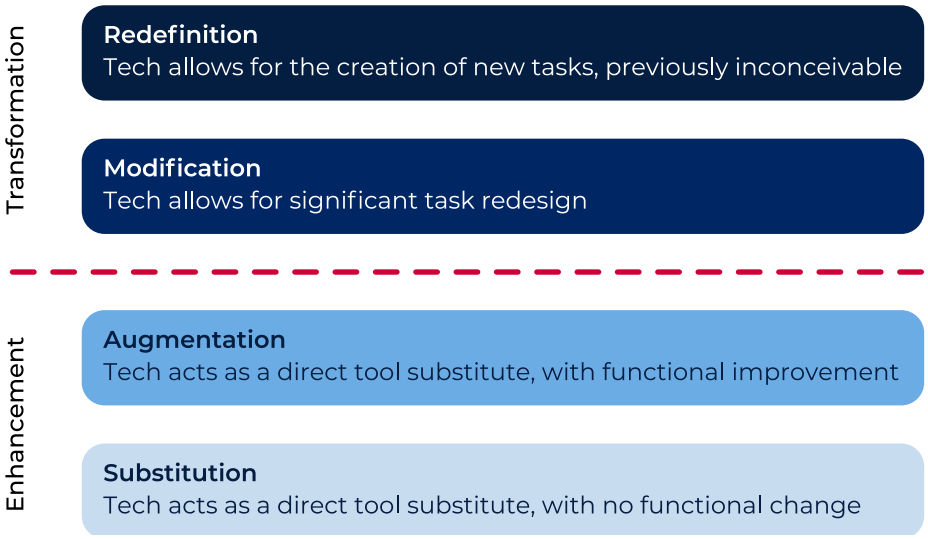
1.4.3 Research relating to technological content knowledge (TCK)

Effective use of technology includes:

- **Adopting appropriate programs and apps.** Research indicates the increasing choice of software available to teachers (Kervin & Mantei 2016). Effective practice requires educators to recognise and become familiar with the best tools for particular curriculum outcomes (Zheng, Warschauer, Lin and Chang 2016; Walsh 2010).
- **Utilising shared platforms for the joint review of student writing.** Certain platforms promote the development of writing skills across the curriculum, enabling recursive movement from planning to presenting, from drafting to designing (Kervin & Mantei 2016; Edward-Groves 2012; Walsh & Simpson 2013).
- **Encouraging creativity.** Digital technologies are recognised as resources with the capacity to promote interactivity, creativity and transformation of student outcomes. Students can use devices to enhance and transform learning in ways not previously possible. Figure 4 shows the substitution augmentation modification redefinition (SAMR) model which outlines the ways that digital technology can influence task design, culminating in the transformational expression of meaning in the redefinition stage (Edwards-Groves 2011, 2012; Zammit 2014; Puentedura 2006).

Figure 4

The SAMR model (Puentedura, 2006)



1.4.4 Summary

Technology represents a tool for learning and is usefully employed to support existing pedagogical goals. Effective pedagogy for writing creates a learning environment that encourages student engagement, where the crafting and composition of texts is developed through explicit, systematic teaching and productive interaction within the classroom. Digital technology, when combined with teachers' pedagogical and content knowledge, has the potential to transform writing, promote the development of writing skills, encourage creativity and offer new channels for quality feedback from both students and teachers.

The central zone of the TPACK model, or overlap between all 3 knowledge systems, represents the complex interactions that occur within the specific context of the school and classroom. Research verifies that teacher expectations and performance within this zone are influenced by both professional learning and peer support. The benefits of collegial conversations suggest the need for 'a substantial investment in providing site-based professional learning projects conducted **over time**' (Edwards-Groves 2012, p. 111). These research findings provided the basis for the design of the project intervention and professional learning program.

The next chapter of this report presents an explanation of the study's research methodology, including the research questions and information relating to the selection of participating schools and teachers. It is followed by the findings of the study as they relate to each research question. The report concludes with salient issues for discussion and directions for future work.

Chapter 2: **Methodology**

2.1 Research questions

This research seeks to better understand existing practice in the teaching and learning of writing supported by ICT in NSW primary schools. It also aims to explore ways to support teachers to develop new knowledge of technology, and to investigate how such knowledge is translated into effective writing pedagogies in their classrooms. The research questions guiding this enquiry are:

1. How is ICT currently used to support writing in the participating primary classrooms and how does it vary across school locations?
2. How can professional learning (PL) be designed and delivered to maximise effective writing pedagogy enhanced by technology?
3. Do the participating students write differently when supported by ICT, and what is the impact of new technologies on students' planning, text composition and editing strategies?

2.2 Research design

This study adopted a mixed-methods approach, using a combination of quantitative and qualitative methods of data collection and data analysis in order to enhance responses to each research question. A case study design allowed for the use of multiple data sources to develop insights into the complex digital writing environment of primary classrooms in the selected schools.

The duration of the project was 2 terms: Terms 1 and 2, 2018. Ten schools were identified from an informal expression of interest process in Term 4, 2017. Two project classes (from Stage 2 and/or Stage 3) were selected within each school, with the exception of school 4, where a third class of Stage 3 new arrivals (students learning English as an additional language or dialect (EAL/D)) was also included. One control class within each school was identified. These students were not exposed to the project (that is, their teachers weren't involved in the program of professional learning and support), and so measurement of their progress in writing over the 2 terms allowed for a comparison of expected growth (without intervention) with growth of students exposed to this project after the intervention.

A sample of 816 students from 10 primary schools (674 students from 8 government schools, 142 students from 2 Catholic schools) participated in this research. This sample represented a range of locations, including 7 Sydney metropolitan and 3 provincial/regional schools, a range of socio-educational advantage levels approximated by ICSEA[2] scores (903-1156), and a mixture of culturally and linguistically diverse student populations. Participating teachers represented a range of teaching experience (from second year of teaching through to 30 years in the classroom) and confidence in the use of ICT (from 'novice' to 'expert' as reported by teachers). Table 1 provides descriptions of the student sample.

Table 1

Student sample

Year group	Project	Control	Total
Stage 2: Year 3	31	15	46
Stage 2: Year 4	192	89	281
Stage 3: Year 5	175	118	411
Stage 3: Year 6	166	40	206
Total students	**564**	**262**	**816**

The project involved the design and impact analysis of an evidence-based intervention for the use of ICT in teaching writing. There were several elements of the project:

- Teachers were provided with **professional learning and support** informed by the research review to improve their implementation of ICT in the classroom.
  - An initial 2 days of professional learning built a strong shared foundation of teacher knowledge around effective pedagogy for teaching writing and effective integration of ICT into the writing process.
  - This was followed by in-school support, where teachers were encouraged to actively participate in the project with opportunities to trial and evaluate innovative practices within the digital teaching environment.
- An **assessment rubric** was designed, trialed and further refined in collaboration with academics, subject experts and participating teachers as the literature review revealed there were no existing assessment rubrics for multimodal texts for the school context. The use of the assessment rubric in pre and post data for project classes allowed the investigation of improvement in student writing on digital platforms across traits (refer to Appendix 1).
- **Pre and post project data** were collected in 2 forms (refer to Appendix 4):
  - A **paper-based writing** task from project and control classes. This element tested the hypothesis that the professional learning may have run-on effects on students' underlying writing skills. This was not seen as a burden to control classes who were easily able to integrate the traditional writing task into classroom activities as a diagnostic assessment of student writing.

2 ICSEA is the Index of Community Socio-Educational Advantage generated by ACARA.

  - Students in project classes completed a second writing task, pre and post project, using technology to enhance the writing. This provided some evidence of whether students' **multimodal writing** improved after the project. The control classes were not required to complete this second task as researchers were mindful of teacher work load.
- To provide a more descriptive picture of teaching practices and student behaviour relating to the use of ICT in the classroom, a broad range of **qualitative evidence** was collected throughout the project. The researcher visited each case study school multiple times, observing lessons and conducting interviews with participating teachers and students.

  Qualitative data was also collected at the **end of the project**, when teachers shared their work and personal experiences and discussed the impact of the project.

Table 2 summarises the evidence collected for each research question.

Table 2

A summary of evidence collected

Research question	Research evidence
Question 1: How is ICT currently used to support writing in the participating primary classrooms and how does it vary across school locations?	• Teacher surveys • Teacher semi-structured interviews • Focus groups (students)
Question 2: How can professional learning be designed and delivered to maximise effective writing pedagogy enhanced by technology?	• Teacher semi-structured interviews • Lesson study notes • PL workshop activities and evaluations
Question 3: Do the participating students write differently when supported by ICT, and what is the impact of new technologies on students' planning, text composition and editing strategies?	• Pre and post tasks • Focus groups (students) and semi-structured interviews (teachers) • Teacher observations of target students • Work samples • PL workshop activities and evaluations

The following section describes in more detail the range of data collected during the project.

2.2.1 Qualitative data sources

- **Semi-structured interviews** were designed to obtain more detailed information about teachers' beliefs and practices relating to pedagogy within writing programs, their use of ICT in the classroom and its impact on students' performance in writing. These were conducted orally during school visits in Term 2, transcribed and then sent to teachers for verification and, where necessary, revision.
- **Student focus interviews** allowed for the inclusion of student voice in relation to understandings about the nature of contemporary writing, ICT usage and the kinds of writing engaged in at home, and attitudes towards digital technology in the classroom. These were conducted orally during school visits during Term 2 and transcribed.
- **Teacher observations** of 3 case study students provided evidence of the impact of teaching and learning on student planning, composing and editing processes when supported by ICT.
- **Class programs, lesson study notes** and work samples provided evidence of the integration of ICT into the teaching of writing over the period of the project.
- **Professional Learning workshop activities and evaluations** provided evidence of teacher developing understanding of pedagogy, writing and ICT during the project.

All qualitative material was examined using thematic analysis, a systematic coding and categorising approach used to determine patterns within the data. This indicated common elements across schools, as well as allowing for a nuanced interpretation of teachers' and students' contributions.

2.2.2 Quantitative data sources

- **Teacher surveys** were designed to solicit information on teacher experience with and access to ICT in schools, and existing practice in the use of ICT to support the teaching and learning of writing. Due to the small number of teachers participating, no significance testing was conducted. However, differences in percentage of teachers were examined.
- **Pre and post project student writing tasks** provided information on the impact of the program (refer to Appendix 4). Students in project classes were asked to submit both paper-based and digital compositions on related topics prior to and after the implementation of the program (4 tasks in total). Writing both paper and digital compositions on the same topic gave valuable information about the enhancements possible through use of ICT. As indicated earlier, one control class was identified within each school. To minimise the load on teachers, students in the control classes participated in the paper-based writing task only, whereas students in the project classes participated in both the paper-based and digital compositions.

  Texts were assessed using NAPLAN style rubrics developed with the assistance of academic partners who provided guidance and feedback on the scope and wording of assessment criteria relating to digital compositions (refer to Appendix 1 for the assessment rubrics). Trained NAPLAN markers were employed to assess student work. Their feedback on the marking criteria and process, as well as their observations on the nature of paper-based and digital compositions, were collected as additional qualitative data.

Writing score analyses included fixed-effects, using analysis of variance (ANOVA), with interactions to test the impact of the use of digital technologies on student writing. This was tested with interactions (Table 3) of time (students completed the writing task on 2 occasions – once before and once after implementation of the program), group (classes within schools were assigned to either the project or the control groups) and school (to test how schools differed on the effectiveness of the program).

Table 3

Research design of participation in writing tasks

Experimental condition	Time 1		Time 2	
	Paper-based writing task	Digital composition	Paper-based writing task	Digital composition
Control classes	✓	–	✓	–
Project classes	✓	✓	✓	✓

Findings from the analysis of the data, organised under the 4 research questions, are provided in the next section.

Chapter 3: **Findings**

3.1 Research question 1 – How is ICT currently used to support writing in the participating primary classrooms and how does it vary across school locations?

Findings to answer this research question are obtained from both quantitative data (pre and post project teacher surveys) and qualitative data (teacher interviews, student focus groups and documentation from professional learning activities). Data sources confirmed that teachers within the study made regular use of ICT to support their writing programs, although the nature of such support varies across classrooms. Despite such variation, there are emerging trends and patterns of use common to all 10 schools. These are outlined below, with illustrations of practice to provide further clarification.

3.1.1 Online survey data

The online survey (refer to Appendix 2), distributed before the project began, was designed to ascertain the extent of teaching experience and confidence in using ICT in the classroom. This survey also provided information relating to their existing school access to digital technologies and the application of ICT to their writing programs. School differences, and differences in rural versus metro areas, were not investigated using the quantitative data survey due to the small number of teachers participating (N=23).

Teachers were quite confident in their ability to use technology in the classroom with 91% of teachers reporting they were 'extremely confident' or 'confident most of the time', and 9% of teachers reporting they were 'confident some of the time'. No teacher reported having no confidence in using technology in the classroom.

Teachers reported on the frequency of use, with 52% of teachers reporting giving their students 4 or more sessions per week to use technology (other than the use of interactive white boards (IWBs)), and 48% giving students between one and three sessions per week.

