acara AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

Leading Curriculum Change Using an Ecosystem Approach

Digital Technologies in focus: Supporting implementation of Digital Technologies

June 2021

Initiative of and funded by the Australian Government Department of Education, Skills and Employment.

NOTES

Anonymised data and privacy

To protect the privacy of individuals, for the purpose of this report the comments by and about teachers and curriculum officers and other professionals have been de-identified. Case study schools are identified by number. Where a school is included by name the material has been published on the DTiF website.

Terminology

School location or geolocation is reported using the Australian Statistical Geography Standard Remoteness Structure, which includes the classifications 'Remote' and 'Very remote'. ACARA recognises that the terminology 'remote' describes a Settler perspective of Country/Place and acknowledges that schools in this case study are on places that always were and always will be Aboriginal and Torres Strait Islander Land. For more information see Australian Bureau of Statistics Remoteness Area: https://www.abs.gov.au/websitedbs/D3310114.nsf/home/remoteness+structure

For reporting purposes, some changes have been made to the verb tense that was used in original research.

LIST OF ABBREVIATIONS

AC	Australian Curriculum
ACARA	Australian Curriculum, Assessment and Reporting Authority
AGDESE	Australian Government Department of Education, Skills and Employment
AITSL	Australian Institute for Teaching and School Leadership
ASISTM	Australian School Innovation in Science, Technology and Mathematics
CO	curriculum officer (mentor)
CSER	Computer Science Education Research Group
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DTiF	Digital Technologies in focus
DT	Digital Technologies
EAL/D	English as an additional language or dialect
GELP	Global Education Leaders' Program
ICSEA	Index of Community Socio-Educational Advantage
ICT	information and communication technology
LA	learning area
LLE	local learning ecologies
MOOC	massive open online course
NISA	National Innovation and Science Agenda
PD	professional development
PL	professional learning
QR	quick response (in QR code)
SAMR	substitution, augmentation, modification, redefinition
TAS	technological and applied studies
TPACK	technological pedagogical content knowledge
TPL	teacher professional learning

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Initiative of and funded by the Australian Government Department of Education, Skills and Employment.

CONTENTS

1. EXECUTIVE SUMMARY

> *As a result of this project, students are now engaging in a wider variety of learning opportunities that is inclusive of the Digital Technologies curriculum. ... We have built a strong foundation for the inclusion of DT into our learning as a result of strong professional learning focuses for staff and parents, resourcing our school effectively, engaging with Digital Technologies both in and out of the problem-solving contexts and a commitment to ultimately improve the lives of our students as they grow into a new and ever-changing digital world. (SCH04, final report)*

The Leading Curriculum Change Using an Ecosystem Approach: Digital Technologies in focus: Supporting implementation of Digital Technologies evaluation report (June 2021) reports on ACARA's National Innovation and Science Agenda (NISA) funded project for the period June 2016 to June 2021.

This report is highly relevant to those with an interest in Digital Technologies curriculum specifically, as well as to those with an interest in influencing curriculum change in disadvantaged schools and seeking to maximise the impact of teacher professional learning (TPL).

Introduction

The Digital Technologies in focus (DTiF) project aimed to support the implementation of the Australian Curriculum: Digital Technologies in selected disadvantaged schools across Australia. The curriculum was published in 2015 and not fully implemented in all states and territories until 2020. The need for professional learning (PL) nationally was high and particularly so in disadvantaged schools where students often have limited access to digital devices at home, and so the school's role is critical.

DTiF focused on supporting school leadership to plan for implementation in their school, and PL for teachers in these schools. Participating teachers developed their information and communication technology (ICT) capability and their Digital Technologies knowledge, understanding and skills. In turn, students' Digital Technologies skills, computational thinking and ICT capability were enhanced.

One hundred and sixty-four schools from all states, territories and jurisdictions completed the first project deliverable and 146 of those schools completed the project over 4 years. Given the complex situations of many of the schools, this was a high retention rate. Project schools engaged in action research with mentor support and received a small grant. In addition, 28 partner schools were supported with school visits or PL or both. The project team worked with more than 2,300 teachers and 30,000 students to improve Foundation to Year 10 Digital Technologies implementation. More than 1,700 teachers participated in PL workshops.

Phases of the project

There were 5 phases to the project to allow for piloting activities and for school readiness to engage. Phase 1 began in May 2017 with the first introductory workshop. Many of these schools concluded the project by December 2019. Phase 2, 3 and 4 schools began the project by the end of 2017 with Phase 5 schools engaged by March 2018. Until June 2018, when schools withdrew from the project some replacement schools were invited to join. See Table 1 for the number of schools and timing for each phase of the project.

Table 1: Project phases, number of schools and timing

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Total
No. of schools	18	37	21	52	35	164
Timing	Jun 2017 – Mar 2020	Aug 2017 – Jun 2020	Aug 2017 – Dec 2020	Apr 2018 – Mar 2021	Jul 2018 – Mar 2021	

Research and frameworks informing the project

Projects and frameworks

The methodology for the DTiF project situates action research in schools implemented using a design process and supported by facilitating a PL ecosystem. Two projects and a framework informed the development of the DTiF project methodology:

- Australian School Innovation in Science, Technology and Mathematics (ASISTM) funded project known as Technology K–8: Design in practice (NSW Department of Education and Training)
- Global Education Leaders' Program (GELP)
- technological pedagogical content knowledge (TPACK).

The elements of the ASISTM project that informed the DTiF project were action learning; the importance of an introductory workshop; a design focus; collaboration within and between schools; collaboration with industry, professional associations and universities; and undertaking pre-project surveys with teachers and students.

A focus on transformation, systems and futures thinking; communities of practice; roadmap framework and an ecosystem approach were influenced by the GELP.

The DTiF PL workshops were developed with consideration of TPACK and teachers learning technology by design, then applying their learning to design effective teaching and learning opportunities for their students.

Research

In the early stages of the project, the project lead researched best practice in teacher PL. The focus was on identifying effective approaches to PL to build teacher confidence including the importance of leadership and collaboration. The research also considered change management in schools, how to support schools to make the most of the resources available to them beyond the school gate, and how to improve the chances of sustaining change.

The intent of PL in the DTiF project was to build a school's capacity to implement the Digital Technologies curriculum and assist teachers to develop personally and professionally. Key outcomes of the DTiF project were not only improved implementation of the curriculum but also increased confidence of leaders and teachers to share their new knowledge with others and to try new ways of doing things, and improved student outcomes.

In the DTiF project the project lead undertook the role of designer and researcher. The design of the PL was approached in a designerly way and informed by the key ideas of the Australian Curriculum: Technologies including design thinking and project management. The approach that teachers adopt in the design of action research and the design of teaching, learning and assessment plans for the Technologies curriculum, or any curriculum, aligns closely to the solution-focused approach of designers.

The decision to use the language of design thinking and a design process for the DTiF project was an attempt to increase teacher familiarity with the language and the benefits of design education as part of general education.

DTiF project methodology

The DTiF project methodology was designed to focus on whole-school and inter-school collaboration, supported by mentors. It was developed using the key ideas of the Australian Curriculum: Technologies – creating preferred futures, design thinking, computational thinking, systems thinking and project management – and reflects those key ideas in its project elements.

The project comprised a range of elements to support the implementation of the Digital Technologies curriculum and the development of legacy products to help support teachers during and after the project.

Each of the elements evolved over time and was iterated in response to changing school situations. The project was implemented using the processes of design to support the action research while at the same time enhancing the professional knowledge and understanding of teachers.

Action research

The DTiF project encouraged schools to focus on their school context and how best to implement Digital Technologies. Schools focused on their school situation and worked collaboratively to develop an agreed purpose and approach. They focused on building the framework for a course plan. In the introductory workshops, teachers and leaders worked together to develop a shared understanding of the work and considered what PL was needed to ensure implementation was effective.

Curriculum officers (COs) focused on working with school executive and the school project team to develop an action research proposal and implementation strategies for each school. As schools began to implement their action research they were encouraged to collect evidence of student learning and to discuss with others the effectiveness of teaching, learning and assessment. They did this within their schools working collaboratively with teachers, with their CO and with teachers from other schools through regular webinars.

Mentors

The DTiF project provided ongoing support for more than 2 years in each school. The Australian Curriculum, Assessment and Reporting Authority (ACARA) mentors (COs) were highly skilled primary and secondary educators with high levels of digital literacy, computational thinking skills and a deep knowledge of data and digital systems. Their capacity to provide effective and engaging PL; to assist teachers with planning comprehensive teaching, learning and assessment plans; and to foster effective and collaborative relationships with staff was critical.

The face-to-face strategy and the length of time that they were able to engage with the school allowed for collegial relationships to develop that resulted in the COs becoming part of the school.

Professional learning ecosystem

A strategy to help with building sustainable implementation of Digital Technologies in schools, particularly those with high staff turnover, was to build an ecosystem of support. The DTiF project methodology involved developing a PL ecosystem for each school. This featured external experts such as the CO and others such as professional association contacts; and support from jurisdictions, industry and universities. COs regularly used the PL ecosystem as a touchpoint to remind schools of the various people and organisations that could support them with curriculum implementation.

Sustaining change

A key aim of the DTiF project was that implementation of the Australian Curriculum: Digital Technologies be sustainable and not reliant on continued support from the COs. This model informed the development of the iterative process outlined in the DTiF project methodology and promoted in schools. COs reinforced that if the project proposal and implementation plans were not working then the school should iterate, and that the iterative approach should continue after the project closed. Schools completed a review scale with COs to plan for next steps.

Evaluation strategy

Evaluation of the DTiF project was based on 3 components:

- **impact:** success including sustainability within each participating school
- **outcomes:** including transferability of outcomes to schools outside the project
- **methodology:** including transferability to similar initiatives.

For each of these components there was a dual purpose. First, to confirm that the 'people, processes and products' were achieving results and to inform next steps; for example, clarifying PL needs. Second, the success of these components was measured to contribute to research on Technologies education and TPL, particularly for those working in disadvantaged schools.

Evaluation of the project comprised an external evaluation conducted by a contractor, Deakin University, and internal evaluation conducted by ACARA staff.

External evaluation

Deakin University was contracted to complete the external evaluation of the project from 2018 to 2020 to assist in determining the extent to which the DTiF project achieved its aims, specifically with respect to its impact on schools and the transferability of the project methodology to other initiatives. The evaluation focused on 6 schools from 4 states and territories as a representative sample of all jurisdictions. The full report is published on the DTiF website: https://www.australiancurriculum.edu.au/resources/digital-technologies-in-focus/about

Internal evaluation

The internal evaluation was coordinated by the project lead and project officer from 2017 to 2021. The research methodology used a mixed-methods approach. Data

sources comprised teacher surveys, teacher self-assessment matrices, student assessments, PL workshop evaluations, reports and reflections.