Teachers were also generally satisfied with access to ICT at their school with 39% reporting they were 'very satisfied' with their schools' systems of accessibility. While almost half of the teachers were 'somewhat satisfied', only 4% of teachers reported they were 'very dissatisfied' and 9% were 'somewhat dissatisfied'. Satisfaction with ICT accessibility was also moderately correlated (r=.578, p<.01) with the time teachers provide students to use technology – that is, teachers who tended to feel more satisfied with ICT accessibility tended to also provide students with more lessons where they can use ICT.

When asked about issues restricting ICT use in the classroom, device display issues (for example, blank screens) were most common with 10% of teachers reporting experiencing device display issues 'all of the time', 50% experiencing issues 'most of the time' and 40% 'some of the time'. No teacher 'hardly ever' or 'never' experienced device display issues.

In addition, over 50% of teachers reported experiencing issues related to logging in, with 10% experiencing this 'all the time' and 40% 'most' of the time'. While no teacher reported experiencing problems with internet connectivity 'all of the time', 30% of teachers reported experiencing connectivity issues 'most of the time'. Likewise, approximately 30% of teachers experienced non-working computers/laptops/tablets 'all' or 'most' of the time, and 25% experienced devices not being charged 'all' or 'most' of the time.

Moreover, these issues were often highly correlated (Table 4), suggesting teachers who had problems with one area of accessibility (for example, devices not being charged) were more likely to have other issues (such as device display issues, difficulty logging in, problems with internet connectivity and devices not being charged).

So, while teachers were generally satisfied with their access to ICT in the classroom, they were experiencing significant constraints related to the efficient use of this technology.

Table 4

Correlations between issues of ICT use faced by teachers

	Device display issues	Difficulty logging in	Problems with internet connectivity	Devices not charged
Difficulty logging in	.652**	–	–	–
Problems with internet connectivity	.669**	.336	–	–
Devices not charged	.614**	.597**	.535**	–
Computers/laptops/tablets not working	.423*	-.087	.417*	.218

Note. ** $p<.01$, * $p<.05$

When using ICT to enhance classroom writing programs, teachers listed numerous resources they use. Google apps and extensions were the most popular with 26% of teachers reporting that they used these, followed by Office software or equivalent (22%), blogging or online sharing (17%), video or storyboards (13%), literacy apps (9%), and other programs such as touch typing (9%).

In summary of the teacher survey, teachers were generally confident in their use of ICT and generally satisfied with accessibility at their school but were constrained by technological issues in the classroom, particularly device display issues. In addition, teachers who tended to have one ICT issue tended to also have other ICT issues. Teachers who tended to be satisfied with accessibility also tended to provide more sessions for students to use ICT.

3.1.2 Teacher interview data

Teacher interviews were conducted to provide a more descriptive picture of teaching practices and student behaviour relating to the use of ICT in the classroom. The data revealed that on average around 4 hours of teaching time in class per week is spent on the development of writing skills. This time is increased where it includes writing instruction across all curriculum areas. A cross-curricular approach was reflected in the project with teachers using the project to develop research and writing opportunities in science (4 classrooms), history (4), geography (3), PDHPE (1) and religion (1). All teachers confirmed that they saw technology as a tool capable of both enhancing and constraining student writing. The following factors influenced current usage of ICT within the writing program.

Availability of digital resources has a direct influence on their flexible use in the classroom

Teachers from 7 schools commented on increased availability of digital resources in 2018 – "students now have access to multiple platforms" – as well as more efficient systems of sharing between classes: "we have additional iPads and I have a trolley in room for easier access". Teachers from 3 schools reported no change in their access to ICT since 2017.

Teachers reported variable availability of ICT within schools, with senior classes usually accessing more resources. A common pattern of resourcing in schools was the distribution of iPads to classes within Years K to 2, and laptops, especially Chromebooks, across classes in Years 3 to 6. One Stage 3 class reported sharing a set of Chromebooks with the neighbouring class while another was only able to access laptops on a Wednesday each week. In response to this issue, 3 schools made use of the bring your own device (BYOD) initiative to supplement school resources, but security and reliability of equipment remained a challenge.

Variable availability of ICT

School 8 used to have 2 to 3 computers per class and 40 minutes per week in the computer lab until this year, when the students were provided with 24 iPads between 4 Stage 2 classes. This has resulted in students increasing their time with digital technology to 1 to 2 hours a day in the classroom, and teachers now meet every week to plan the integration of ICT into their writing program. "ICT is a priority in the school now – it hasn't always been. We are planning as a Stage now and our work is part of the School Plan".

Some teachers noted the need for greater flexibility in accessing ICT:

> "I would like more use of the iPads … funding is an issue – I tried to use some new apps but it was unsuccessful as there is not enough storage on my iPad and we can't upgrade – the cost is too high."

School 2 was using new apps and software programs but teachers admitted "we're not using as much as we'd like because of limited access to the devices – we have to share them with all Year 5 classes".

School priorities are significant in promoting the use of ICT in the classroom

Decisions to fund new equipment and to provide teacher mentoring support for writing and/or for integrating ICT across the curriculum are instrumental in increasing teachers' technological pedagogical knowledge. Such priorities strengthen teachers' confidence and capability with ICT and as a result, more systematic usage of technology was noted. Examples include:

- The creation of a 'Tech Hub' in school 3 for storing, booking and using devices. This was seen to give greater access to those students for whom BYOD was not an option.
- The design of the 'Incubator Room' in school 9 where extra resources such as MacBooks have been kept. This school employs a STEM (science, technology, engineering and mathematics) specialist to mentor teachers in their usage of ICT and the school has imposed an ICT levy on school fees for technology provision.
- The current school improvement plan (SIP) for school 7, which is 'contemporary learning'. Teachers report that "we are all encouraged to include digital technology in our teaching".
- A leadership shift in school 5, with a move towards integration of ICT and "the focus being taken off traditional bookwork".

Other school priorities also influenced effective use of ICT within writing programs by focusing on teachers' technological content knowledge. For example:

- At the time of the study school 1 had a K to 6 focus on formative assessment in relation to writing, allocating the role of mentor to the Stage 2 assistant principal who collaborated in the planning, co-designing, delivery and reflection of writing lessons. This support facilitated the time for informed usage of ICT in the writing program within Stage 2 classrooms.
- Schools 4 and 6 had a strong specialist program of EAL/D support throughout the school, providing rich content knowledge of language use and writing skill development for classroom teachers. Team teaching involved EAL/D and classroom teachers and resulted in the effective use of ICT as a tool to enrich language use and improve student writing.

Connecting to the internet can take up valuable teaching time

Teachers vary in their responses to the inevitable time spent getting all students online. Some report the relative ease of logging on, with improved connectivity and user-friendly devices: "wi-fi and updates are more efficient this year". Students note that increased access to ICT takes more time out of their lessons: "we are using computers more now so it takes longer to log in and set up"; they also become irritated with technical problems: "we're losing precious time". Most teachers report at least some regular access issues, such as forgotten passwords and frozen screens, noting as well that "the internet not working is very frustrating!"

Effective use of ICT in the classroom is impacted by students' familiarity and capability with devices

Teachers comment on the challenge of upskilling students on new functions but note that they improve with practice: "they are really at the start of their technology journey and need to have experience of different kinds of tools". Such comments are reflected in student observations that technology can be hard to master, and unreliable. Some teachers prefer their students to work on laptops at their desks rather than at computers at the back of the room, noting the possibility of distraction: "students need practice in working together productively". However, all teachers noted increased student engagement when writing is supported by ICT, especially by those with language and learning needs.

Many noted that their students frequently used technology at home but that usage was different within the classroom:

> "Students are familiar with digital technology but need to be taught how to use them (apps) properly … they can download apps but are not so capable of creating a worthy composition."

The observation by one teacher that "students are consumers rather than creators of digital material" is confirmed by evidence collected within student focus groups – the most popular usage reported for digital devices at home is online games. Some programs and applications (Google Classroom and SeeSaw) provide tools for reflection and connection with home and parents, an opportunity welcomed by teachers of EAL/D students. Many teachers appreciated the provision of "easier access for students at home", as it allowed for increased engagement outside the classroom.

Data indicated that it was common practice to use a combination of ICT and paper-based technology to support writing programs

Teachers made conscious decisions in selecting technology on the basis of device availability, the suitability of the tools for the particular phase of writing, time available and student preference. Student responses to choice of technology were divided, with many preferring the familiarity and availability of paper while others opted for tablets and laptops that offer a superior presentation style and assistance with spelling. All students recognised the importance of typing skills in facilitating the digital writing process, with some citing the benefits of online instructional programs.

Figure 5

Students composing on laptops using paper-based planning scaffolds

Classroom observations indicated that ICT is used widely as a whole-class stimulus for writing, with images and videos displayed on the interactive whiteboard as a way of providing background information to the task. While most of the students are engaged by such usage, criticism was voiced by one student, who observed that he preferred his teacher to use traditional tools: "when she explains something using the whiteboard, she talks for longer and she looks at us more … when she uses the smartboard she looks at the screen". Such observations suggest a potential challenge for educators, where technology may shift the focus away from student interactions.

There are many instances of laptop and tablet use for individual and/or paired research, especially where such practice is used to inform and produce factual writing across the curriculum. A smaller but growing number of online compositions were reported. These included creative writing, reports, blogs and the creation of websites on Google Classroom. ICT was sometimes used to facilitate the explicit teaching of writing skills in the areas of grammar, vocabulary and spelling. For example, students in school 5 used PowerPoint slides to illustrate their understanding of the etymology, meaning and application of words in the weekly spelling list. There were also many references to teacher and peer online review of student writing through Google Classroom.

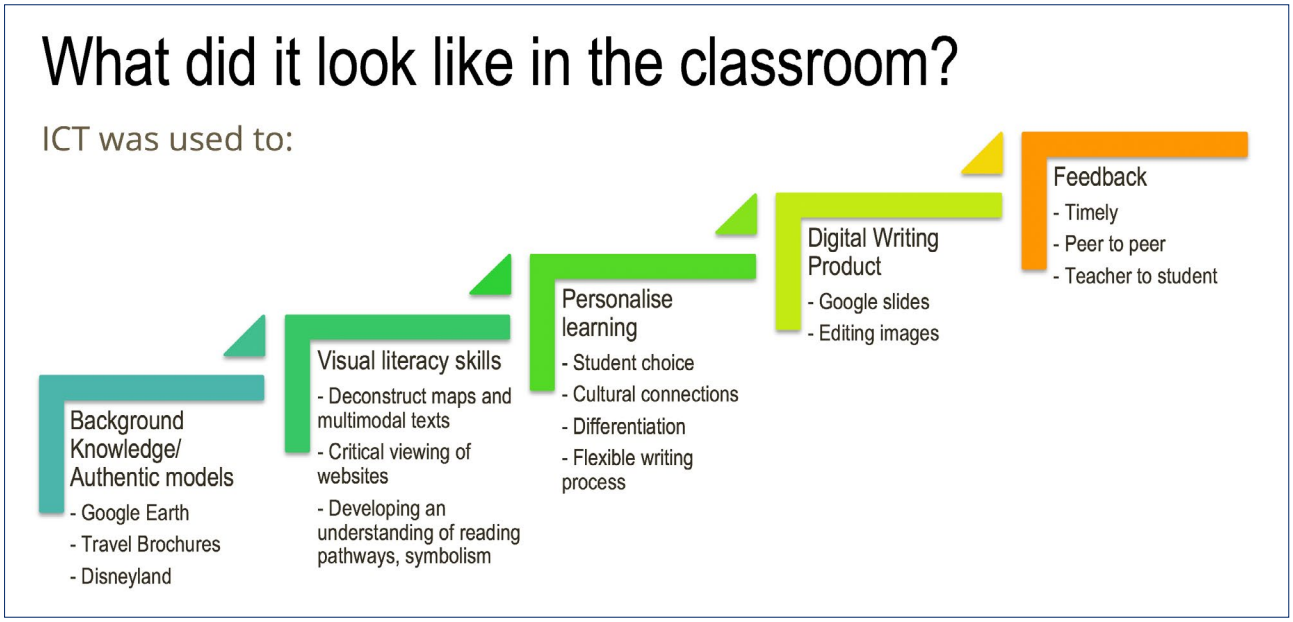
This section concludes with 3 examples of effective school practice which represent the significant elements identified above

The samples demonstrate how teachers use available digital resources in the classroom to develop the writing process; how school priorities, in this case relating to EAL/D learners, translate into digital storytelling; and how one teacher uses a blend of technologies to strengthen her implementation of the teaching and learning cycle within the writing program.

Figure 6 is an extract from the school 6 final project report presentation summarising the use of ICT at different stages of their Stage 3 teaching program where students created a digital travel brochure for a fantasy island.[3]

Figure 6

Use of ICT in the writing program



3 At the concluding workshop teachers presented findings from their classroom writing projects to the other project school teams.

Figure 7 is a work sample from school 4, showing how visual and print literacies combine within a digital story to demonstrate a student's bilingual skills.