Data analysis

There was a very large volume of data collected over the 4-year period. The researchers analysed data progressively and produced progress reports and an interim final report to not only capture regular snapshots of progress but to inform the next stage of the project.

Quantitative data was collected through SurveyMonkey. Various data points were exported from SurveyMonkey and imported to other programs for further analysis. A report was generated for schools including advice from COs on the strategies the school could use to improve results.

Qualitative data comprised school progress report webinars (audio), final reports (text), CO and teacher reflections (text and audio). Audio data was transcribed and uploaded to NVivo where text files and transcripts were coded according to largely pre-determined categories related to impact, outcomes and methodology. The data was collated as school case studies and CO and teacher reflections. The case studies provided a descriptive, authentic account of the DTiF project in a purposeful sample of representative schools. Sixteen of the 160 project schools were selected for analysis to be representative of the project schools, based on school size, geolocation, and proportions of Aboriginal and Torres Strait Islander and EAL/D students.

One of the main challenges was the inconsistent completion rates of the pre-project and post-project teacher surveys and student assessments. Much larger numbers completed the pre-project activities than post project, which made it difficult to make valid judgements in terms of impact and outcomes.

Also, the original plan for the data analysis had been for some of the COs to help but the demands of the intensive engagement with schools, the challenges faced by schools through COVID-19, and competing priorities in 2020–21 resulted in them having limited time to assist.

Findings

> ***The findings clearly indicate that the project methodology, in particular mentors in schools over a long period of time and the development of customised professional learning workshops, supports professional learning and professional practice and fosters student engagement, agency and confidence.***

The internal evaluation findings are presented in terms of the measures of success: impact, outcomes and methodology. The evidence for most measures has been triangulated. Many findings are supported from 3 different viewpoints – teacher, student and participant-observer (mentor).

Impact

All schools indicated substantial progress on the measure: teaching, learning and assessment plans for Digital Technologies developed for all band levels. Teachers reported on their progress on this measure in progress reports and final reports. The impact for teachers in case study schools was increased understanding of Digital Technologies with flow-on effects for students.

Teachers

By the end of their time in the project, teachers from most case study schools had embedded Digital Technologies into other learning areas and were confident to have done so. They highlighted the importance of integrating Digital Technologies in terms of manageability of the curriculum and rich connections to other learning areas to enhance learning and transfer.

Final reports from case study schools indicate that there were significant increases in engagement with the Digital Technologies curriculum and how best to teach it. Teacher reflections indicated that teachers and students were engaging collaboratively with digital technologies.

Final reports from case study schools and teacher reflections indicate an increase in Digital Technologies knowledge, understanding and skills. This was evidenced by improved use of terminology by teachers and students, and increased confidence using digital technologies. COs found that teachers and students used more technical language and teachers took the initiative to ask for specific PL to support the activities they were planning.

Many schools included their education assistants in PL. Often these staff members live locally and are the constant in schools with high staff turnover, and can therefore assist in sustaining the use of digital technologies.

COs noted changes in pedagogical practice in the classrooms they visited over the 2–3 years of the project. They indicated that teachers were applying new approaches to foster an open and engaging student-driven learning environment.

An unintended impact reported by teachers was increased collaboration within schools and between

cluster schools. Final reports from case study schools highlighted there was increased sharing of ideas and resources, team teaching, planning and support.

Teacher reflections at the close of the project affirmed the positive impact of the project for professional practice. They noted increased awareness of educational technologies, increased ICT capability, and improved understanding of the Digital Technologies curriculum and how to most effectively implement it.

School community

Teachers and COs through reflections and final reports indicated that the impact for school communities was an increased understanding of the place of digital technologies in their school and local community, and a greater understanding of the importance of online safety and teacher and parental or carer responsibilities.

Students

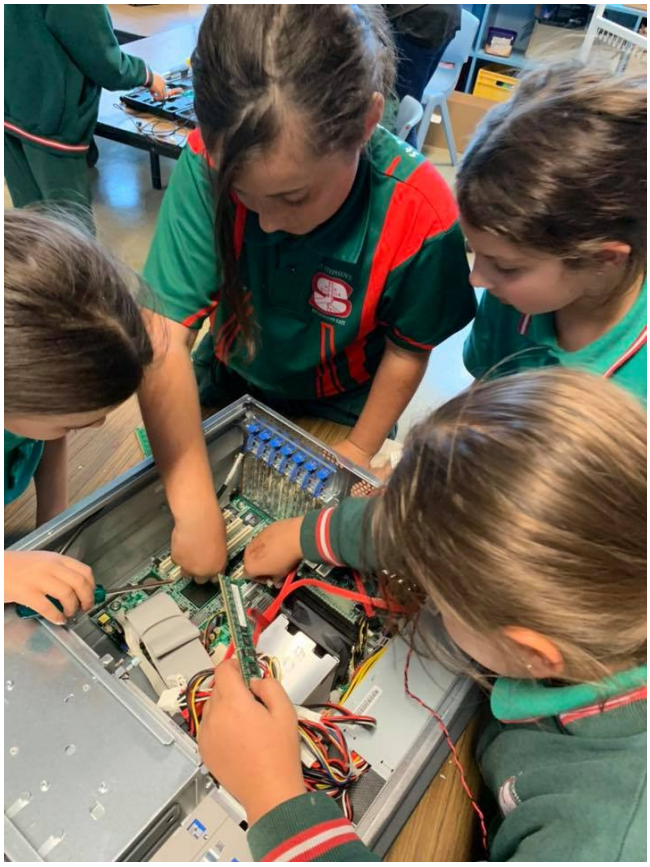
Based on the data collected from pre-project and post-project student assessment across all tests and levels, there appears to be improved student capability that could be attributed to the DTiF project. Final reports from case study schools indicate gradual improvements in students' Digital Technologies knowledge, understanding and skills. Increases in computational thinking were particularly noted.

Teacher reflections and final reports from case study schools indicate that students enjoyed the purposeful application of their Digital Technologies knowledge, understanding and skills to create digital solutions. COs also observed increased confidence in students as the project progressed. Many Aboriginal and Torres Strait Islander students benefited from learning opportunities that were offered as part of the DTiF project which included a focus on story, exploring their local language, learning on Country/Place and programming robotic devices. They showed increased engagement and confidence.

Students in areas classified as regional, remote and very remote often had limited understanding of how digital technologies were used in their local communities. The DTiF COs helped teachers and students to see where and why digital technologies were being used and how to make connections within their local area. PL for teachers and workshops for students helped to improve student engagement and confidence.

External connections

Progress reports from case study schools indicate that connections with local schools, industry and community



organisations increased. COs indicated that those schools that made strong connections beyond the school were more likely to sustain change.

Outcomes

The key outcomes for teachers were increased understanding of Digital Technologies curriculum; increased ICT capability; effective implementation of Digital Technologies; deeper understanding of computational thinking and how to integrate it with other learning areas; professional confidence to plan teaching, learning and assessment; and increased collaboration with teachers and students.

The key outcomes for students were increased confidence and independence in using digital technologies; increased engagement in their learning; increased ICT capability; and improvements in computational thinking, and design thinking, problem-solving and resilience.

The project team published 15 newsletters sharing stories and resources. The newsletter has more than 800 subscribers and archived newsletters are published on the DTiF website. The website had more than 100,000 unique page views from its inception to June 2021.

A total of 1,716 people benefited from PL workshops and 934 (54 per cent) responded to the survey. Average overall satisfaction with all workshops was 4.4 out of 5.0. This high level of satisfaction was also reflected in the

comments, which were mainly positive. The DTiF team appears to have delivered workshops that met the needs of the participants.

Methodology

The people, processes and products of the DTiF project methodology all contributed to the positive impact and outcomes for participating schools. While some elements could be further enhanced, many proved to be very effective and have been shared with educators planning similar PL.

People

Professional learning ecosystem

The key 'people' methodology was the PL ecosystem for each school. Eighty-one per cent of case study schools identified that they had made connections outside their school including other local schools, communities, jurisdictions and industries. The PL ecosystem formalised the identification of people who could help them to support implementation or to help students see why learning Digital Technologies was of value.

> ***The importance of the school principals, leaders, teachers and education assistants cannot be underestimated; without their engagement in the project and their commitment the elements of the project could not have been realised. The success of the project in schools is determined by the 'people'.***

Mentors

The mentors (COs) were the critical part of the project. They provided effective strategies for implementation, assisted with planning and provided a sounding board for ideas. Their commitment to their allocated schools over 2 to 3 years made a significant difference for schools. The role of the COs was highly valued by schools. Case study schools and teacher reflections reiterated this on multiple occasions.

Processes

> ***All schools were able to develop a project proposal; however, those who participated in the introductory workshop found this easier as they had already begun to explore ideas for their action research in the workshop.***

COs reflected at the end of each term on those strategies that were most effective. A key message was the importance of developing teacher expertise in planning teaching, learning and assessment.

The opportunity for schools to develop their own action research projects to suit their unique school context was very positively received, with most identifying extra opportunities to collect data and evidence of growth. Eighty-one per cent of case study schools conducted research on Digital Technologies implementation in their schools and indicated they were using that data to inform teaching and learning.

Templates

Schools indicated that the templates were easy to use and manageable in terms of expectations; for example, how much detail to provide. Final reports were completed by 85 per cent of project schools. The progress report (5 slides in 5 minutes) was a relatively quick way for teachers to reflect on their progress at points in time. Most schools found the progress reports as webinars manageable and a good way to make connections with other schools. However, some found them challenging to prepare. There may need to be more flexibility around how to manage progress reports for any similar projects in the future. As a data collection source the webinars were invaluable as they provided not only a visual artefact but also an audio record.

Workshops

Eighty-seven per cent of case study schools identified upskilling staff as pivotal to implementing Digital Technologies, whether that was attending DTiF workshops or other PL.

Products

Professional collaboration was a feature of the DTiF project. At the micro level, the COs as a team were very supportive of each other and contributed to each other's PL. Positive collegial relationships between COs and school personnel were critical to the success of the project. Many schools had rarely had visitors to their schools to provide PL. The collaboration between staff within schools and with local schools was also enhanced.

The DTiF team collaborated with state, territory and jurisdiction education consultants to develop PL. The collaboration between COs and regional officers was very positive. The regional officers co-presented, organised venues, promoted PL and shared their knowledge of local custom and practice.