Figure 7

Blended technologies: screen shot from a digital story

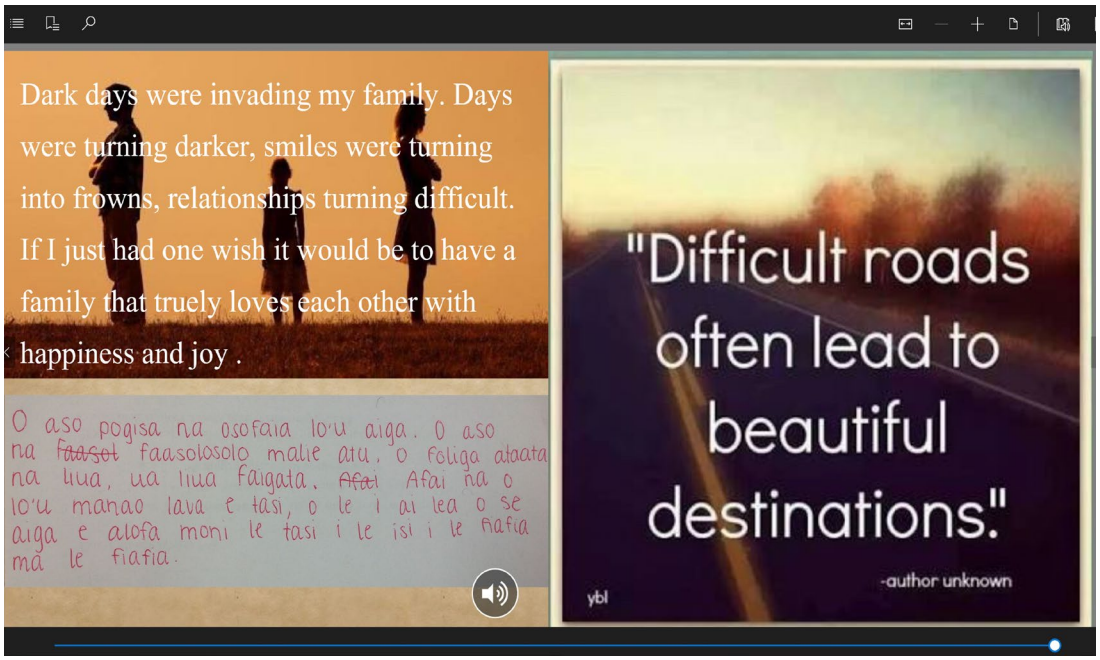


Figure 8, from school 2, shows an extract from one teacher's Term 2 writing program. It illustrates some of the activities undertaken, using both traditional and digital technologies, in the preparation for the creation of an article to be submitted to National Geographic's online journal. Within the program, (D) denotes use of digital technology, while (P) denotes paper-based technology.

Figure 8

Extracts from Stage 3 writing program

Week 1 plan	Field Building: class viewing of visuals on interactive whiteboard (D) Modelled texts: deconstruction of digital mentor texts (D/P) Joint construction: joint planning on Popplet or Prezi (D) Independent construction: mind map planning – students may choose to use Popplet or Prezi or art paper (D/P)

3.1.3 Summary

Overall, teachers reported a high level of confidence in using ICT to support their writing programs, with most of them describing general satisfaction with their accessibility to resources. The availability of digital devices, device issues and internet connection was shown to have a direct influence on the nature and extent of their usage in the classroom, with connection issues a source of frustration.

Consistent with the TPACK model, variation in usage of ICT exists within as well as between schools, confirming the significance of the local context. At the school level, leadership decisions to fund new equipment and to develop teachers' ICT knowledge and expertise was welcomed by all participants. Within the classroom, effective use of ICT was influenced by students' learning needs, as well as their capabilities with digital technology. Therefore, teachers needed to spend time explicitly teaching how to use the devices and software before these tools could be used to promote learning.

It is common practice amongst teachers to use a combination of ICT and paper-based technology to support their writing programs. Teachers must therefore select the most appropriate tools on the basis of the requirements of the writing task, device availability, and student need.

The next section examines ways in which professional learning for teachers supports the development of effective writing pedagogy.

3.2 Research question 2 – How does professional learning support the development of effective writing pedagogy within the digital environment? What elements should be included within future professional learning programs?

Sustained, quality professional learning is critical for developing teacher capacity to use digital technology in the classroom (Edwards-Groves 2012). Findings from the teacher surveys and interviews confirmed the importance for participating teachers of professional learning in building knowledge and acknowledged the ongoing process of learning about new technology. The design and delivery of appropriate professional learning to develop effective writing pedagogy was therefore one of the main objectives of the research.

This section describes the model adopted throughout the project, including activities and evaluations which comprised the teacher workshops, and observations made during in-school programs. It concludes with some proposed elements for future professional learning.

Professional learning that seeks to promote teacher knowledge of technology, pedagogy and content needs to involve more than a single lecture or workshop. Research suggests that a more productive approach lies in creating cultures and mechanisms for teachers to learn from each other and to set up 'enablers for effective professional conversations' (Timperley 2007) which can extend and challenge teachers' thinking, deepen their understanding and allow them to explore new ideas. Teachers were therefore encouraged to see themselves as active participants in the project with opportunities to create new knowledge and to trial and evaluate innovative practices within the digital teaching environment. They were invited to select a curriculum focus for their classroom research and to determine outcomes in relation to their chosen syllabus area, designing writing tasks and identifying appropriate use of ICT to support their students' learning.

The model thus comprised out-of-school professional learning in the form of 2 full-day workshops followed by a period of in-school focus where teachers could collaborate to plan and implement their ideas, gathering relevant classroom data (for example, lesson study notes and student observations) in relation to elements within the research questions. A final workshop in Term 3 gave teachers the opportunity to share the outcomes of their professional learning with the whole group.

3.2.1 Out-of-school learning

The main focus of the first workshop was content knowledge (writing), integrating technological and pedagogical knowledge into theoretical understandings about language and the craft of writing. The workshop developed understanding to support the use of the teaching and learning cycle (Feez 1999) and explicit teaching of language appropriate to audience and purpose when composing written texts. The session was led by a literacy expert who presented ways to effectively incorporate knowledge of grammar and visual and design literacies into writing programs. The second workshop was led by academic staff from a local university, who adopted a technological knowledge focus, referencing the SAMR model (Puentedura 2006) of technology usage and demonstrating findings from current research into successful integration of ICT into primary school literacy programs.

Both sessions maintained a focus on dialogue between teachers, researchers and presenters, with the inclusion of activities to build common understandings of the nature of contemporary writing and to explore existing models of writing pedagogies currently enacted in schools. Teachers were aware that all the material developed during such discussions was collected as project data.

The creation of concept maps to explain teachers' pedagogical content knowledge in relation to writing provided useful insights into current practice. Some schools made reference to the explicit teaching of language and grammar. School 4, for example, had high numbers of EAL/D students and had developed a strong focus on language teaching; they were also engaged in on-going school based professional learning on effective literacy development. Other schools included a temporal organisation of their pedagogy (maintaining a focus on before, during and after writing) but made only a general reference to 'language features' with little use of metalanguage and no systematic approach to the teaching of grammar and language conventions. Schools adopting a more implicit approach to the teaching of language and grammar tended to have higher ICSEA scores, reflecting a demographic in which Standard Australian English is used at home. In comparison, lower ICSEA scored schools in the study provided more explicit instruction of writing techniques and grammatical structure.

Written evaluations from both workshops helped researchers identify key 'take home messages' as well as any concerns and challenges voiced by participants. After the first workshop, with its focus on pedagogical content knowledge, teachers reported a new awareness of adopting the metalanguage of writing within a framework for teaching. In particular, 10 teachers wrote that they had been introduced to the use of the mode continuum[4] as a way of identifying differences between spoken-like and written-like language; 6 of those teachers registered awareness of the need to identify purpose and audience in writing tasks. As a result, many teachers recorded an intention to build a greater focus on the register of language into their writing lessons. In particular, they wanted to make use of a teaching/learning cycle for writing, to ensure purpose and audience is clarified before students begin planning for writing, and to develop an explicit teaching focus moving along the mode continuum.

After the second workshop, with its focus on technological pedagogical knowledge, teachers' new ideas and understandings included use of the mode continuum in relation to ICT and the possibilities of embedding ICT through a variety of platforms. They reported increased knowledge of new apps and websites to use, with 10 teachers citing the Explain Everything[5] app. Teachers recorded an intention to develop multimodal texts within their writing lessons; several felt the need to prioritise writing within a crowded curriculum. They wanted to investigate new apps, implement use of websites and apps and "not be afraid to experiment". They also recognised the need to give guidelines to encourage appropriate choices with multimodal tasks – for example, sourcing material, referencing, and maintaining a balance between images, audio and text. They recognised the challenge of students "favouring aesthetics over content" when composing digital texts. Finally, teachers identified challenges that related to project requirements, in particular the amount of work to be covered within a limited time, with many teachers seeing themselves as 'time poor'.

4 The mode continuum describes the linguistic differences between contextualised spoken language and decontextualised written language (Derewianka & Jones, 2016).

5 The Explain Everything app gives students pre-prepared projects and templates they can work with, view, share, or present to support reflection, feedback and ongoing assessment.

3.2.2 In-school focus

The next phase of the professional learning component required teachers to trial new knowledge and understandings from the workshops within their chosen curriculum focus. Over the remaining weeks of Term 1, and for all of Term 2, they were encouraged to collaborate with their project partner and, where possible, with other members of the group. A special interest group on Yammer, a social network platform, was established for intra-group communication and information sharing.

In order to provide an in-depth picture of students' responses to writing in a digital environment, teachers were asked to identify 3 target students whom they could observe over the next term. A writing checklist was provided to enable teachers to document progress in all aspects of the writing process, with outcomes drawn from relevant areas of syllabus documents (NESA 2018) and the National Literacy Learning Progression (ACARA 2018).

Teachers were also requested to engage in lesson study, or action learning at the micro level of the lesson. Lesson study required teachers to collaboratively identify a pedagogical focus – in this case relating to ICT and writing – and together design a lesson to develop student learning goals. After the lesson was taught in class by both teachers, evidence related to the target students was collected and analysed, and the lesson refined on the basis of shared analysis and joint reflection. All participants were given one day's relief to allow time for lesson study, planning and professional dialogue.

Some writing checklists and lesson study notes were submitted to researchers at the end of the project, but this data set was not completed by all participants. Analysis of relevant data is included in response to the final research question within Chapter 4.

During Term 2, all participating schools were visited by researchers who conducted semi-structured interviews with the teachers and focus group interviews with a representative sample of students. Teachers were asked questions that related specifically to their use of ICT in the classroom, including any changes that had been made to their pedagogy and practice as a result of advice offered in our professional learning sessions. This element of the professional learning was included as a way of giving a voice to participants, encouraging them to engage in reflective practice with researchers. As a research tool, such interviews allow for triangulation of data by building up a more detailed picture of the digital environment through the perceptions of those involved. Data from the interviews informs findings relating to research questions 2, 3 and 4.

As a result of the professional learning workshops, 15 teachers reported more of a teaching focus on register of language, including audience and purpose: "this was new, made us reflect"; "I'm learning about more awareness of different language use … we need to develop this … it has more of a focus now". In addition, 14 teachers reported devoting more time for explicit teaching to develop language skills and also to develop affordances offered by ICT apps and programs – a teacher from school 7 reported that "we are using an understanding of spoken-like language in planning for video, then written language for script, then oral in performance".

Seven teachers noted that they were experimenting and risk-taking with ICT as a result of the professional learning workshops – "I'm trying something completely new now; I'm really out of my comfort zone!" – and were appreciative of the time made available to them to discuss the potential of new software with their colleagues. One teacher reported contacting participants at another project school to use the expertise of their STEM mentor, asking advice about future purchases: "there are so many more apps yet to learn about!"

All teachers made the same response when asked whether technology embodies a new pedagogy of writing. They were clear that the sequence of teaching and learning, while supported by ICT, remains unchanged: "ICT is embedded throughout, but my focus is on WRITING". All teachers reported a preferred sequence of teaching strategies (as discussed in chapter 2) into which they were incorporating ICT – as one teacher commented: "field building and research have a wider scope online, and visuals and videos can be used as stimulus for writing".

Teachers recognised the influence of technology on aspects of student performance when supported by explicit teaching about the technology: "ICT can be integrated into the same teaching sequence but must include explicit teaching of the device and its usage". ICT is seen by one teacher as a supplement, making writing "a better process … an engaging way of doing it". Most teachers welcomed the increased engagement with writing that accompanies the use of technology, although some question the duration of this appeal once the novelty of using new devices wears off.

Teachers also recognise the challenges presented by the digital environment. "ICT disrupts established practice" is a representative comment that acknowledges the uncertainty of moving away from traditional practice. Reflecting earlier findings on the blending of established and innovative technologies is the notion that "ICT builds on, improves and consolidates learning … but you can't take the voice of the person (teacher) out of the process … there is still a place for traditional teaching methods." Consistent amongst all participants is the belief that while ICT has the potential to enhance and transform learning, the digital environment is still very changeable and unpredictable: "we need more time to become confident … both teachers and students".