The team also collaborated with other projects, particularly those funded through the NISA, for example the Australian Computing Academy, the Computer Science Education Research Group (CSER) Digital Technologies project; and organisations including Education Services Australia. Also, COs built relationships with government organisations such as CSIRO, and

industry and business groups providing implementation support such as Google and Apple, and professional teacher associations such as the Australian Association for Computers in Education and state affiliates. The PL and resources developed by these organisations both informed DTiF and were informed by DTiF.

Conclusion and recommendations

Four key messages emerged from the project. These are the value of:

- using curriculum implementation as a framework for pedagogical change
- building teacher confidence in planning teaching, learning and assessment skills and strategies
- mentoring teachers in disadvantaged schools to provide effective curriculum implementation support
- ongoing engagement with schools to sustain long-term change.

Conclusion

Impact

The impact of the DTiF project is reflected in the successes within each participating school relative to their starting place and the potential for sustainability at the close of the project. The impact of the project for teachers was very positive. There was a significant increase in engagement with the Digital Technologies curriculum and an increase in teachers' Digital Technologies knowledge, understanding and skills. There were changes in pedagogy as a result of participating in the DTiF project, with teachers and students engaging collaboratively. An unintended impact reported by teachers was increased collaboration within schools and between cluster schools. The project impacted positively on teacher professional practice. The DTiF project provided the opportunity for many project leads and teachers to increase their confidence and to become leaders in their schools and local networks.

Across geolocations, the impact for students in DTiF project schools was increased knowledge, understanding and skills; engagement; agency and confidence. Many Aboriginal and Torres Strait Islander students benefited from a focus on story, exploring their local language, learning on Country/Place and programming robotic devices. A number of schools indicated an increase in engagement and confidence by girls.

There was an increased understanding of the place of digital technologies in school communities and in the local community, and a greater understanding by parents or carers of the importance of online safety and teacher and parental or carer responsibilities.

Outcomes

The outcomes achieved in project schools and partner schools include improved understanding of the difference between the ICT Capability and Digital Technologies; increased confidence to integrate Digital Technologies with other learning areas; enhanced use of technical

vocabulary; and deeper understanding of the intent of the Digital Technologies curriculum, particularly in relation to computational thinking.

The learning from the project was shared and transferred within and beyond schools through the PL workshops, publication of the DTiF newsletter, updates to the DTiF website and more informally through the DTiF wiki.

Methodology

The key implications are that the methodology of the DTiF project (people, processes and products) contributed not only to positive impacts for each project and partner school but also to ongoing support for any school by providing a repository for resources and PL webinars.

Based on the data from the progress reports, final reports, CO and teacher reflections, workshop evaluations and qualitative research analysis, the methodology was effective. There was prolonged engagement in the project by most schools, and an increase in teacher and student capability in relation to ICT capability and Digital Technologies.

People

The features of the project that seem to be particularly appropriate for similar implementation projects are experienced educators as COs providing a mix of face-to-face and online support. The face-to-face strategy and the length of time that COs were able to engage with the school allowed for collegial relationships to develop that resulted in the COs becoming part of the school.

The PL ecosystem (see Figure 1) was a key element of the DTiF project methodology. It provided a systematic way of communicating to all schools about the support that was available to them and the relationship of their school to others in their cluster. It allowed for clear and consistent messaging for schools across the country and reinforced the value of reaching outside the school gate.

Processes

The processes included data collection through pre-project and post-project school surveys; engaging schools through the introductory workshop; supporting schools to develop and report on an action research project using templates that reflected the Technologies processes and production skills strand; mentoring; developing and providing PL workshops; and building PL communities through regular webinars, project focus clusters and hosting summer and winter schools.

Products

Publishing the resources, PL and school stories on the DTiF website has meant that participating schools and schools outside the project can continue to access products to support implementation.

Recommendations

Three sets of recommendations have been identified: modifications to methodology, future research, and resources and PL.

RECOMMENDATIONS FOR MODIFICATIONS TO METHODOLOGY

The following modifications to the DTiF methodology are recommended:

1. Mandate early leadership involvement

While it was strongly recommended that a member of the leadership team participate in the introductory workshop, it should be essential, and leadership must be engaged from the start.

2. Develop teacher planning skills further

The importance of teachers' skills to develop teaching, learning and assessment plans cannot be underestimated. Side-by-side mentoring is very important as well as targeted PL. To support this, adequate teacher relief is needed.

3. Resource relief teacher supply

One of the challenges for schools in areas classified as regional, remote and very remote is the availability of relief staff. And this is also sometimes the case in metro locations. Travelling with a teacher or another CO who can teach classes while the planning meeting is underway would help with recommendation 2.

4. Plan for sustainability by developing induction programs

While part of the final report template included plans for next steps, this could be enhanced by assisting schools to develop an induction program for new staff.

5. Introduce 'summer' school earlier

Introducing an intensive engagement 'school' for project leaders midway through the project could assist in building greater buy-in for the final stages of the project and to allow more time for the professional networks to develop before the project closed.

6. Make progress reports more flexible

Most schools found the progress reports as webinars manageable; however, there could be more flexibility around how to manage progress reports, for example using options such as reflective podcasts.

7. Allow more time for reflection

Scheduling time when some COs do not go out to schools, but rather analyse, interpret and write papers related to the data should become part of the process. While this was planned for the end of the project, the impact of COVID-19 affected the time available, and there would be value in doing this earlier in the project.

RECOMMENDATIONS FOR FURTHER RESEARCH

8. Conduct research on assessing achievement, assessment validation, and scaling PL projects

a. Assessing student achievement in computational thinking, Digital Technologies and ICT capability. The assessments have been developed and validated for Year 2 and Year 4; further use of these by schools would help to provide data on student knowledge, understanding and skills to inform future PL and curriculum refinement.

b. Validating the Year 8 questions before using them to assess student achievement more comprehensively.

c. Scaling long-term PL projects to reach a broader audience, with a particular focus on project management.

RECOMMENDATIONS FOR RESOURCES AND PROFESSIONAL LEARNING

9. Develop, publish or offer DTiF resources and PL

a. DTiF resources should be updated to reflect version 9 of the curriculum, which will follow the Review of the Australian Curriculum to be completed by the end of 2021.

b. The DTiF website provides a tangible legacy product from the project. It includes information about the project; the reports generated from it; resources including classroom ideas, assessment tasks and tutorials; and PL webinars. The DTiF website should be available until at least December 2023.

c. The PL workshops developed and implemented by ACARA staff should continue to be offered and where possible be developed into online offerings.

2. INTRODUCTION

This section provides the context for the project, an overview of the funding source, the background and rationale for the project and the projects and research that informed the methodology.

This evaluation report, Leading Curriculum Change Using an Ecosystem Approach, on ACARA's Digital Technologies in focus: Supporting implementation of Digital Technologies (June 2021) project, reports on ACARA's NISA funded project for the period June 2016 to June 2021. The interim report (June 2020) focused on the schools in the first 3 phases of the project, primarily schools from Tasmania, Western Australia and South Australia, and some Queensland schools. This final report includes these phases of the project as well as Phases 4 and 5.

As a result of COVID-19, ACARA was given the opportunity to continue the project until June 2021, which allowed schools in Phases 4 and 5 that started their project in 2018 to have a reasonable amount of time to complete their action research projects and to benefit from face-to-face PL as travel restrictions were eased.

2.1 Background and rationale

In October 2015, ACARA published the F–10 Australian Curriculum: Digital Technologies. This innovative curriculum outlined new learning for all states and territories and presented some implementation challenges for schools, particularly in the primary years. The challenges included teachers understanding the difference between the ICT Capability and the Digital Technologies curriculum, planning for implementation of a new subject and teacher expertise.

The Australian Government acknowledged the national importance of successful implementation of the F–10 Australian Curriculum: Digital Technologies. Under the NISA, the intention of the Provision of Peripatetic ICT Teachers initiative was to focus on 'tackling the digital divide by ensuring that students most at risk of falling behind in the digital age are given opportunities to participate and engage' (AGDESE 2016).

The Australian Government Department of Education, Skills and Employment (AGDESE) invited ACARA to submit a proposal to undertake the Provision of Peripatetic ICT Teachers initiative. The proposal was accepted and ACARA was contracted to complete the project – known as Digital Technologies in focus: Supporting implementation of Digital Technologies (DTiF) – by June 2020.

Project purpose

The DTiF project was targeted to support the implementation of the Australian Curriculum: Digital Technologies in selected disadvantaged schools across Australia. It focused initially on supporting school leadership to plan for implementation in their school, and then on PL for teachers in these schools. The intention was that participating teachers would develop their ICT Capability and their Digital Technologies knowledge, understanding and skills. In turn, students' computational thinking and ICT Capability would be enhanced.

Selection of schools

The selection of disadvantaged schools was determined by ACARA in collaboration with the AGDESE and ACARA's F–12 Curriculum Reference Group (F–12 CRG).

Schools Plus https://www.schoolsplus.org.au/for-schools classifies schools eligible for support as those with an Index of Community Socio-Educational Advantage (ICSEA) value below 1000 (about 4,600 Australian schools).

It was noted that there were very few Catholic and independent schools with ICSEA values below 950. To achieve a fair distribution of support across states, territories and jurisdictions and a manageable number of schools, the following process was adopted to identify participating schools:

- Review the number and percentage of schools in 2015 across states and territories and by school sector. Noting that the percentage of Catholic and independent schools with an ICSEA below 900 is very small, the breakdown of schools was based on the total number of schools.
- Identify schools below ICSEA 850–900 from the school profile dataset and to provide a representative mix of schools across states/territories, jurisdictions, geolocation, and proportions of >40% Indigenous and >40% EAL/D students.
- Sort schools based on location to form manageable geographic clusters.
- Review school selection proposal with the AGDESE and F–12 CRG to refine the selection of schools and the number of schools.

School engagement

One hundred and sixty-four schools completed the first deliverable. At the end of 2019, 153 schools from all states, territories and jurisdictions continued to participate in the project. Since the return of schools in 2020 and changes in staff that number dropped to 146, including one school closure. Six schools that left the project became partner schools. Twenty-eight partner schools were supported with school visits, PL or both. Table 2 shows the reach of the project since 2017 and Table 3 the distribution of schools across states, territories and jurisdictions.

School distribution

Phases of the project

There were 5 phases to the project to allow for piloting activities and for school readiness to engage. Phase 1 began in May 2017 with the first introductory workshop. Many of these schools concluded the project by December 2019. Phase 2, 3 and 4 schools began the project by the end of 2017 with Phase 5 schools engaged by March 2018. As some schools withdrew from the project some additional replacement schools were invited up until June 2018.