3.2.3 Concluding workshop

The professional learning process concluded with the completion of a post-project teacher survey. This was followed by one full-day workshop where schools presented findings from their classroom writing projects to the whole group, along with invited school leaders and curriculum policy officers. Each school gave a short presentation in which they identified the opportunities and challenges encountered during their increased focus on the impact of ICT on writing programs. These, along with responses from the survey, can be summarised as follows:

Opportunities

- Increased levels of engagement amongst students, especially reluctant writers: "allowing reluctant writers to engage in writing and use possible technology strengths to showcase what they CAN do." Engagement also noted amongst parents (who enjoyed sharing access from home).
- Increased levels of interaction between students through peer feedback, sharing of ideas, reflection and instruction. Growth was noted in the quality of these interactions: operational requests ("how do I cut and paste?") developed into evaluative comments relating to the attributes and value of particular websites. "Technology can be used to give more timely and accurate feedback to students. Students were open to peer feedback and this seemed to happen more organically during the task construction."
- Technology as a writing resource: "technology can be used to support students with developing writing skills. It gives rich visual texts and allows access to culturally diverse texts."
- Greater focus on the task whilst writing with ICT: "there was a calmness in the classroom".

- Flexible use of tools used in the writing process:

> "Teachers would be able to differentiate lessons using an array of supporting technology. [For example], language apps of EALD students and the use of puppet pals for students who connects visually to text. Students could record themselves reading [and so on]."

> "iPad to plan, storyboard and record ideas before writing. Images and sounds to support writing."

- Improved understanding of the relationship between written and visual meaning, and purposeful use of language, including writing for a real online audience: "allowing different creative expressions of knowledge".
- Teachers working collaboratively to enhance their practice: "we are keen to build our knowledge base: we've been in touch with the project teacher from (school 9) who has been giving us advice".

Challenges

- Lack of access to devices and issues with connectivity: "lack of access and skills"; "internet problems frustrate and disengage students attention, lack of basic skills may affect confidence".
- Use of time: "over-reliance, distractions, time management/students not getting the most out of the writing time because of issues"; "technology can take the student longer to complete writing task as they can focus too long on the visual aspects"; "time was a challenge for students to complete their work as they did not have the necessary typing skills".
- Some students distracted by (mis)use of ICT resources:

> "Some students also wrote less because of a mix of factors – slow typing, unsure about application and becoming distracted by font and colour visual elements rather than typing content … students go on other sites, inappropriate sites, copy and paste information."

- Maintaining a focus on meaning ("rather than frills") to create "balanced multimodal texts".
- The need to build teachers' familiarity with new digital resources.

School presentations were included in the final stage of the project to give teachers the opportunity to reflect on their professional learning and to consider how it had translated into practice within their writing programs. The final workshop provided a forum where teachers could share their ideas with others, articulating their progress and identifying future directions within their schools. The professional learning program thus concluded by translating the theoretical aspects of their learning into the reality of the classroom as teachers were involved in 'discovering and describing how technology-related professional knowledge is implemented and instantiated in practice' (Koehler, Mishra & Cain 2013, p. 18).

3.2.4 Elements for future professional learning programs

Through discussion at the final workshop, and in response to survey questions, teachers were invited to give feedback on the professional learning model adopted during the project. Their responses have contributed to the following interrelated elements identified within effective models of professional learning.

Central to teacher feedback was the notion that **professional knowledge is developed through a planned sequence of learning opportunities that parallels scaffolding for student learning.** They identify the importance of initial access to expert, specialist knowledge followed by a chance to jointly consider, discuss and reflect on new ideas before adopting them in their own classrooms. In a model reminiscent of modelled, guided and independent scaffolding for student learning, participants suggested a three-tier approach:

1. Presentation of new concepts, in this instance the craft of writing in a digital environment: "theory with explicit activities that are purposeful".
2. Opportunities to practice new learning, including exploring new apps and programs: "time to play with ICT while experts are close by". In relation to this project, teacher feedback indicated that the second workshop might be further improved by including opportunities for hands-on practice with new apps and devices, with advice from experts and other participants familiar with the technology.
3. Implementation in school: "do it with your team – implement/discuss/bounce off ideas together", followed by individual application of chosen technology in the classroom.

Professional learning provides opportunities for teachers to apply new learning in their own context. Teachers design their own research questions, set purposeful goals and relevant activities that relate to existing priorities and programs. Teacher research encourages the investigation of local issues, on-site professional dialogue and a sharing of local knowledge and digital resources. Lesson study facilitates the cyclical process of enquiry, planning, implementation and reflection as a way of successfully integrating ICT into the writing program.

As part of this in-school focus, teachers identify **the significance of local teacher support, ideally through the role of a knowledgeable mentor.** Mentoring allows for the successful uptake of knowledge and development around the use of digital tools, assisting with the integration of theory into classroom practice. This can be achieved through the various aspects of professional dialogue including collaborative planning, demonstration lessons, point-of-need advice and probing questioning. Mentors are also well placed to facilitate valuable networks and online sharing platforms. In relation to this research project, the in-school elements could have been strengthened by such support – participation in the Yammer online platform was disappointingly low, with teachers reporting that they were too busy to use it or unfamiliar with the site. The presence of a mentor would also have strengthened the lesson study process which was only successful in some schools. Teachers reported that they appreciated visits from the researchers and recognised the capacity of a mentor to extend the whole professional learning process.

Time is central to an effective model of PL. Teachers reiterated this throughout the project: the learning process for both teachers and students within the ever-changing digital environment requires a considerable investment of time. "MORE TIME!!!" appeared in evaluations, teacher interviews and oral feedback with requests for schools to allow "time to plan together with colleagues"; also, recognition from departmental and school leaders that, in relation to the use of ICT, "we are still experimenting…we are at the beginning of our journey".

Finally, **teachers need to recognise their identity as valuable and valid researchers within the development of new knowledge.** Professional learning programs need to encourage active participation by teachers and help them to develop agency and engagement in their own learning, as reflected in this comment within the final teacher survey: "have loved the professional learning and the ideals of the research project – it has strengthened my understanding of explicit teaching and meaningful integration of ICT".

3.2.5 Summary

This section has outlined the model of professional learning adopted throughout the project, drawing on insights from activities and evaluations conducted during teacher workshops, and also from observations made during school visits and interviews.

In response to this research question, the feedback from project teachers suggests that effective professional learning can comprise a mix of expert led workshops followed by school-based implementation guided by knowledgeable mentors and colleagues. Time is a critical factor within this sequence of learning, with the development of new skills and knowledge happening over a period of months rather than days. Provision of time for reflection and discussion therefore needs to be built into the schedule of learning.

Teachers can play a more active role within their professional learning. Current research identified in the review of literature calls for more empirical research to allow teachers a voice in the development of policy responses to the dynamic digital environment. Within this project, teachers as researchers have been able to provide valuable feedback to inform the proposed elements for future professional learning.

The final question looks in closer detail at students' writing when supported by ICT, examining each stage of the writing process to determine the impact of digital technology on their written compositions.

3.3 Research question 3 – Do the participating primary students write differently when supported by ICT, and what is the impact of new technologies on students' planning, text composition and editing strategies?

The majority of teachers in this project believed that students write differently when supported by ICT. This section looks in detail at the way students set about writing, and the results they achieve when writing in a digital environment. It begins with an overview of the results of the quantitative analysis of scores from pre and post project writing tasks which were designed to measure the impact of the project on student progress (refer to Appendix 3 for a full analysis of this data). This is followed by some insights into students' perspectives on writing, with the final analysis examining the influence of ICT on different stages in the writing process, illustrating findings with case studies drawn from some of the participating classes.

3.3.1 Pre and post project writing task: quantitative analysis

To identify the impact of the program of professional learning and support on student writing, differences in paper-based writing scores were examined over time. Students completed the writing tasks immediately prior to the beginning of the project (early in Term 1) and again after it had concluded (end of Term 2). Students in the control classes took part in the paper-based writing task only and completed the task on 2 occasions (2 writing tasks in total); while students in the project classes took part in both the paper-based writing and digital composition tasks on 2 occasions (4 writing tasks in total). The writing tasks are provided in Appendix 4.

This study employed a small sample size and the project was implemented over a short period (2 terms); thus, caution needs to be taken when interpreting the results. Given this limitation, we provide our analysis of the writing scores and focus on the qualitative analysis of the impact on the writing process.

A comparison of paper-based writing task scores for control and project classes was conducted to investigate whether the professional learning program had run-on impacts on student paper-based writing scores. Results did not show that students from project classes improved more than those from control classes on the paper-based writing task scores. However, when investigated across schools, significant improvements were observed in some schools.

A comparison of pre and post project digital writing task scores for project classes was also conducted to examine whether the professional learning program impacted on student digital composition. Results showed that student scores significantly increased over time. In addition, when investigated across schools, improvements were dependent on which school students attended – that is, student scores at some schools improved significantly more than student scores at other schools.

On average, the impact of the program of professional learning was evident across the digital composition and paper-based writing tasks over time, but the extent of this improvement was dependent on context. While many schools experienced improvements across the paper-based writing task in both their project and control classes, some schools saw improvements in their project classes only, while one school experienced improvements in their control classes only.

Improvements in students' scores on the digital composition task were evident. However, it was not clear that this was due to the program of professional learning as no control classes were measured for comparison. It was evident that the impact of the program of professional learning on student digital composition scores differed across schools, which could be due to a range of factors including school context or the fidelity of implementation.

3.3.2 Students' perspectives on the impact of ICT on writing

During the focus group interviews, students were asked what they understood 'writing' to be. Responses were thoughtful and detailed: "words and letters that mean something to you … sharing emotions and expressing ideas" and "something that you work on for a while and print your own words". One student outlined the difference between the spoken and written word: "talking is just you and your ideas and then you take a piece of paper and write it down so someone can read it like library books". Another recognised the value of writing for posterity: "without writing, every generation would have to start from scratch". Purpose and writing were often seen as synonymous: many students gave "imaginative, persuasive and informative" as definitions of writing. Many responses also equated digital writing with typing, with only a few students citing examples of including pictures and diagrams in their compositions.

Preferences for writing on paper or on devices were divided. Paper was popular because, as one student recognised, "we've been using paper and pencils since Kindergarten", and also, "there's something enticing about a piece of paper". However, many opted for digital writing for its superior presentational qualities and support with secretarial skills: "typing's easier, my wrists don't get so sore, and I like the spell-check". Formal and information texts were seen as better expressed on a computer, whereas stories and personal diaries called for paper and pen. Most students liked to have access to both sets of tools: "it's easier to write on a computer but harder to draw pictures". Many believed that they don't spend much time writing at school, "though we've done more this term because of NAPLAN".

Students recognise the benefits and challenges presented by an increasingly digital environment at home and at school. They appreciate that "the technological world of the 21st Century is changing rapidly so it's a great idea to bring it into the primary school" and that jobs in the future will require familiarity with many different kinds of devices "so we need to navigate them safely and responsibly – we need choice". Cyberbullying was often cited as a challenge, along with poor work habits – "you might forget how to write with a pencil … computers can make you a lazy speller" – and concerns about plagiarism. Typing speed and competence were seen as vital for efficient digital writers: "maybe they should start teaching it in Kindergarten so they'll get better".

3.3.3 The impact of ICT on planning for writing

Project findings show that ICT is making some impact on the way students plan for writing, but that most still prefer paper or small whiteboards for their immediate accessibility. The majority of project teachers report that students usually plan through the use of mind maps on paper: "they waste too much time accessing their devices…or they're not always available when we want them". Other reasons for teachers preferring paper-based planning include students' lack of confidence in using appropriate apps and/or a lack of expertise in using the app to its full capacity, slow typing skills and the possibilities of distraction from the task. Some students choose to plan on paper because "I like drawing shapes and arrows…my mind works that way", or "I think harder when I'm writing with paper", or "the teacher likes us to use our books". A number of students are beginning to use digital planning tools out of school, however: "SMART notebook has lots of templates, including mind maps – I would use that app if we had it in school", and one student describes using her mobile phone to jot down ideas for stories when she's not at home.

Teachers report making use of a blended combination of traditional and digital technology during planning, giving students a choice of tools when availability of resources permits: "some students like to take notes on iPads … some plan on Google Docs and then access it from home"; "we're beginning to use Padlet for brainstorming and categorisation and Popplet for organising ideas in pairs". Students also see the value of a flexible approach: "I make a draft on paper and then make it neater on the computer at home"; "I plan in my head, not on screen".

Paired research projects encourage greater collaboration and interaction with students working together to plan digital compositions. School 2 set up collaboration between 2 classes, allowing students to share their learning experiences as a way of enhancing the planning of their digital compositions, and their effective use of particular apps. One teacher from school 9 describes how his students discussed the potential layout of their intended website while still on their class excursion: "they orally communicated … discussing what they already knew from prior readings, experiences, excursions, and what they needed to know more about".

Use of digital technologies in planning for writing leads to less anxiety and increased motivation, especially amongst high support students: "xxx was excited to plan her PowerPoint but didn't know how to begin … she needed support". Students are keen to share their digital expertise, thus contributing to the quality of the planning process: "her friend offered an opinion about how she should change the font to match the theme of Hallowe'en … xxx liked this idea and added it to her planning".

When students and teachers are satisfied with the quality of preparation for writing, the planning notes and diagrams become resources to assist with the written compositions. An understanding of the ways that ICT supports students to compose their texts is central to this project.

3.3.4 Impact of ICT on composing written texts

Findings show that the nature of digital compositions is changing. A number of variables impact on students' digital compositions, including the students' (and their teachers') fluency with, and access to, particular devices and programs; teachers' knowledge and practices; and the intended audience and purpose for their writing. These variables interact within the digital environment of the classroom to create multiple options for written expression including more multimodal elements and a greater variety of written genres across the curriculum.

Students report greater efficiencies using pen and paper to compose. Many noted that their typing skills are not fast enough to keep up with their flow of ideas: "I can write faster and get my ideas down better". There are those who prefer a slower pace: "it's OK to type slowly because then I can get think up new ideas as I go"; some EAL/D students prefer to compose via the keyboard because "I can use iPads for translations and definitions". Cognitive load theory may help to explain the importance of typing or handwriting automaticity in writing as cognitive load on working memory is reduced with increasing levels of automation, leaving more mental space for authorial (higher-order) writing skills (Sweller, van Merrienboer & Paas 1998).

Students also acknowledge that access to digital technology influences how they communicate out of school. "I write emails to my mum when I'm not at her house"; "I like to write emails to family overseas and I message my friends sometimes"; "I write to my friend through Xbox". Students appreciate the ease and speed with which they can write to family and friends online. A few send traditional letters via the post: "but I have to with my friend in the country because they have no reception". In these instances, ICT has impacted on the composition of personal writing in the context of the home.

In traditional classwork the intended audience for any written compositions is the teacher, but **the use of digital platforms has facilitated the extension of audience to include other students.** A teacher from school 10 writes on Yammer to describe her successful use of class blogs:

> "I thought some teachers may be interested in Kidblog – my grade partner and I use it all the time! You can link with other classes in the school as well as communities around the world.
>
> You can use it in any way you choose and share it with any group you choose. My colleague uses it for literature circles work or you might like to showcase your writing samples and share it with your class to have peer assessment and feedback. You might like to pose a question, and have students answer, and share it with the world!"

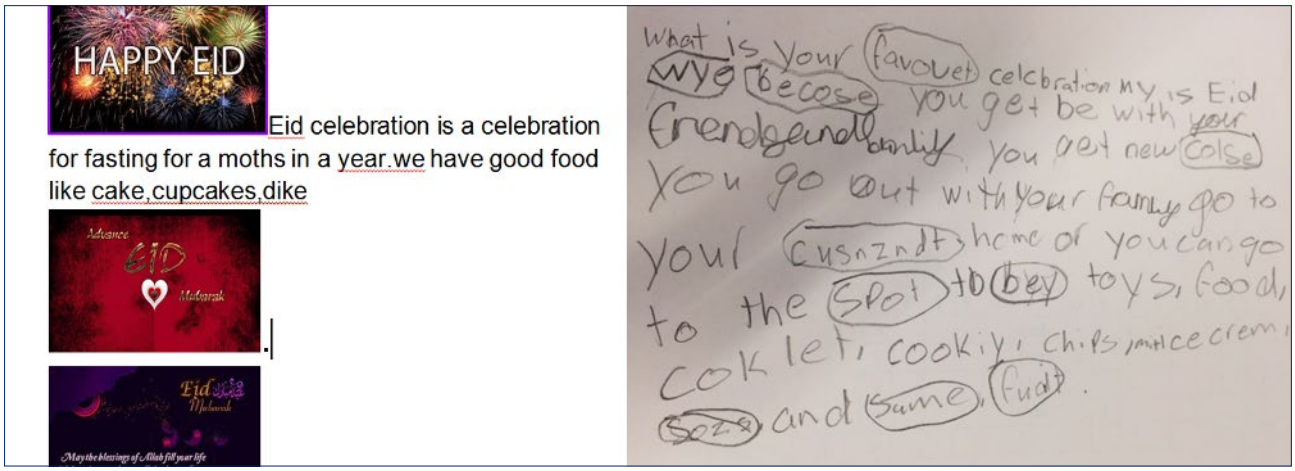
Use of a digital platform thus widens the writers' potential audience, with compositions in English (and other languages) now read by school students overseas.

Findings suggest that in class, students are increasingly using multimodal elements to enhance their writing. In relation to the SAMR model (refer to Figure 4, page 18), most students are using digital technology at the level of substitution (for example, a story written on paper and then typed onto a laptop, thus acquiring no change to its content) or augmentation (a story typed up with the subsequent addition of images and sound to extend the meaning of the narrative). There are exceptions to this finding – some students have produced compositions in response to the redesign of writing tasks through engagement with digital options, as in the modification stage of the SAMR model. The writing sample in Figure 9 shows augmentation of a text.

The use of digital technology has made a significant impact on the appearance of students' writing. Students recognise the potential of digital technology to improve the presentation of their writing, with use of particular fonts and formatting producing a more legible and polished result: "it's much neater … you just have to hit the right keys and it will all look just the same". Teachers appreciate the value of this effect, especially for their high needs students who show more enthusiasm for writing when it can be represented in a more attractive format, but are wary of the time spent on design choice at the expense of crafting the language. Figure 9 shows an example of student A's writing, where the same content is expressed through digital and paper-based technology.

Figure 9

Student writing, 'My Favourite Celebration', using digital and paper-based technology



The use of ICT has reportedly enhanced both her engagement and the legibility of the composition. The teacher writes:

> "She is very excited to use technology … she doesn't have it at home. AD's writing is enhanced when ICT is integrated. As she struggles to write, using ICT has helped her get the ideas and information she wants to share out there to the class. The class are engaged and can read her writing compositions when they are complete."

Lack of familiarity with the device, however, means that 'when technology is used, AD is slow to begin. She is not at all confident when it comes to logging on and opening up new applications, even with explicit instructions'.

The writing samples shown in Figure 9 are part of the pre-project writing task which was assessed using a NAPLAN style rubric. The paper-based composition, despite looking less legible and containing more spelling errors, scored higher marks. It seems likely that the student had more time to devote to writing down her ideas and produced a longer stretch of text in which she was able to demonstrate her authorial skills, thus attracting more marks. The digital text includes visual information about the festival to support the reader (providing elements of 'augmentation' in the SAMR model) but the structure of the writing is simpler and contains fewer ideas.

While welcoming the opportunities for increased engagement during writing lessons, teachers were mindful of the need to balance both content and technological knowledge, providing explicit instruction in the craft of digital writing and the written language choices students can make. As one teacher reflected:

> "I was aiming for a balance between visuals and written text, and effective use of both at the right times – a healthy and exciting challenge for me and my class to experience."

The most successful writing reflects a sound knowledge of language use and is sustained by content as well as attractive formatting and design.

Digital technology can be used in writing to respond to individual student's learning needs. The following extract comes from a teacher's observations of an EAL/D learner completing her rich task, the creation of a multimodal text portraying the effect of migration on people.

> "Student LY wanted a story that had a theme of freedom. She wasn't sure how this would be told at the beginning. Initially it was a story of a person leaving their country to go to Australia. She was born in Australia; her parents are from a Vietnamese background. Her plan was written in her book, listed in point forms. We read over them and she has decided that she'll use iMovie's movie trailer as she completed her pre-test on this platform and was comfortable with using it.
>
> After going over student ideas and seeing what most of them wrote, which was very little or in point forms, we had another class discussion about the theme of the texts we've been reading. We looked again at the structure in which the authors have written their work [for example] Ziba went on a boat – home away home. I gave the students a very simple storyboard so to help them structure their stories into pages but also think of how their story might 'flow'.
>
> Student LY is a softly spoken student and engages mainly in small group discussion. She began to plan her story board and was able to discuss the events that she'd like to include to show the theme of freedom. She seems to be more interested in finding the images that she's like to use to portray the effect of the life altering change in her story. She continued to use the iMovie app on the iPads. She wrote in phrases to tell her story with images capturing emotions of despair all the way to freedom.
>
> We reviewed the story and made some adjustments using vocabulary learned from an earlier cline[6] activity completed in class."

6 A cline is a scale of language items. In a cline activity, students place synonyms along a cline.

This extract suggests use of technology at the 'modification' stage of the SAMR model, with a redesign of the migration story to allow the portrayal of significant themes; it also illustrates some of the variables which guide the student's writing choices. Technological knowledge informs the use of both paper-based and digital technologies and recognises the importance of familiarity and experience with ICT, and content knowledge is reflected in the systematic teaching and learning in the craft of writing.

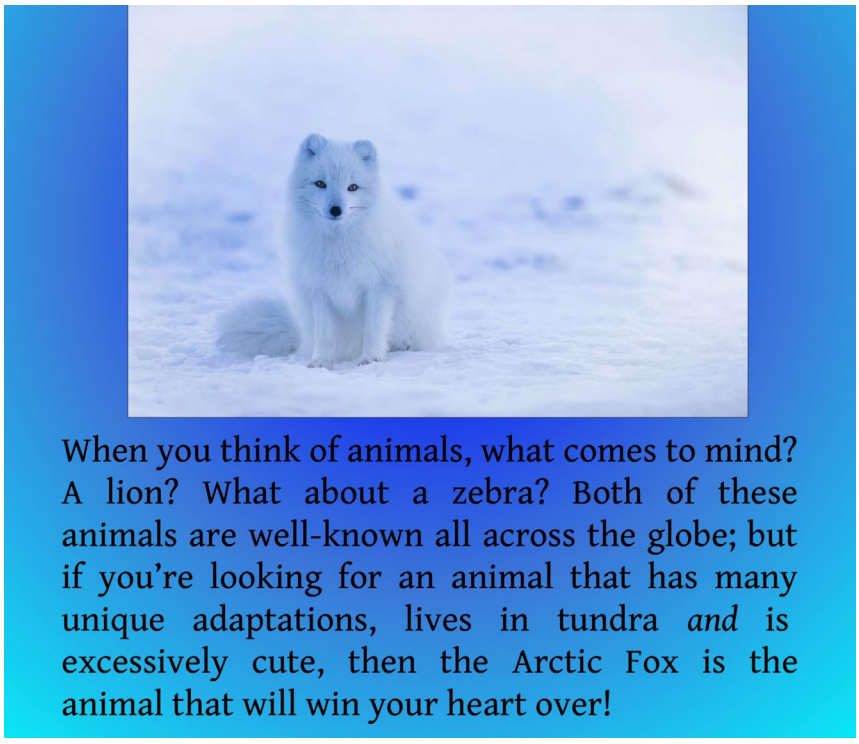
The following work sample comes from a very different school context but is also the result of a carefully planned learning sequence which scaffolds students' understanding of text structure and the use of literary devices. The student has composed a lengthy informative text to submit to the National Geographic online magazine. The extract reflects the teacher's focus on pedagogical content knowledge through the use of a 'bold lead'[7] to introduce the article. The teacher comments:

> "Student DM is very confident and creative (when) writing a bold lead. She had used Google Slides before and so was confident. She seemed to prefer to work alone – headphones on and focused. She didn't seem to like partner feedback time. All students seemed more motivated writing on laptops rather than in their book."

As part of a class writing lesson, this student had already experimented with writing another 'bold lead' in her workbook. As the teacher observes, her confidence with the content and her knowledge of the technology allows her to compose a successful introduction for the article (Figure 10).

Figure 10

Writing a bold lead: 'Adorable Arctic Foxes'

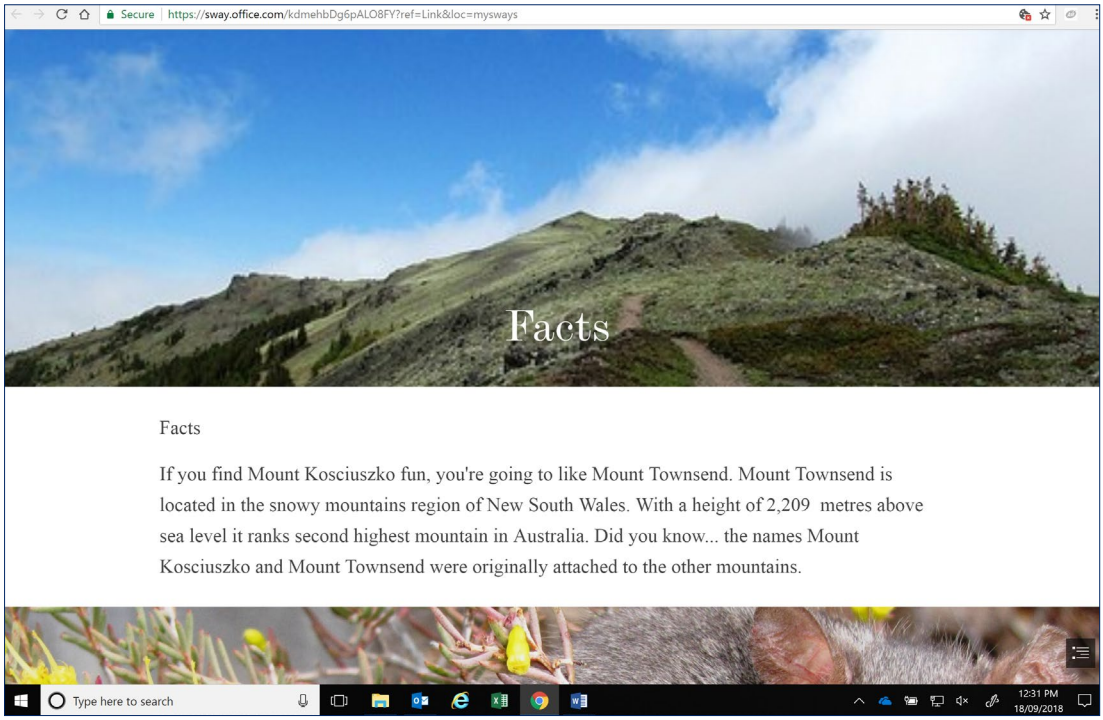


7 A good beginning sentence to lead a reader into the text.

Findings show an expansion of the range of digital writing tasks can enhance learning across the curriculum. Within the project, several teachers challenged their students by introducing new types of written texts encompassing ICT. In school 1, the creation of blogs[8] was a stimulus for content, language and ICT learning. School 1 created geography blogs with their Stage 2 classes where students worked to develop their own blogs on the differences between the physical geography of Australia and China. Their learning cycle included field building, where students were introduced to contrasting landscapes through images and videos on the interactive whiteboard; explicit teaching about blogs through modelling and deconstruction of a travel blog; shared digital construction of a group blog, including learning the language and rules for responsible and accurate publishing; and independent constructions of blogs using Sway, an accessible platform for the presentation of their information. Teachers reported the ease with which students could share their work, gaining feedback from other classes, as well as showing their blogs to parents and completing their work at home.