Table 2: Numbers of schools, teachers and students engaged in the project in each year since 2017

	2021	2020	2019	2018
Schools	146	147	164	164
Partner schools	28	27	0	0
Teachers	2,681	2,681	2,530	2,530
Students	32,085	32,085	30,700	30,700

Note: Teachers and students were calculated on total teachers and students in primary and combined schools, and 1/8 of teachers and students in high schools to reflect one of 8 learning areas.

Table 3: Distribution of DTiF project schools across states, territories and jurisdictions in 2020

State or territory	Government	Catholic	Independent
ACT	1	1	0
NSW	43	6	2
NT	11	3	2
Qld	19	4	6
SA	6	1	2
Tas.	10	2	0
Vic.	5	4	0
WA	6	9	3
Total	**101**	**30**	**15**

Table 4: Summary of projects and frameworks informing the DTiF project

Project or framework	Description	How the principles informed DTiF
ASISTM project: Technology K–8: Design in practice	Aimed to enhance the teaching of the design process and model a progression of technology learning through practice-based professional collaboration	• action learning • introductory workshop • a design focus • collaboration between schools • collaboration with industry, professional associations and university • pre-project surveys for teachers and students
GELP	Partnership of teams of education system leaders and organisations from countries collaborating to create a vision of education for the future with a focus on transforming education in practice	• a focus on transformation, systems and futures thinking • communities of practice • roadmap framework • an ecosystem approach

TPACK framework (Mishra and Koehler)	Aims to understand and describe the kinds of knowledge needed by a teacher for effective pedagogical practice in a technology-enhanced learning environment	• Underpinning principle of the PL support. Teachers:
		  • learning technology by design
		  • applying learning to design effective teaching and learning opportunities for their students

2.2 Projects and research informing DTiF

This section focuses on how existing projects and frameworks, and research into best practice in TPL, with a focus on effective approaches to curriculum implementation, change management, action research, design research, local learning ecologies and sustainability, informed the design of the DTiF project methodology.

Projects and frameworks that informed the design of the DTiF project methodology

The methodology for the DTiF project was informed by 2 projects and a framework:

- the ASISTM funded project known as Technology K–8: Design in practice (NSW Department of Education and Training)
- GELP
- TPACK.

See Table 4 for a summary of the projects and frameworks and how they informed the development of the DTiF project.

The DTiF project used the key ideas of the Australian Curriculum: Technologies as a driver for developing teachers' TPACK and Digital Technologies PCK and as a framework for change. The work of Mishra and Koehler (2006), Koehler and Mishra (2009) and Koehler (2012) on TPACK (also known as TPCK) directly informed the development of the DTiF project methodology and is an underpinning principle of the PL support. TPACK helped teachers to design pedagogy that includes educational technologies suitable for the content.

> *Our approach to professional development in light of this framework, learning technology by design … (Mishra and Koehler, 2006, p. 1031)*

The DTiF team developed the PL workshops to consider teachers first learning technology by design, and then applying their learning to design effective teaching and learning opportunities for their students.

TPL: Curriculum implementation, change management, local learning ecologies and sustainability

Research was undertaken in the early stages of the project into best practice in TPL. It focused on identifying effective approaches to PL to build teacher confidence including the importance of leadership and collaboration. The research also considered change management in schools, how to support schools to make the most of the resources available to them beyond the school gate, and how to improve the chances of sustaining change.

Curriculum implementation

Building confidence

The intent of PL in the DTiF project was to build a school's capacity to implement the Digital Technologies curriculum and help teachers develop personally and professionally. This reflects Mockler's observations that PL is more than developing knowledge, understanding and skills. 'Teacher professional learning at its best is not merely about the acquisition of knowledge and skills, but the formation and mediation of teacher professional identity' (Mockler 2013, p. 42).

The development of the PL provided through the DTiF project endeavoured to build teacher capacity and improve student outcomes by focusing on basic principles that Brock (2015, p. 1) suggests should underpin all quality policy development in education: evidence-based research; scholarship; wisdom (reflections by teachers/educators); and 'strategic nous' (common sense). 'Timperley's meta-analyses of professional learning … has shown the benefits of setting clear objectives for PD and rigorously assessing its impact on student attainment' (Timperley 2008 in PwC 2016, p. 21).

A key outcome of the DTiF project was not only improved implementation of the curriculum but also increased confidence of leaders and teachers to share their new knowledge with others and to try new ways of doing things and improved student outcomes.

Importance of leadership and collaboration

The DTiF project focused on COs working with school executive and the school project team to develop an action research proposal and implementation strategies. McIntyre (in Brock 2015, p. 6) identifies 6 key elements of greatest impact for primary teachers:

- collaborative preparation of lessons and teaching resources
- lesson observation and observing each other's lessons
- collaborative assessment and evaluation of student work
- structured feedback meetings
- developing evidence to demonstrate the achievement of professional teaching standards
- team teaching.

The Social Ventures Australia research project, *Learning for impact,* identified 4 key factors that influence how well implementation can impact student outcomes and teacher behaviours:

- fidelity (ongoing support)
- dosage (amount of participation in a certain activity)
- quality of delivery (support from principals)
- acceptability (teachers' participation and attitudes to that activity)

(Alberts, Pattawage and Vaughan 2017 in Ho and Deeble 2018, p. 48).

As schools began to implement their action research they were encouraged to collect evidence of student learning and to discuss with others the effectiveness of teaching, learning and assessment. They did this within their schools working collaboratively with teachers, with their CO and with teachers from other schools through regular webinars. The DTiF project provided ongoing support for more than 2 years.

Change management

The DTiF project encouraged schools to focus on their school context and how best to implement Digital Technologies. Schools focused on their school situation and worked collaboratively to develop an agreed purpose and approach. They focused on building the framework for a course plan. Underpinning this change management process in DTiF schools was Michael Fullan's notion of coherence making and deep learning. In a presentation in Spring 2017, Fullan identified the drivers for change in schools as 'capacity building, collaborative work, pedagogy and systemness' (Fullan 2017, p. 1). In the introductory workshops teachers and leaders worked together to develop 'the shared depth of understanding about the nature of the work' (Fullan 2017, p. 3) and to consider the capacity building and pedagogical practices that may need to be developed on return to school to ensure implementation was effective.

Action research

Participating schools in the DTiF project designed and undertook an action research project that addressed implementation of the Digital Technologies curriculum. The introductory workshop guided participants through the preliminary steps of shaping a project proposal to facilitate implementation of the curriculum in their school. While the ASISTM project, Technology education K–8: Design in practice, used an action research approach and informed the development of the DTiF project methodology, the strategies and templates to support schools for the DTiF project were also informed by Kemmis (2009), Mills (2007) and Macintyre (2000).

The Australian Institute for Teaching and School Leadership (AITSL) published a resource in 2016 that documented the action research conducted by teachers at John Monash Science School. An excerpt of the video of teachers discussing the next steps in their action research was a valued part of the introductory workshop.

Design research

While design education has been included in state and territory Technology curriculum in Australia for some time before the publication of the Australian Curriculum, teachers' confidence to implement design projects and to explicitly teach design thinking varies considerably, particularly among primary teachers. Cross (2007) states that design research focuses on 3 sources: people, processes and products; and suggests that the field of design research falls into 3 main categories:

- design epistemology – study of designerly ways of knowing
- design praxiology – study of the practices and processes of design
- design phenomenology – study of the form and configuration of artefacts
  (Cross 2007, p. 125).

Design epistemology – study of designerly ways of knowing

The decision to use the language of design thinking and a design process for the DTiF project was an attempt to increase familiarity with the language of design and the benefits of design education as part of general education. There is a 'strong educational justification for design as an introduction to, and assisting in the development of, cognitive skills and abilities in real-world problem solving' (Fox 1981 in Cross 2007, p. 27).

According to Cross (2007, p. 30), design:

- develops innate abilities in solving real-world, ill-defined problems
- sustains cognitive development in the concrete iconic modes of cognition
- offers opportunities for development of a wide range of abilities in non-verbal thought and communication.

Cross (2007, p. 29) identifies 5 aspects of 'designerly ways of knowing'. In Table 5 these aspects are mapped to the skills needed to plan effective teaching, learning and assessment, and to the Australian Curriculum: Technologies.

Design praxiology – study of the practices and processes of design

In the DTiF project, the focus of the research aspect is on design praxiology, and how the processes of design can support action research while at the same time enhancing professional knowledge and understanding. The following describes application of Cross's (2007) 3 sources – people, processes and products – in the DTiF project:

- The people or actors are the COs, the school executive, the teachers, students and community members as well as the individuals from other organisations contributing to the PL ecosystem.

Actors also include any non-human entities that act on other entities, for example wi-fi networks, robotics, devices, physical spaces, documents or templates that shape behaviours of other actors.

- The processes include the strategies used to engage and support the schools such as the introductory workshop; PL ecosystems; and templates for the action research proposals, progress reports and final reports. Other processes are ways that were used to build PL communities such as the regular webinars and the project focus clusters.
- The products are the action research projects designed by the schools to facilitate implementation of the curriculum; the case studies evaluated by the external evaluator and the internal qualitative research; the school stories published on the project website; and the quantitative and qualitative reports summarising the project findings.

There are strong links between design research, the design of action research projects and action-network theory. In the DTiF project the project lead undertook the role of designer and researcher. The design of the PL was approached in a designerly way and was informed by the key ideas of the Australian Curriculum: Technologies including design thinking and project management.

The approach that teachers adopt in the design of action research and the design of teaching, learning and assessment plans for Technologies curriculum, or any curriculum, aligns closely to the solution-focused approach of designers rather than the problem-focused approach of scientists. Like design problems, many of the challenges facing teachers are 'ill-defined, ill-structured, or "wicked"' (Rittel and Webber 1973 in Cross 2007, p. 23). The approach presented to teachers in the DTiF project emphasised the need to be flexible and to iterate. See Section 3, Figure 3.