Figure 11

Individual construction of blogs using Sway



Students applied their knowledge through independent learning, developed extended conversations with peers and increased their engagement in the learning process. Their students also increased their understanding of the content as they linked geography with literacy, developing their vocabulary and knowledge of appropriate language choices. There was a growth of technological knowledge (for both teachers and students) in the struggles to save documents and in the addition of visual and sound effects to blogs. Teachers noted extended conversations between students around the use of technology, despite (or because of) disruptions to progress through a lack of digital resources and unreliable internet access.

8 The term 'blog' is derived from the term 'web log'.

Of particular interest here is evidence of the reciprocal processes within this digital text composition. As students research information to add to their blogs, they are digital consumers, reading and acquiring material through efficient use of online search engines. In the composition of their blogs they are digital creators, using information from the internet to represent their growing knowledge of geography through an online mode. Awareness of the purpose and audience for this task has focused their attention on the appropriate use of language.

Effective writing within any mode requires a thorough process of reviewing and editing techniques before completion. The concluding segment explores the impact of ICT on the final stages of text composition.

3.3.5 Impact of ICT on editing written texts

ICT has made a significant impact on the editing of written texts. Students in focus groups were keen to discuss the merits of spellchecks and valued access to the online thesaurus and dictionary as they edited their final drafts. Few students reported making use of online cutting and pasting tools to improve their compositions as they type, mainly because as discussed above, they are copying out a draft rather than creating a new text.

Students in focus groups generally agree that technology is useful for editing writing. A recurring comment from a student focus group:

> "We write with a pen or pencil and a book … if we're finished we go to a laptop and type it up and send it to Google Classroom so the teacher can read it … and all the other students can too."

Digital platforms supported greater and more effective teacher and peer feedback. All teachers and students were aware of the capacities of digital platforms, where work is submitted online and can be reviewed by all members of the class. Feedback relating to the written draft is made alongside the text: "students will be finishing their narratives on Google classroom and will receive online comments by peers". Use of blogs, discussed in the previous section, also provide opportunities for online feedback:

> "It is a fantastic way for you to assess and mark student's work online, to have students reading and constructively commenting on each other's work. It's also a way to invite parents and other teachers to see your work."

Students are thus writing for a wider audience and receiving feedback as they write. Teachers appreciate the chance to interact with students via the medium of Google Classroom, with some students accessing their evaluations by logging on at home: "it allows teacher and student to review texts together remotely".

One teacher's classroom observations indicated that "peer conversations are valued and used as preliminary to a teacher conference". However, not all feedback is positive. Some teachers report that students find it confronting to be given comments from their peers: "peer feedback is not always welcomed … we've encouraged more explicit justification of commentary". As a result of such reaction, one school has led workshops on constructive feedback, aiming for comments which are specific and positive. Teachers see a need to formalise editing strategies through the development of assessment rubrics and other guidelines: "we need more focus on editing and review, and to design a structure for editing (for example an explicit spelling or grammar focus)". Two project schools developed their own rubrics to assess digital compositions.

In this example of editing from a Stage 3 history unit, the students jointly write and edit a documentary film as part of a unit on the stolen generations or the White Australia policy. The aim was to move students beyond the role of consumers of digital technology, requiring them as well to become creators, in this case, of a documentary film. In the process, they use Google Docs to jointly write a script as a narrative voiceover to accompany the videos and photographs.

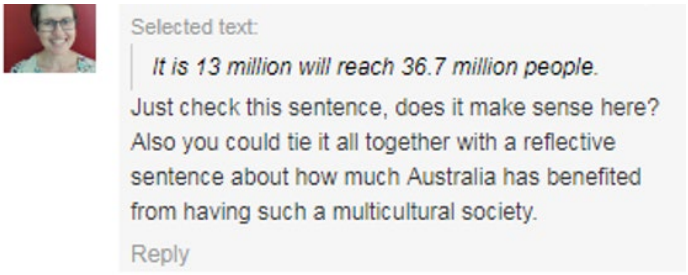
Later in the process, students share the drafts of the completed storyboards onto Google Classroom, as shown in Figure 12 below.

Figure 12

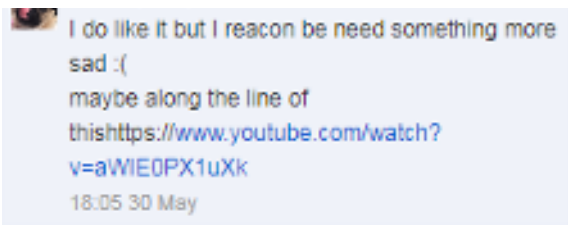
Example of completed storyboard

Narrator: Student 1	Narrator: Student 2	Narrator: Student 3
Script4: **2008, 13th of February in the House of Representatives, Parliament. This was a momentous occasion, as its effects spread over the entire continent. After 98 years the long wait for the apology was finally made. Kevin Rudd, prime minister of Australia at the time, said sorry to the generations of Aboriginals who were taken from their communities and home.**(cut segment from sorry speech-s://www.creativespirits.info/aboriginalculture/politics/sorry-apology-to-stolen-generations).	Script5: The apology built a new relashionshionship between aboriginals and white australians it showed that we cared about the 35000 that lost their homes and the thousands of families which were deeply affected by it too. The apology meant a lot to them, it was a sign that after 108 years since it started people still cared about the mistake we made and the cause that it had on others. Though some were heartfelt others showed signs of disgust, some going as far as to protest against it. One argument is that it is not Rudd's responsibility to say sorry. This group was a minority in comparison to the millions celebrating National Sorry Day. This is now an annual celebration.	Script6: stolen generation is one of the most emotional times in our Australian history. Its effects are still felt in many people's hearts today, as current and future generations of Aboriginal people continue to be impacted. From the first aboriginal protection act to the change in the constitution in 1967 and onto 2008 with Kevin Rudd's apology speech Australia continues to move forward with a greater sense of fairness for both cultures. Play this music in the background as pictures and videos are shown from the stolen generation. https://www.youtube.com/watch?v=aWIE0PX1uXk

Google Classroom provides a platform for online feedback from both teacher and other students. The first sample shows teacher feedback relating to grammatical and historical content knowledge:



The second sample is part of a dialogue between students as they discuss which backing music should accompany the visual depiction of the subject (content has been trimmed to remove students' names). The time and date indicator at the end of the post shows that this online review happened outside of school hours, with access to ICT allowing students to engage in extended collaboration, drawing on their personal knowledge of digital resources to refine their compositions:



The quality of digital composition improved during the project, although it's unclear to what extent this improvement is due to natural growth or due to exposure to the project.

3.3.6 Summary

The use of digital technology in the classroom has extended the range of text types, audiences, language and multimodal features of written texts that students produce, as well as impacting positively on the writing processes of planning, composing and editing.

For project schools, digital composition writing scores improved over the duration of the project, although it is unclear to what extent this improvement is due to natural growth or due to the exposure to the project intervention. School context appears to affect the benefit of ICT writing, with the quantitative analysis of paper-based writing tasks suggesting that the impact professional learning on general writing ability varied substantially between schools.

The qualitative analysis shows that digital technology is making some impact on the way students plan, compose and edit writing. Teachers and students require technological fluency and flexibility to harness its potential and fully demonstrate their writing skills. While most students still make use of paper or small whiteboards for their text preparation, the use of devices was found to encourage collaborative planning, with students working together to plan digital compositions. Teachers report that use of ICT leads to less anxiety and increased motivation to begin writing tasks, especially among high support students.

The use of ICT makes a significant impact on the ways that students compose written texts, with their writing reflecting a sensitivity to the wider audience available through websites and social media platforms. Findings suggest that across the curriculum, a wider array of digital writing tasks can enhance student engagement in learning. Most of the project classes are operating at the augmentation stage of the SAMR model, using digital technology to achieve some functional enhancement to written texts with the inclusion of more multimodal features. The use of ICT has made a significant impact on the appearance of students' writing, with students reporting the benefits of online spell checks and dictionary references. The use of these editing tools did not mask students' true level of mastery or diminish the role of explicit teaching of writing skills and language, which was shown to have a positive influence on composition.

Digital technology is most effective when used as a writing tool within a carefully designed teaching and learning cycle. This includes the use of digital platforms for timely teacher and peer feedback, where ICT is influential in the editing of written texts. Teachers and students report the benefits of collaborative online review and reflection, but recognise the need for detailed guidelines and assessment rubrics to inform and structure peer and teacher feedback.

Chapter 4: **Conclusion**

With the presence of digital devices now commonplace in most classrooms, research into the current state of ICT provision and usage in schools is timely. By examining classroom practices in a small but representative sample of primary schools in NSW, this project provides insights into the impact of digital technology on students' writing in Stage 2 and 3, as well as exploring ways to develop effective pedagogy to improve the teaching and learning of writing across the curriculum.

The research findings as summarised here, are salient to both educators and policy makers. The research into current ICT use (Research question 1) found that participating teachers had a high level of confidence in using ICT to support their writing programs. However, the extent and effectiveness of use was very much influenced by the availability and reliability of the technology. The research highlighted the need for continuing development of teacher and student capabilities with digital technologies to ensure critical and informed selection and use of tools as part of the writing process.

The research into the impact of professional learning (Research question 2) found that the model of professional learning adopted for this project led to more informed use of digital technology in the teaching of writing. Professional learning comprised a mix of expert led workshops followed by school-based implementation guided by knowledgeable mentors and colleagues. It provided teachers and students with the technological fluency and flexibility to harness ICT potential and fully demonstrate their writing skills.

The research investigating the impact of ICT on writing (Research question 3) found limited evidence of improved writing scores in digital compositions over the duration of the project. The qualitative analysis, however, showed that digital technology is impacting on the way students plan, compose and edit writing. Teachers reported that use of ICT leads to increased engagement in writing, especially among high support students. Students' writing represented a wider range of genres in response to a diversity of audiences available through websites and social media platforms. Students' writing also reflected the positive influence of explicit teaching of writing skills and language, collaborative online peer and teacher feedback, and the use of online editing tools.

Technologies in the classroom, whether paper-based or digital, are tools that support both learning to write and writing to learn. As an enabling tool, ICT has the potential to provide students with opportunities for increased engagement, creativity and interaction. However, teachers are also aware of the challenges presented by technical difficulties and digital distractions. Students themselves acknowledge both benefits and constraints when writing with new technologies, but mostly welcome the chance to prepare for an increasingly digitalised future. Understanding of the role of ICT as a pedagogical tool, rather than a pedagogy in itself, is critical to its effective use in the classroom.

ICT as a learning tool has been shown to be more effective in some schools than others. Within the context of the classroom, many interacting elements influence the successful uptake and integration of digital technology within the curriculum. These include:

- societal factors, including technological development; community and parental attitudes towards use of ICT in and out the classroom
- system-wide factors, including education policies, curriculum and assessment programs relating to the development of ICT capabilities in school students; funding measures
- school factors, including leadership and school priorities towards ICT (curriculum organisation, provision of resources, professional learning)
- teacher knowledge and experience of ICT; preferred pedagogy and classroom organisation
- student socio-economic background; language and learning needs, provision of (and experience with) ICT in the home.

A combination of elements within the educational digital environment thus creates a unique classroom context which is central to any analysis of ICT usage.

This notion of context is further impacted by the current rapid rate of technological growth. As observed in the introduction, the 'new' of tomorrow is constantly replacing the 'new' of today (Walsh 2010, p. 212), with the development of digital technology applications continuing to challenge existing processes and practices in the teaching of writing. References to levels of digital competence can now be found throughout syllabus documents and learning progressions, but as yet there are no assessment programs for teachers attempting to determine the characteristics of quality digital compositions.