Local learning ecologies

A strategy to help with building sustainable implementation of Digital Technologies in schools, particularly those with high staff turnover, was to build an ecosystem of support. See Section 3. This concept is reflected in Hodgson and Spours' model of local learning ecologies (LLE). Professor Patrick Oliver in a presentation at the Centre for Research on Learning and Innovation Research Fest, November 2018, stated:

> ***recent thinking in UK policy research has pointed to the potential resilience that can be afforded through closer integration of a broader spectrum of stakeholders in the delivery of education … Models such as LLE can both help us understand issues pertaining to resilience of education provision, but also point towards new roles for digital technologies***

Table 5: Mapping designerly ways of knowing to teacher planning and the Australian Curriculum: Technologies

Designerly ways of knowing	Planning teaching, learning and assessment Teachers:	Australian Curriculum: Technologies The curriculum provides opportunities for students to:
Designers tackle 'ill-defined' problems.	plan units of work and assessment to meet the needs of a broad range of students	develop the confidence to respond to 'ill-defined' problems
Their mode of problem-solving is 'solution-focussed'.	focus on finding a solution to implementing the curriculum	create designed and digital solutions
Their mode of thinking is 'constructive'.	interpret situations and respond by planning appropriate teaching and learning	use critical and creative thinking skills
They use 'codes' that translate abstract requirements into concrete objects.	design experiences that allow students to develop knowledge, understanding and skills within and across learning areas	develop abstract thinking skills as they decompose problems, and design and implement solutions
They use these codes to both 'read' and 'write' in 'object languages'. (Cross 2007, p. 29)	communicate using the verbal and non-verbal language of Technologies	communicate in a variety of ways (verbal and non-verbal; plugged and unplugged) to develop solutions suitable for purpose

> *to realise models of community, business and civic institution engagement with school-based education.*

Videoconferencing was a feature of the DTiF project methodology. While most introductory workshops were presented face to face, some schools participated via videoconference. Each school's representative presented their progress reports in webinars that involved up to 6 schools. The sharing nature of these webinars was designed to build capacity of teachers presenting to colleagues as well as developing PL communities where teachers could hear the experiences from schools similar to their own.

Maximising impact of external support

The DTiF project methodology involved developing a PL ecosystem for each school. This featured external experts including an ACARA CO but also others such as professional association contacts, jurisdiction support and industry support. See Section 3 and Figure 1. Hattie in PricewaterhouseCoopers (PwC) (2016, p. 4) indicates that it is clear PL can make a major difference to student learning, and he identifies in particular the value of external experts. He goes on to say that PL:

> *... is more successful when it relates to testing the impact of competing ideas and when discussions are grounded in artefacts representing student learning; and when school leadership is involved and supports the implementation. The most effective PD relates to teachers working collaboratively to evaluate their impact ... (PwC 2016, p. 4).*

COs regularly used the PL ecosystem as a touchpoint to remind schools of the various people and organisations that could support them with curriculum implementation.

Sustainability

A key aim of the DTiF project was that implementation of the Australian Curriculum: Digital Technologies be sustainable and not reliant on continued support from the COs. Dufour et al. (2016) highlight the importance of creating a data picture of a school and describing a continuum for PL communities: pre-initiating, initiating, implementing, developing and sustaining. The BASE model developed by Williamson and Blackburn (2017) in (Blackburn and Williamson, 2018, p. 8) features 4 steps: begin to plan; act to implement; sustain success; and evaluate and adjust.

> *... creating a culture of collegiality, executing a clear strategy for collecting, assessing, and using data, identifying ways for teachers to discuss successes and challenges regarding the implementation, having a clear decision-making process, and regularly sharing information in a systematic manner' (Blackburn and Williamson 2018, p. 10)*

This model informed the development of the iterative process outlined in the DTiF project methodology and promoted to schools. COs reinforced that if the project proposal and implementation plans were not working then the school should iterate. See Section 3.

3. DTIF PROJECT METHODOLOGY

The purpose of this section is to describe the elements of the DTiF project methodology. Following an overview, the elements are described under the categories of people, processes and products.

3.1 Project methodology

In supporting teachers in disadvantaged schools as they implemented the Australian Curriculum: Digital Technologies, the DTiF project was designed to focus on whole-school and inter-school collaboration, supported by COs. The methodology for the project situates action research in schools. It was informed by the Technology K-8 Design in practice project, GELP and TPACK. The methodology reflects the key ideas of the Australian Curriculum: Technologies – creating preferred futures, design thinking, computational thinking, systems thinking and project management in its project elements.

Project elements

The DTiF project comprised a range of elements to support the implementation of the Digital Technologies curriculum and the development of legacy products to help support teachers during and after the project.

The project methodology is presented below using Cross's (2007) people, processes and products. Each of the elements evolved over time and was iterated in response to changing school situations. The project was implemented using the processes of design to support the action research while at the same time enhancing the professional knowledge and understanding of teachers.

People

The people or actors were the teachers, the school executive, students, community members, COs, as well as the individuals from other organisations contributing to a PL ecosystem.

Actors also include any non-human entities that act on other entities; for example, wi-fi networks, robotics, devices, physical spaces, documents or templates that shape behaviours of other actors. This was particularly pertinent for a project focused on the implementation of the Digital Technologies curriculum.

Teachers as designers

The project adopted the position that the teachers were the designers of teaching, learning and assessment of Digital Technologies and as such the project used a design process as a scaffold for activities. Some primary teachers are less familiar with the design process than they may be with a historical or scientific inquiry process so the project was an opportunity to foreground the language of the design process through the documentation. For example, the threads of the Australian Curriculum: Technologies strand processes and production skills were used in documentation templates such as the project proposal, the progress report webinar presentations and the final report.

Shirley Agostinho and Sue Bennett (University of Wollongong) and Lori Lockyer (University of Technology Sydney) are researching a teacher design model. The model highlights the role of design thinking in the design of teaching and learning.

> ***... this study focuses on teacher design thinking as the teachers' cognitive process when engaging in the pedagogical design of a teaching program level – a coherent series of lessons that make connections across the curriculum and cumulatively build students' knowledge and skills. (Agostinho et al. 2018)***

PL ecosystem

The development of the DTiF PL ecosystem was informed by the GELP and the Technology education K–8: Design in practice project. The graphic that was developed to communicate the element reflects the colours of the key ideas diagram of the Australian Curriculum: Technologies (v.8) so that teachers could recognise the connection to the Australian Curriculum. Figure 1 shows the relationship between the 2 diagrams.

At the heart of the PL ecosystem is the school. Each school was provided with a customised version of the diagram which evolved as new connections were made. COs used the updated images to highlight new opportunities for connections with other parts of the ecosystem. See school example in Figure 2.

ACARA mentors (curriculum officers)

The ACARA mentors (COs) were highly skilled primary and secondary educators with high levels of digital literacy, computational thinking skills and a deep knowledge of data and digital systems. Their capacity to provide effective and engaging PL; to assist teachers with planning comprehensive teaching, learning and assessment plans; and to foster effective and collaborative relationships with staff was critical.

COs were allocated up to 20 schools to coordinate. Most officers supported schools in their home state but some supported schools in other states or territories as well.

Professional association contacts

The contacts for the relevant state or territory association of the Australian Council for Computers in Education professional association were identified for each school. Many of these contacts were involved in PL activities organised by DTiF COs.

Jurisdictions contacts

COs contacted jurisdictions to identify the most appropriate contact. The jurisdiction contacts were very

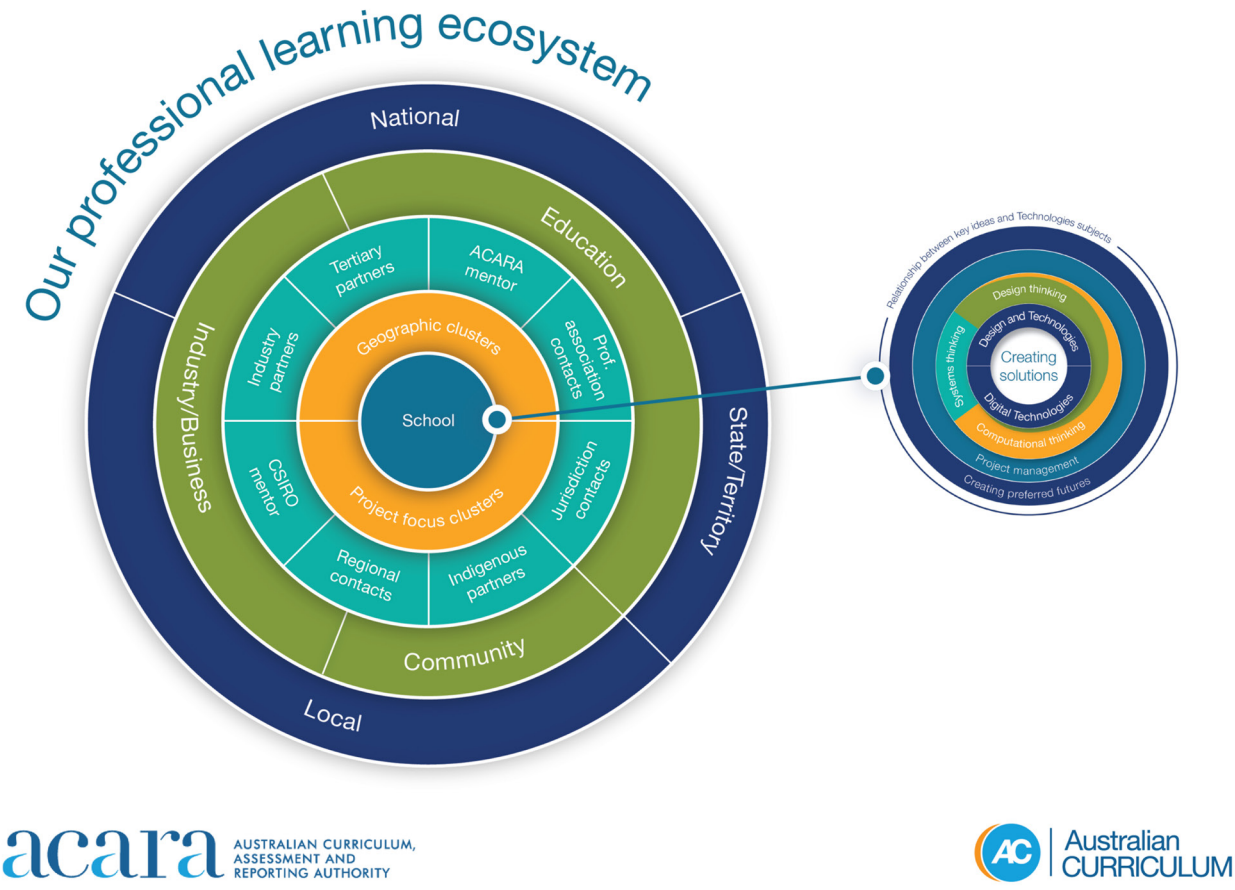


Figure 1: DTiF PL ecosystem and its relationship to the Australian Curriculum: Technologies (v.8)

helpful in providing advice about local requirements and providing extra PL support.