There is a critical need to develop assessment rubrics for multimodal texts which have been tested and validated for use in schools. Comments recorded from NAPLAN markers during the assessment of the project pre and post tasks confirm that the existing NAPLAN writing rubrics are inadequate to acknowledge the developing skills of students composing multimodal texts. The crafting of the written word remains an essential literacy skill within primary classrooms. However, if the composition of texts is to include visual and auditory modes, then teachers need clear and comprehensive guidelines which do not privilege the value of some modes over others.

The development of new assessment guidelines needs to be accompanied by a suite of professional learning for teachers, allowing them to develop technological knowledge alongside rich content and pedagogical knowledge. Such programs will enable them to familiarise themselves with the latest devices and applications and to implement new knowledge within the context of their own learning community. The significance of on-site mentoring as part of this program cannot be overstated.

Learning to write in the digital age is still an essential part of becoming literate. The challenge now for schools, as well as for education systems, is to support students and teachers to make the most effective use of all available tools to develop and craft quality texts.

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Appendix 1:
Writing tasks assessment rubric

The assessment rubrics were developed in consultation with academics to incorporate elements of both paper-based and digital texts so that the rubric could be used for both tasks.

1. Audience (6)

Skill focus: capacity to engage, support and inform the audience

Mark	Category descriptor	Additional information
0	• No relevant content	
1	• Contains some simple written content (words/images/sounds)	
2	• Shows awareness of basic audience expectations through use of simple layout and informative language	• Simple layout may include: ◦ basic titles/subtitles/captions ◦ simple content ◦ minimal illustrations
3	• An internally consistent text that attempts to support the audience by developing a shared understanding of content	• Contains sufficient information for the reader/viewer to follow the information report fairly easily: ◦ elaborated titles/ subtitles/ captions (font choice may link thematically to meaning of words) ◦ more detailed description of content information ◦ images that illustrate relevant content
4	• Supports audience understanding • Attempts to engage the audience	• Choice of language/visuals/sounds may: ◦ include evaluative language ◦ encourage reflection ◦ include images shown from an angle and or distance that position the viewer in a way appropriate to the purpose of the text
5	• Supports and engages the audience through deliberate choice of language and/or images and/or sounds	
6	• Successfully engages, supports and informs the audience through precise and sustained use of informative language/ visuals/sounds	

2. Text structure (4)

Skill focus: the organisation of an informative text including an introductory statement, a series of paragraphs describing key information about the topic, and a concluding statement

Mark	Category descriptor	Additional information
0	• No evidence of any structural components of informative writing	
1	• Minimal evidence of appropriate structure – for example, a list of basic facts relating to the topic	
2	• Contains limited structural components (brief written description/non-specific images) about key information	• Descriptive details of content (using written text, images or sounds) • Evaluative comments may be used to elaborate information • Structure of informative text may be strengthened through frequent use of connectives within the text, or use of relevant captions with photos • Visual or written details may be chosen to add interest to the text
3	• Contains most structural components of an informative text, sequenced with adequate details to provide the reader/viewer with a general understanding of the topic • Images and/or sounds match the information shown	
4	• Highly controlled and complete informative structure, deliberately sequenced with detailed information to provide the reader/viewer with a precise understanding of the topic • Images and/or sounds match and enhance the information shown • Includes an effective conclusion	

3. Ideas (5)

Skill focus: the selection and crafting of ideas for an informative text

Mark	Category descriptor	Additional information
0	• No/insufficient evidence	
1	• Ideas very few and simple	
2	• Ideas are few, not elaborated or very predictable	
3	• Ideas show some development and elaboration, and are represented consistently through use of written text, images and/or sounds	• Elaboration should be relevant and on topic
4	• Ideas are appropriate, effective and show some elaboration through use of written text, images and/or sounds	
5	• Ideas are substantial and highly informative, and are elaborated by carefully crafted written text, images and/or sounds	• Ideas may include: ◦ unexpected topics ◦ mature viewpoints ◦ contrasts and comparisons

4. Description of setting (4)

Skill focus: the development of the setting and atmosphere ('My School')

Mark	Category descriptor	Additional information
0	• No/insufficient evidence	
1	• Only gives vague description of setting in captions or text; unrelated images	
2	• Makes some attempt at brief description of setting but text lacks substance and detail; images lack continuity and focus	
3	• Setting emerges through more detailed information; description makes some contribution to creation of place • Adequate use of captions, labels, images and/or sound	
4	• Maintains a strong sense of setting. Description of the subject matter is precise, clear and detailed and contributes strongly to creation of place • Captions, labels, images and/or sound are used effectively to enhance description	• Effective use of hyperlinks

5. Vocabulary (5)

Skill focus: the range and precision of appropriate language choices, including choice of image and/or sound

Mark	Category descriptor	Additional information
0	• No content submitted	
1	• Very short composition; brief or no captions submitted with images	• Few content words
2	• Use of simple verbs, adverbs, adjectives or nouns • Images aligned with meaning of written text • Repetition of images	• Simple words: play, read, dance, walk, maths, sport, help • Simple groups: my new classroom; lots of fun
3	• More precise use of words and word groups • Images and/or sounds enhance the meaning	• Single precise words: perform, research, experiences • Precise phrases: the mural on the canteen wall • Metaphor: the school is a brain factory • Evaluative: awesome teachers • Colloquial language: playing tip • Images of classroom icons decorating the text
4	• Sustained and consistent use of precise words and phrases to enhance meaning, substituting them for common or everyday word use • Images and/or sounds embellish (create impact and enhance) the language choices	
5	• A range of precise and effective words and phrases used throughout • Images and/or sounds extend meaning, evoking humour or emotional responses	

6. Cohesion (4)

Skill focus: the control of multiple threads and relationships over the whole composition, achieved through the use of referring words, associations and connectives; use of audio/visual references and transitions

Mark	Category descriptor	Additional information
0	• No writing submitted	
1	• Very short composition with unrelated information	
2	• Some links between sentences • Most referring words are accurate • Most images clearly relate to meaning in the text • Some slides, images or sounds transition smoothly and/or are appropriately arranged • Colour is used with some inconsistency • Reader may need to re-read and infer links to clarify meaning	• Simple connectives and conjunctions include: then, and, but, so, when • May use repetition of nouns or unreferenced pronouns
3	• More complex connectives used correctly to support meaning • Accurate use of referring words • Most slides, images and/or sounds transition smoothly and/or are appropriately arranged • Colour is used with consistency • Meaning is clear and text flows well in a sustained composition	• More complex connectives include: meanwhile, instead, just as, although, finally • Word association used to avoid repetition • Appropriate layout of images will support the establishment of a left to right, top to bottom reading path and be consistent across several slides • Use of font to support meaning
4	• A range of connectives is used correctly to enhance meaning • An extended, cohesive composition showing continuity of ideas • All slides, images and/or sounds transition smoothly and/or are skilfully arranged • Colour is used symbolically and with consistency	• Consistent use of word associations and substitutions that enhance meaning • Use of font to support meaning

7. Paragraphing/segmenting of text (2)

Skill focus: the segmenting of text to assist the reader to negotiate the recount

Mark	Category descriptor	Additional information
0	• No use of paragraphs or text segmentation	• Composition is a block of text • New line for every sentence
1	• Composition organised into segments that are mainly focused on a single idea or set of like ideas that assist audience to digest chunks of text	• Indicates broad changes in setting
2	• All paragraphs or segments focus on one idea to develop and enhance the meaning • Segments are appropriately contained within slides	• Deliberately structured to pace and direct audience attention • Single sentence or caption used as dramatic comment or for emphasis

8. Sentence structure (6)

Skill focus: the production of grammatically correct, structurally sound and meaningful sentences

Mark	Category descriptor	Additional information
0	• No evidence of sentences	• Lists of words, text fragments
1	• Some correct formation of sentences • Some meaning can be construed	
2	• Most simple sentences are correct • Meaning is predominantly clear	• Correct sentences are predominantly simple
3	• Most simple and compound sentences are correct • Some complex sentences are correct • Meaning is predominantly clear	• Experiments with complexity
4	• Simple and compound sentences are correct • Most complex sentences are correct or • All sentences correct but do not demonstrate variety • Meaning is clear	• Greater control of complex sentences but lacks variety • Allow for occasional typo in simple or compound sentences
5	• Sentences correct (allowing for occasional typo or missing word) • Demonstrates variety* in length, structure and beginnings • Meaning is clear and sentences enhance meaning	*Variety: • Clause types and patterns (for example, adjectival, adverbial) • Length and rhythm • Lexical density: elaborating and extending phrases • Stylistically appropriate choices
6	• All sentences correct • Composition contains controlled and well-developed sentences that express precise meaning and are consistently effective	

9. Punctuation (5)

Skill focus: the use of correct and appropriate punctuation to aid reading of the text

Mark	Category descriptor	Additional information
0	• No evidence of correct punctuation	**Sentence punctuation includes:** • capital letters to begin sentences • full stops to end sentences • question marks to end sentences • exclamation marks to end sentences **Noun capitalisation includes:** • first names and surnames • titles: Mr, Mrs, Miss, Ms and so on • place names: Paris, Italy • institution names: Valley High • days of week, months of year • street names: Ord St • book and film titles • holidays: Easter, Ramadan • historic events: World War II **Other punctuation includes:** • apostrophes to mark contractions • commas in lists • commas to mark clauses/phrases • apostrophes to mark possession • correct hyphenation of compound words • quotation marks for direct speech • capital letters and commas used within quotation marks • new line for each speaker • quotation marks for text extracts and highlighted words • brackets and dashes • brackets to signal humorous asides • colons and semicolons • points of ellipsis • commas or semicolons to balance or create rhythm between clauses
1	• Some correct use of capital letters to start sentences **or** full stops to end sentences • Punctuation is minimal and of little assistance to the reader	
2	• Some accurately punctuated sentences (beginning and end) • Some noun capitalisation where applicable • Provides some markers to assist reading	
3	• Some correct punctuation across categories (sentences mostly correct with some other punctuation correct) **or** accurate sentence punctuation with no stray capitals, nothing else used • Provides adequate markers to assist reading	
4	• All sentence punctuation correct • Mostly correct use of other punctuation • Provides accurate markers to enable smooth and efficient reading	
5	• Writing contains accurate use of all applicable punctuation • Provides precise markers to pace and control reading of the text	

10. Spelling (6)

Skill focus: the accuracy of spelling and difficulty of words attempted

Mark	Category descriptor	Additional information
0	• No conventional spelling	**Simple words** • Short vowel single-syllable words (bad, fit, not) with: ◦ consonant digraphs (shop, thin, much, chips) ◦ consonant blends (drop, clap, grass, bring) ◦ double final consonants (will, less) • High frequency long vowel single-syllable words (name, park, good, school, feet, food) **Common words** • Single-syllable words with: ◦ harder two consonant blends (crack, square) ◦ 3 consonant blends (stretch, catch, strung) ◦ common long vowels (face, sail, eight, mean, nice, fly, coke, use, close, again) • Multisyllabic words with even stress patterns (middle, litter, plastic, between, hospital) • Compound words (downstairs) • Common homophones (there/their, write/right, hear/here, brake/break) • Suffixes that don't change the base word (jumped, sadly, adults, happening) • Common words with silent letters (know, wrong, comb) • Single-syllable words ending in ould, ey, ough • Most rule-driven words: drop e, double letter, change y to i (having, spitting, heavier) **Difficult words** • Uneven stress patterns in multisyllabic words (chocolate, mineral) • Uncommon vowel patterns (drought, hygiene) • Difficult subject-specific content words (obese) • Difficult homophones (practice/practise) • Suffixes where base word changes (generate/generation) • Consonant alternation patterns (confident/confidence) • Many 3 and 4 syllable words (invisible, organise, community) • Multisyllabic words ending in tion, sion, ture, ible/able, ent/ant, ful **Challenging words** • Unusual consonant patterns (guarantee) • Longer words with unstressed syllables (responsibility) • Vowel alteration patterns (brief to brevity, propose to proposition) • Foreign words • Suffixes to words ending in e, c or l (physically, changeable, mathematician)
1	• Few examples of conventional spelling	
2	• Correct spelling of: ◦ most simple words ◦ some common words (errors evident)	
3	• Correct spelling of: ◦ most simple words ◦ most common words	
4	• Correct spelling of: ◦ simple words ◦ most common words ◦ some difficult words ◦ (more correct spellings than errors)	
5	• Correct spelling of: ◦ simple words ◦ most common words ◦ most difficult words ◦ (more correct spellings than errors)	
6	• Correct spellings of: ◦ all words, including 10 difficult words and some challenging words *** Spelling in online scripts may be affected by limited keyboard skills or, conversely, students' over-estimation of their own typing accuracy at speed.**	

Appendix 2: **Teacher survey**

1. What is the name of your school?
2. Which age group are you in?
3. How many years have you been teaching?
4. Which technologies do you have access to at school, in the classroom and at home? Select all that apply.