Indigenous partners

Where appropriate, COs connected schools with Aboriginal and Torres Strait Islander Elders and Community. For example, in one school activities on Country/Place used digital technologies to capture and share scientific data. In another, Elders worked with students on digital stories and the recording of language.

Regional contacts

Many of the DTiF schools were located in areas classified as regional, remote and very remote. Unlike a metropolitan area it was not immediately clear to teachers how digital technologies might be relevant to their school communities or their access to resources was constrained. Regional contacts opened up opportunities. For example, in Figure 2 these contacts included commercial providers and the state library.

CSIRO mentor

CSIRO is Australia's leading scientific organisation and coordinates the STEM Professionals in Schools program. Schools were able to identify an interest and apply to be connected with a mentor with relevant expertise, for example someone with robotics expertise. This is an example of how the synergies between projects funded by NISA were maximised.

Industry partners

Often schools did not have connections with local industry or business. The CO undertook the work of identifying the 'Why?'. Why are digital technologies important in this community in industry and business? In doing so they found local industries that used digital technologies, including agriculture, community services and engineering.

Tertiary partners

COs contacted the universities closest to the schools to help build the bridges between schools and the tertiary sector. Tertiary partners participated in PL, provided venues for workshops and where requested engaged with the schools.

Processes

The processes included data collection through pre-project and post-project school surveys; engaging schools through the introductory workshop; supporting schools to develop and report on an action research project using templates that reflected the Technologies processes and production skills strand; mentoring; developing and providing PL workshops; and building PL communities through regular webinars and project focus clusters and hosting summer and winter school.

Teacher surveys

The teacher surveys were completed at the start, middle and end of the project to capture at a point in time the

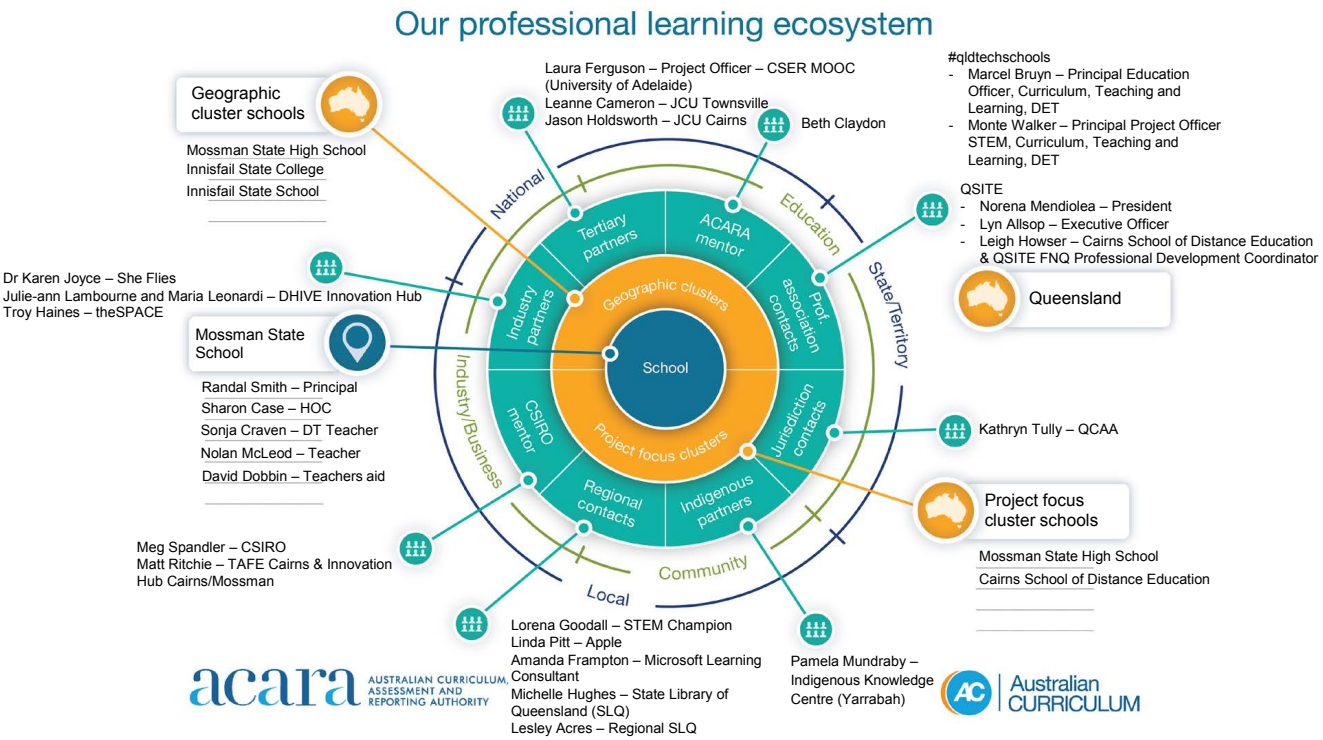


Figure 2: DTiF PL ecosystem for Mossman State School

level of understanding of the school's preparedness to be able to implement the Australian Curriculum: Digital Technologies and to inform planning for the school's action research and decision-making. The findings were also used to determine what impact the project had had for each school and more generally for teachers.

Teacher self-assessment matrices

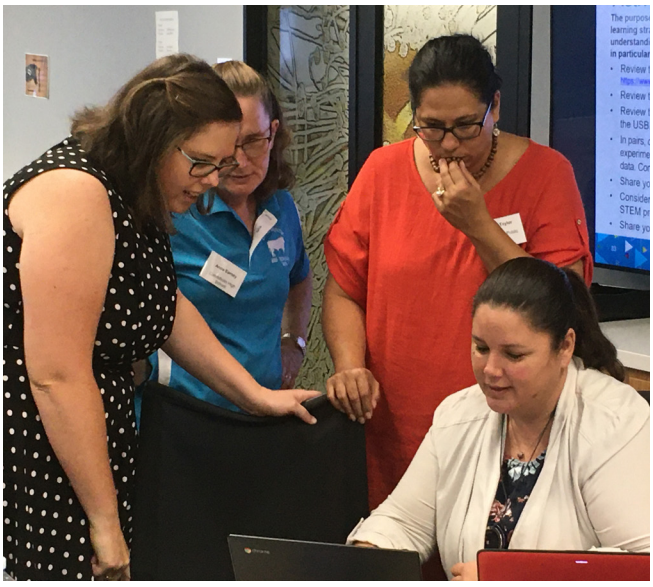
To help teachers reflect on their own knowledge, understanding and skills, 2 matrices were provided for optional completion. One focused on ICT capability and the other on Digital Technologies knowledge, understanding and skills. Teachers were invited to complete these self-assessments again mid project and at the end of the project to gauge their progress. A relatively small number of teachers opted to do this but where they did it provided evidence of the impact of the project.

Introductory workshop

The introductory workshop guided participants through the preliminary steps of shaping a project proposal to facilitate implementation of the curriculum in their school. It provided an opportunity for the project lead to meet all the schools and for each of the COs to work with their schools and to establish ways of working. In most cases these were face-to-face workshops but for some schools this was an online experience.

Action research

Each school involved in DTiF completed a proposal for an action research project. The proposal stated the school's research question, the aims of the project and criteria for success. It outlined how the school would implement the project by identifying how data would be collected, the resources needed and risks, and describing how the school would implement the Digital Technologies curriculum. The proposals were reviewed by 2 COs and the schools could revise their proposals. This provided valuable PL in terms of writing proposals.



Mentoring

COs provided face-to-face and online support to project schools and, where appropriate, partner schools. The support included customised PL, demonstrations, observations, side-by-side mentoring for curriculum planning or lesson planning and critiquing documentation.

Geographic cluster

Schools were organised into geographic clusters for the initial introductory workshops and then later in smaller clusters of 5 schools for the progress report webinars. The intent was that there would be some inter-school collaboration or at least the sharing of ideas. For many schools this was a positive of the project and as they became more comfortable with the webinars there was increased confidence to share.

Project focus cluster

Based on the interests of schools they were also aligned to a project focus cluster. These clusters included one focused on very small schools or multi-age classrooms, and others on literacy and numeracy, Aboriginal and Torres Strait Islander perspectives, and integrated STEM learning. The very small school cluster, for example, progressed from teachers sharing and collaborating online to their students showcasing what they had been learning. Using the cluster platform, diverse schools across the country were able to interact and students were able to access a larger audience for their work.

Student assessment

An optional pre-project student assessment was developed for students in Years 2, 4 and 8. Schools elected for students to complete the assessments at the start of the project and again at the end. This provided some insights into student growth and provided a measure of project outcomes.

An iterative process

From the beginning it was emphasised with schools that the project would involve an iterative process. See Figure 3. This approach reflects a design process and also the 4-step BASE model of Blackburn and Williamson (2018).

Planning began with the activities included in the DTiF introductory workshop and the support provided by COs to schools in planning their action research proposals. School project teams with the support of COs implemented their proposals by engaging in PL and building a culture of collaboration.

A key focus of the DTiF project was to sustain success. COs regularly reflected on how best to support their schools to sustain implementation. They continued to extend the PL ecosystem and to promote collaboration within the school and with community and other schools.

> ***... monitor implementation ... provide continued support for implementation ... and build internal capacity with teacher leaders (Blackburn and Williamson 2018, p. 12)***

Schools evaluated their progress regularly against their criteria for success. They presented progress reports and shared their learning with other schools in their geographic cluster. Schools reported on the adjustments they had made to their plans.

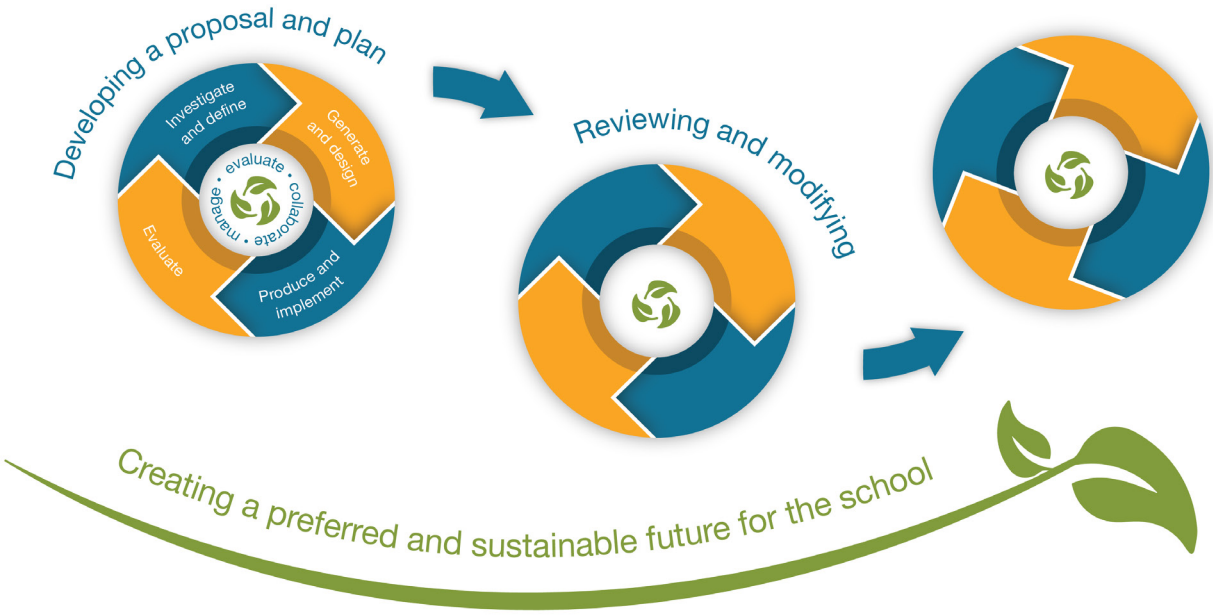


Figure 3: Iterative process recommended to schools

PL workshops

Ten Digital Technologies workshops were created and presented to project schools and offered more broadly to help support teachers implement the Digital Technologies curriculum. All were accredited with the NSW Education Standards Authority and a number with the ACT's Teacher Quality Institute until 2020.

Also, customised workshops were developed and presented to meet the specific needs of schools and jurisdictions.

Summer school and winter school

In January 2020 a summer school for 20 teachers was held and in June 2021 a winter school for 12 teachers. The purpose of these intensive 'schools' was for teachers to deeply focus on technological skills, teacher researcher skills and pedagogical content knowledge; and to build confidence to publish teacher research, present at conferences and develop local PL networks.

Building the team

As the team of COs was located around the country, it was important to quickly build the relationships in the team. This was achieved through weekly team meetings, trio meetings for specific tasks that were then shared with the whole group, and monthly 1:1 meetings. Twice each year the team met in a central location and debriefed about the project, shared insights and planned for the next steps. The collegiality of the team was critical to the project's success.

Templates

To facilitate the manageability of the project for schools the project team developed templates. These were: a project proposal featuring questions framed as steps in a design process, pre-project and post-project survey reports, timelines (Figure 4), progress report PowerPoint templates for '5 slides in 5 minutes', final report, review scale and state/territory reports.

Reflection

The purpose of the CO and teacher reflections was to collect anecdotal evidence of the effectiveness of the project methodology including perceptions of impact and evidence of outcomes. See sections 5.1.1 and 5.2.1 for findings. In addition to these reflections the COs reflected on the progress of schools using a learning pit visualisation and collaborating with teachers to complete a review scale.

Learning pit

The project team met face to face twice a year. During this time COs tracked the journey of schools by placing them on a learning pit to visualise the progress of schools. Schools were placed on a continuum from beginning to implement to full implementation. Each time the COs placed schools on the learning pit, most schools moved through the pit and up the other side. Those schools that were making slower progress were then targeted for extra support.

Review scale

A review scale was developed as a last reflective activity with schools to consider how far they had come and what the next steps would be. It provided a template for reflection on the progress and sustainability of implementation. The review scale was completed by the school in collaboration with the curriculum officer.

Products

The products of the DTiF project are the action research projects designed by the schools to facilitate implementation of the curriculum; the case studies created by the external evaluator and the internal qualitative research; the school stories published on the project website; and the quantitative and qualitative reports summarising the project findings.

In addition, there are PL workshop materials and a broad range of resources published on the DTiF website.

Action research final reports

Each school prepared a final action research report. Each report was reviewed by 2 COs and feedback provided. Most schools appreciated the opportunity to have their reports critiqued and responded to the feedback before presenting their final report.

Evaluation reports and case studies

Both the internal and external evaluations prepared case studies and provided these in the final reports.

ACARA collected data for 16 case studies for the internal evaluation report (see Appendix) and evaluated aspects of the project. Analysis of the case studies provided evidence for impact, outcomes and methodology. See Section 5.

Deakin University under contract completed an external evaluation of the project from 2018 to 2020. Its evaluation focused on 6 schools from 4 states and territories as a representative sample of all jurisdictions. Two progress reports and a final report were provided. See Section 5.3.

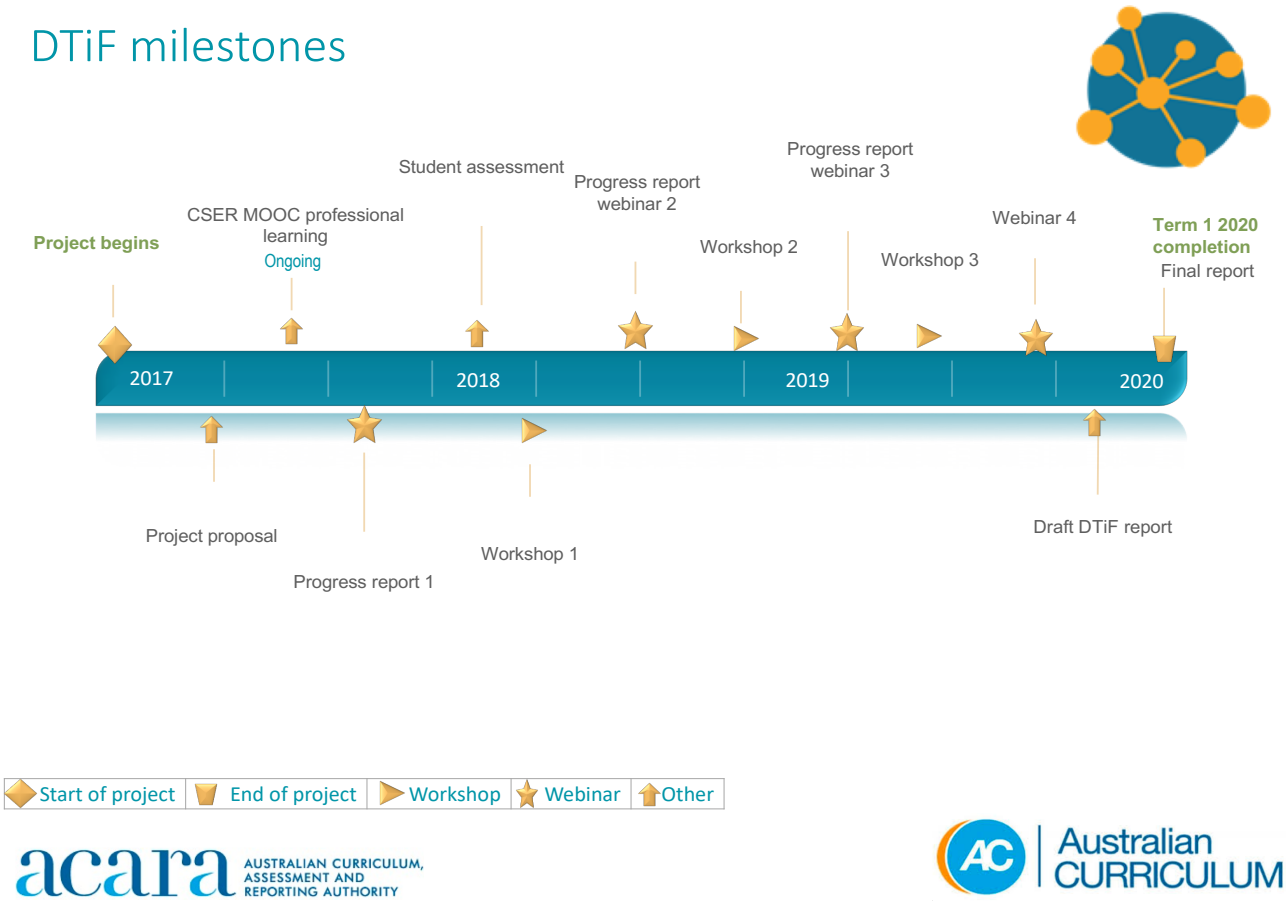


Figure 4: DTiF project school timeline template

Website

The DTiF website is being used as a repository for quality-assured resources for educators in helping support Digital Technologies implementation. From the website launch in December 2018 until June 2021 there were more than 100,000 unique page views.

The website can be accessed at https://www.australiancurriculum.edu.au/resources/digital-technologies-in-focus

Resources

Resources include strategies to explore key ideas and concepts, materials to help teachers plan for Digital Technologies, assessment tasks, classroom ideas, tutorials and useful links.

School stories

Nine project schools were selected to document their journey through the project by publishing their progress reports and supporting materials. Educators can view the school stories to get an idea of how each school has implemented Digital Technologies.

Wiki

The DTiF wiki was used as a repository for unofficial ACARA resources so they could be quickly uploaded for use by teachers. It was helpful to have this resource during the COVID-19 pandemic to quickly help teachers with online learning.

Newsletter

The DTiF newsletter was published each term and sent to more than 800 subscribers. It provided an update on the project and promoted new resources on the website. Past copies of the newsletter can be accessed on the DTiF website.

Webinars

In addition to the progress report webinars, other webinars were recorded. The following were developed in response to COVID-19 restrictions.

DTiF classroom

A CO trialled an online classroom activity. A webinar was recorded and published on the DTiF website along with commentary and reflections from COs who viewed the activity.

DTiF staffroom

Three webinar drop-in sessions were scheduled every week for project schools during Term 2, 2021 to allow schools to talk to COs to help support them during the pandemic. Each webinar was tailored to the needs of the educators. While there were some early attendees, these sessions morphed into an opportunity for COs to record tutorials on the key concepts of Digital Technologies. The recordings are published on the DTiF website.

DTiF in conversation

Following on from DTiF staffroom, the webinars changed again to feature invited guests. In Terms 3 and 4 of 2020 and Term 1, 2021, COs hosted DTiF in conversation webinars, each focusing on a particular aspect of Digital Technologies, with guests presenting information to participants. Many of these DTiF in conversation webinars have been published on the DTiF website.