Technology	School	Classroom	Home
Wireless internet access			
Wired internet access			
Interactive whiteboard			
Data projector			
DVD player			
Sound system (speakers)			
Desktop computer			
Laptop computer			
Tablet (for example, iPad)			
Tablet with external keyboard			
Printer			
Scanner			
Digital camera			
Mobile phone			
iPad			

5. How does your school organise individual/small group student access to computers/devices? Select all that apply.
    a. Scheduled time in computer room
    b. Scheduled use of school tablets/laptops
    c. Class/individual use of technology on request
    d. Workstation/s within each classroom
    e. BYOD
    f. Other (please specify)
6. How satisfied are you with this system of accessibility? (very dissatisfied, somewhat dissatisfied, somewhat satisfied, very satisfied)

7. Other than the use of IWBs, on average how often do your students make use of technology during school hours? (less than one session per week, one session per week, 2 to 3 sessions per week, 4 or more sessions per week)
8. How often have you experienced any of the following at school?

Issue	All of the time	Most of the time	Some of the time	Hardly ever	Never
Devices not working					
Devices not charged					
Problems with internet connectivity					
Device display issues					

9. What system exists in your school for reporting and repairing faulty equipment? Is it effective?
10. How confident are you in using technology in the classroom? (No confidence, confident sometimes, confident mostly, extremely confident)
11. In which areas of the curriculum do you currently incorporate technology use in the classroom? Select all that apply (English, maths, science, HSIE, PDHPE, creative arts, languages)
12. Is your use of technology influenced by school requirements in syllabus and other policy documents? If so, how?
13. Do you prefer to plan and prepare resources using technology at home or at school? Why?
14. How do you use technology in the planning and teaching of your writing programs? Select all that apply.
    a. Presentation of material (PowerPoint, Prezi)
    b. Reference tool (internet searches)
    c. Creation of teaching tools (cloze passage using Word)
    d. Communication device between teachers/students/parents (class website, wikis, email)
    e. Storage of resources and records (iCloud, Excel)
    f. Other (please specify)
15. Have you used any software programs or apps which have enhanced your writing program? What makes them effective?
16. Has an increasing access to technology in the classroom influenced the way you teach writing? If so, how?
17. How do students currently use technology when creating a text? Select all that apply.
    a. Crafting of texts (Word, iMovie, Photoshop)
    b. Storage of resources/texts (iCloud, USB)
    c. Final presentation and publication of work
    d. Field building (YouTube, PowerPoint)
    e. Access to information/research (internet searches)
    f. Tools for synthesis of information (Inspiration, Corkulous)

18. Has an increasing access to technology in the home influenced the way students compose text? If so, how?
19. In what ways might technology in the classroom enhance student writing outcomes?
20. In what ways might technology in the classroom hinder successful student writing outcomes?
21. What are you hoping to get out of the ICT and writing pedagogy project?

Appendix 3: **Quantitative analysis results (question 4)**

Group sizes were unequal (Table 5) and the attrition rate (percentage of students participating in time 1 but not in time 2) was 15% for students completing the paper-based writing task, and 11% for students completing the digital composition task. That is, approximately 1 in 10 students did not complete the writing task (paper-based or digital) during the post time wave after completing the first writing task at time 1.

Table 5

Number of students in each group completing the paper-based and digital composition writing tasks over time

Writing task	Group	Time 1	Time 2	Attrition rate
Paper-based	Control	232	185	20%
	Project	511	454	11%
	Total	743	639	15%
Digital composition	Project	470	419	11%

Digital composition: results of how student scores in the digital composition writing task differed over time (project classes only)

A comparison of digital composition writing scores of students in the project classes between time 1 (pre-intervention) and time 2 (post-intervention) was conducted (using a one-way and two-way ANOVA) to investigate whether the impact of the ICT intervention improved student ICT digital compositions.

Total score (one-way and two-way ANOVA)

The digital composition writing task (refer to Table 6 for means and standard deviations) was first tested using a one-way ANOVA across the total raw score (which ranged from 0 to 48).

Table 6

Means and standard deviations by time, group and school (digital composition – one-way ANOVA test)

Group	Mean		Standard deviation	
	Time 1	Time 2	Time 1	Time 2
Project	23.54	26.58	10.29	11.27

A significant effect of time was found, F (9, 305) = 10.14, p<.001, suggesting students' digital composition writing task scores were higher at time 2 than at time 1, post-program implementation.

A two-way (time by school) fixed-effects ANOVA was then tested across the total raw score of the digital composition task (ranging from 0 to 48). An interaction of time and school was used to test if student digital composition scores differed between schools over time (refer to Table 7 for means and standard deviations).

Table 7

Means and standard deviations by time, group and school (digital composition – two-way ANOVA test)

School	Mean		Standard deviation	
	Time 1	Time 2	Time 1	Time 2
School 1	23.02	24.76	4.15	9.90
School 2	28.08	29.02	8.19	9.75
School 3	21.96	24.21	10.14	10.61
School 4	15.85	26.53	8.57	8.20
School 5	28.00	29.59	11.69	11.50
School 6	24.77	30.08	12.11	10.54
School 7	25.33	26.26	9.18	9.57
School 8	17.74	19.68	7.32	9.98
School 9	25.96	28.30	11.28	10.57
School 10	24.68	23.11	11.30	10.02

Results

Results showed there were significant main effects of time (p<.001) and school (p<.001), and a significant interaction of time by school (p<.001). The significant time by school interaction, F (9, 305) = 10.14, p<.001, suggests student digital composition scores significantly increased over time and these improvements were dependent on which school students attended – that is, student scores at some schools improved significantly, while the improvements in scores at others schools were not significant.

Paper-based writing task: results of how student scores on the paper-based writing task differed over time and between groups (project versus control classes) and school

A comparison of paper-based writing scores between the control and project classes was conducted (using two-way and three-way fixed-effects ANOVAs) to investigate whether the impact of the ICT intervention had run-on impacts on student writing. Control and project classes took part in a paper-based NAPLAN style writing task and differences were investigated over time.

Total score (two-way and three-way ANOVA)

The paper-based writing task was first tested using a two-way (time by group) fixed-effects ANOVA across the total raw score (which ranged from 0 to 48) to test if the professional learning program had impacts over time of the paper-based writing scores from project group students over and above improvements on the paper-based writing scores from control group students (refer to Table 8 for means and standard deviations).

Table 8

Means and standard deviations by time, group and school (paper-based composition – two-way ANOVA test)

Group	Mean		Standard deviation	
	Time 1	Time 2	Time 1	Time 2
Control	22.12	24.04	6.01	6.06
Project	23.96	25.23	6.22	6.68

Significant main effects of time (p<.001) and group (p=.048) were found. Student paper-based writing scores were significantly higher at time 2 than time 1, irrespective of group. The paper-based writing scores of the project group were significantly higher than that of the control group, irrespective of time. No significant interaction effect of time by group F (1, 612) = 0.64, p=.425 (Table 9) was found; the professional learning program was not found to significantly impact student paper-based writing scores.

Table 9

Two-way (time by group) fixed-effects ANOVA summary table

Factor	*df*	Mean-square	*F*
Time	1	307.59	24.13**
Group	1	265.45	3.94*
Time by group	1	8.12	0.64
Residual	612	12.75	–
Total	1,227	40.52	–

Note. * p<.05, ** p<.001

A three-way (time by group by school) fixed-effects ANOVA was then tested across the total raw score (ranging from 0 to 48). An interaction of time, group (control versus project classes) and school was used to test if the impact of the professional learning program differed between schools (refer to Table 10 for means and standard deviations).

Table 10

Means and standard deviations by time, group and school

School	Group	Mean		Standard deviation	
		Time 1	Time 2	Time 1	Time 2
School 1	Control	25.67	26.22	5.81	4.67
	Project	24.20	24.70	3.74	4.22
School 2	Control	24.65	25.94	3.69	5.85
	Project	28.75	30.60	4.20	4.98
School 3	Control	22.21	22.36	2.67	3.54
	Project	23.29	22.31	4.44	4.11
School 4	Control	20.16	21.58	4.61	4.60
	Project	18.77	21.09	7.05	6.47
School 5	Control	30.60	29.70	6.37	7.14
	Project	28.42	31.09	4.75	6.39
School 6	Control	25.40	27.40	3.33	4.33
	Project	26.61	28.20	4.87	5.94
School 7	Control	21.80	22.05	3.81	4.30
	Project	24.20	25.95	3.70	4.87
School 8	Control	13.38	16.00	4.60	3.60
	Project	17.91	18.84	5.61	4.92
School 9	Control	22.31	19.69	3.55	3.94
	Project	22.05	23.84	4.86	6.66
School 10	Control	23.04	26.28	4.53	4.47
	Project	24.72	24.59	6.74	5.79

Results

Results showed there were significant main effects of time (p<.001), school (p<.001), and group (p<.01), and significant interaction effects of school by group, and time by school by group (Table 11). The significant time by school by group interaction, F (9, 594) = 2.94, p=.002, suggested student total scores on the paper-based test significantly increased more over time in the project classes in comparison to the control classes depending on which school students attended – that is, students paper-based writing task scores improved as an outcome to the intervention in some schools.

Table 11

Three-way (time by group by school) fixed-effects ANOVA summary table

Factor	*df*	Mean-square	*F*
Time	1	260.82	21.18***
Group	1	354.90	8.74*
School	9	1,503.65	37.03***
Time by group	1	11.63	0.94
Time by school	9	17.71	1.44
Group by school	9	105.85	2.61**
Time by group by school	9	36.26	2.94**
Residual	594	12.31	–
Total	**1,227**	**40.52**	–

Note. * p<.05, ** p<.01, *** p<.001

Limitations

A number of limitations to the project are noted. It is possible the impact of the program of professional learning was not evident because:

1. The program of professional learning was directed at creating digital compositions (which is a different style of writing to paper-based writing) and run-on impacts on paper-based writing may require more time between program implementation and testing.
2. Natural maturation and skill was expected over time. Improvements were evident across both the control and project classes, but run-on improvements above and beyond that of natural maturation in student writing scores may not have been evident over the short time period used.
3. Collaboration of project class teachers was encouraged as part of the program. However, it became clear at the completion of the project that some project class teachers also shared information with the rest of the teachers in their school (for example, in teacher meetings). It was not clear what or how much knowledge was shared with teachers of the control classes.
4. After the project was completed it was also evident that at least some participating schools may have been running other writing based programs within their schools concurrently to the current program.

Appendix 4:
Writing tasks – information to teachers

Writing task 1: 'My favourite celebration'

Assessment task 1: paper-based writing

'My favourite celebration'

Students are asked to write independently for a Harmony Day website about their favourite celebration. Examples might include birthday parties, religious festivals such as Christmas, Eid or Diwali, neighbourhood parties such as Hallowe'en or extended family gatherings. Students should attempt to include details about their chosen celebration – what was being celebrated and why? Where was it held? Who took part? What happened? They should also write about why they chose this particular celebration – what makes it so special to them?

Marks will be given for original ideas and for descriptions which include well-structured paragraphs, interesting sentences and a varied vocabulary with accurate spelling.

Timing

5 minutes – planning; 30 minutes – writing; 5 minutes – editing.

Time should be taken to plan the writing task with planning pages submitted along with the finished text. Time is also allowed for editing and proofreading, allowing students to check the layout, punctuation and spelling.

Your role

- Your role is to explain the instructions and provide students with a few ideas about their choice of celebration, as well as reminding them of the value of planning and editing. Students are to write task 1 on the script provided (attachment 2) – please ensure they write on only one side of the paper and that they include their name on each page (feel free to give additional pages to enthusiastic writers!).
- Please collect the planning sheets and submit them with the written texts (a pre-paid envelope will be provided for collection).

Assessment task 2: writing with ICT

'My favourite celebration'

Students will take their ideas from assessment task 1 and compose a text using digital technology.

Using any resources available to them at school (for example tablets, laptop computers, scanners), they should create a digital composition that includes visual and/or sound elements as well as written text. Students can use their original writing from assessment task 1 or they can include a new written text as part of this multimodal composition. They can choose the form of their final product using any apps or software with which they are familiar: choices might include PowerPoint presentations, videos, apps and programs such Movie Maker or Puppet Pals, or Word documents illustrated with photographs and pictures.

While each student will submit their own individual composition, they should work with a partner to discuss their ideas and to offer each other feedback throughout the process.

Marks will be given for original ideas and for work which demonstrates creativity and effective organisation of textual elements (any combination of images, sound and written text) within a cohesive composition.

Timing

Digital compositions should be completed within 3 sessions (that is, up to approximately 3 hours). While photographs and pictures can be sourced from home, all composing should be done at school. Personal tablets or laptops may be brought in to the classroom at the discretion of the teacher.

Your role

- Your role is to read the instructions (above) to the students, introducing the choice of digital resources available. You should talk to students about their ideas for compositions and give any help with technology as required. When completed, students' compositions will be saved to Google Docs (details to be provided).
- Students should complete their digital composition within 3 sessions – some may complete it more quickly if they are confident users of ICT and have resources readily available. We are interested in the levels of confidence and expertise which students bring to the task, as well as the availability of ICT resources in the average classroom. If students do not complete their composition within 3 sessions then please submit whatever they have achieved in that time. **Please ensure each composition includes the student's name, class and school.**

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