Impact of COVID-19

The COVID-19 pandemic had a significant impact on the DTiF project by restricting travel to project schools in 2020. COs focused their efforts in supporting project schools' transition to online learning as well as continuing to support schools in implementing the Digital Technologies curriculum by providing online PL and developing resources. In 2021 there were fewer travel restrictions so there were more opportunities for face-to-face PL, particularly in the Northern Territory and New South Wales.

4. EVALUATION STRATEGY

The purpose of this section is to give an overview of the project evaluation strategy, the methods used, such as the research questions and the collection of quantitative and qualitative data, and how the collected data was analysed and interpreted.

The measurement of the success of the project was based on 3 components:

- **impact:** success including sustainability within each participating school
- **outcomes:** including transferability of outcomes to schools outside the project
- **methodology:** including transferability to similar initiatives.

For each of these components there was a dual purpose. First, to confirm that the 'people, processes and products' were achieving results and to inform next steps; for example, clarifying PL needs. Second, the success of these components was measured to contribute to research on Technologies education and TPL, particularly for those working with disadvantaged schools.

The research questions for each evaluation component of the internal evaluation are listed in Table 6 aligned to the sources of data and who would provide the data.

Table 6: Research questions for the internal evaluation aligned to data sources and responsibility for each source

Questions	Data sources	Who?
Impact: success including sustainability within each participating school • What has been the impact of the DTiF project in each school for a) schools/teachers, and b) school community? • What has been the impact of the DTiF project for the following groups of students: Aboriginal and Torres Strait Islander students; girls; metropolitan; regional; remote; very remote? • What has been the impact of the exogenous influences from the schools' professional learning ecosystems? Did those schools engaging with more external influences demonstrate higher levels of impact?	Progress report webinars and final report	Schools
	Reflections	COs and teachers
	Teacher surveys (pre and post)	Schools
	Student assessments (pre and post)	Schools and COs
	Cognitive interviews of students undertaking tasks	Schools and COs
	PL ecosystems	COs
Outcomes: including transferability of outcomes to schools outside the project • What outcomes have been achieved in each school? • How has the learning from the project been shared and transferred with schools within and beyond the project?	Action research reports	Schools
	Teacher surveys (pre and post)	Schools
	Student assessments (pre and post)	Schools and COs
	Reflections	COs and teachers
Methodology: including transferability to similar initiatives • How effective has the methodology of the DTiF project been? • What are the features of the project that could be applied for similar purposes? • What modifications are recommended? • Do the outcomes and impact provide evidence of the efficacy and scalability of the methodology? • How has the professional collaboration influenced change at the following levels: - macro (systemic, national, state) - meso (district and region) - micro (individual and school). (Blackburn & Williamson 2018, p. 11)	Progress reports and final report	Schools
	Reflections	COs and teachers
	Workshop evaluations	Teachers
	Qualitative research analysis	Project Lead and Project Officer
	Three Horizons Framework & Learning Pit: reflection (mid and end of project)	COs, Project Lead and Project Officer

4.1 Overview of methods

Evaluation of the DTiF project included an internal evaluation (see 4.1.1) and an external evaluation (see 4.1.2). Both focused on the 3 components for measuring success: impact, outcomes and methodology.

4.1.1 Internal evaluation

- The internal evaluation was coordinated by the project lead and project officer from 2017 to 2021.

The research methodology for the internal evaluation used a mixed-methods approach. Table 7 classifies the data sources by types of data and the nature of the data (qualitative or quantitative). Further detail on each data source follows.

Data sources

Below is a description of the nature and purpose of each of the data sources for the internal evaluation.

Teacher surveys

The purpose of the teacher surveys was to capture at a point in time the level of understanding of the school's

preparedness to be able to implement the Australian Curriculum: Digital Technologies and to inform planning for the school's action research and decision-making.

The pre-project survey was completed as schools joined the project, from April 2017 to August 2018. All schools were required to complete it. There were 2 groups of respondents: teachers and support staff, and principals. For some questions there were differences in responses between the 2 groups. Highlighting these differences was particularly useful for principals and for the CO working with a school. Teachers brought the day-to-day, in-classroom view, while principals had a broader view of the school's strategic plan.

The pre-project survey collected data from participants on awareness of the Australian Curriculum: Digital Technologies, implementation plans and priorities, the school's devices and infrastructure, and its relationships with communities and other schools.

The COs collated the data from each school and provided individual school reports focused on 6 key areas: awareness; implementation and priorities; digital resources; access to the internet; community relationships; and school relationships. Seventy-five per cent of case study schools completed the school survey before the introductory workshop and the remaining 25 per cent completed it shortly afterwards.

The mid-project teacher survey was optional for schools and was conducted to inform next steps. It was typically completed when schools completed progress report 3. The post-project teacher survey was completed at the end

Table 7: Alignment of data sources to types of data

Data sources	Types of data				Quantitative data	Qualitative data
	Demographic	Student achievement & learning	Instructional process	Attitudinal		
Teacher surveys: *Pre-project*	X			X	X	X
Mid-project		X	X	X	X	X
Post-project	X			X	X	X
Teacher self-assessment matrices: ICT Capability; Digital Technologies				X	X	
Student assessment: *Pre-project*		X			X	
Post-project		X			X	
Professional learning evaluations	X			X	X	X
Progress reports: *Webinar 1*				X		X
Webinar 2			X			X
Webinar 3		X	X	X		X
Webinar 4			X			X
Action research final report	X	X	X	X	X	X
Reflections			X	X		X
Review scale		X	X	X	X	

of the project and captured to some extent the impact of the project for each school. While all project schools completed the post-project survey, there were fewer individual teachers completing the survey.

Teacher self-assessment matrices

To help teachers reflect on their own knowledge, understanding and skills, 2 matrices were provided for optional completion. One focused on ICT capability and the other on Digital Technologies knowledge, understanding and skills. Teachers were invited to complete these self-assessments again mid-project and at the end of the project to gauge their progress. A relatively small number of teachers opted to do this but where they did it provided evidence of the impact of the project.

Teachers rated each statement on a scale of 1 to 4 where 1 is uncertain and hesitant, 2 is willing but dependent, 3 is confident and proficient and 4 is leading and enabling others.

Student assessments

An optional pre-project student assessment was developed for students in Years 2, 4 and 8. Schools elected for students to complete the assessments at the start of the project and again at the end. This provided some insights into student growth and provided a measure of project outcomes.

The testlets were:

Testlet 1: Computational thinking

Testlet 2: Digital Technologies concepts

Testlet 3: ICT Capability

Testlet 4: Student questionnaire (not reported on).

Each of these sets had testlets for Years 2, 4 and 8 and consisted of 5 to 8 questions.

Out of the 160 schools, only 48 schools participated in the assessment, resulting in low engagement for the student assessment; however, some schools created their own assessments or used the Bebras Computational Thinking Challenge or Bebras 365 to assess students.

Cognitive interviews were conducted to validate the questions after the pre-project assessment was completed.

COGNITIVE INTERVIEW VALIDATION

Cognitive interviews were conducted in 2019 by ACARA's DTiF COs when visiting project schools from different states and territories. The purpose of this study was to confirm that the pre-project student assessment questions in 3 of 4 testlets were valid and appropriate to be used as the basis for the post-project student assessments. This research would contribute to establishing the construct validity.

Year 2 cognitive interviews

All students answered question 5 for computational thinking incorrectly. When listening to students think aloud it was evident that the question was too complex for students. The question was modified to include a key. The results were significantly different when the item was retested. Eleven out of 19 (57 per cent) students answered correctly. Students who answered the question correctly were able to logically explain how they selected the correct answer. As the question is the most difficult question for computational thinking and a multi-step question, it was not expected that all students would answer the modified question correctly. Modifying the question with the key validated the question.

Year 4 cognitive interviews

All students answered question 2 for ICT Capability incorrectly. Investigation revealed that students did not know the terminology; for example, students did not know what 'database' or 'edu' meant. The question was also considered misleading as most students thought options B and C could be correct. The question was modified to replace option C to make the question unambiguous. The question was retested with 6 Year 4 students. Half of them answered correctly. In their think aloud they were able to eliminate the incorrect answers and give reasons. Modifying the question proved to validate the question.

Year 8 cognitive interviews

Only 2 students completed the computational thinking and Digital Technologies think aloud and one student did the ICT Capability think aloud. Year 8 questions have not been validated.

Conclusions

This process showed that the majority of the DTiF student assessment testlet items were valid with modifications required for Year 2 computational thinking question 5 and Year 4 ICT Capability question 2. Year 8 questions have not been validated. At the time of this research in early 2020, DTiF schools had already started completing the post-project student assessments without the modified questions. Therefore, only questions initially validated could be compared in the post-project student assessment.

PL workshop evaluations

The purpose of the PL workshop evaluations was to help COs to refine PL workshops and to measure the success of this element of the methodology. Participants were asked to complete an evaluation of the workshops they attended. They rated their level of overall satisfaction for each session between 1 and 5; 1 being of limited use and 5 being very useful. Industry standard for survey response is 30–40 per cent. A total of 1,716 people participated in PL workshops and 934 (54 per cent) responded to the surveys. Average overall satisfaction with all workshops was 4.4 out of 5.

Introductory workshop

Most project schools participated in the introductory workshop. The introductory workshop was presented nationally in 25 locations at the start of the project. Its purpose was to introduce the project, give an overview of the Digital Technologies curriculum and guide participants through the action research process. Participants completed an online or paper-based evaluation. The introductory workshop was well received. The average overall satisfaction score was 4.1 out of 5.0.

PL workshops

The DTiF team developed 10 PL workshops for participating schools and these were offered as needed. Schools in the local area around project schools were invited to participate. Some workshops were offered more broadly. The workshops were:

- Understanding the curriculum
- Key ideas and skills
- Planning for Digital Technologies implementation
- Computational thinking
- Consistent teacher judgement and Digital Technologies
- Technology Mandatory Years 7 and 8
- STEM Connections introduction
- STEM Connections Foundation to Year 8 teaching strategies
- Digital Technologies and project-based learning connections
- Planning and assessment of the Digital Technologies curriculum for students with diverse needs.

Customised workshops (combination of above workshops and online versions of workshops) were also run as required.

Summer and winter school

A summer school (January 2020) and a winter school (June 2021) were run in the ACARA offices. This was a great opportunity to build relationships between teachers who were leading the project in their schools. It also provided an opportunity to develop teacher research expertise and contributed to measuring the impact of the project.

Reports

Progress reports

School progress reports were presented in webinars with up to 6 schools. The sharing nature of these webinars was designed to build capacity of teachers presenting to colleagues as well as developing PL communities and providing a record of the impact, outcomes and methodology of the project. The video and audio from these webinars and the PowerPoint presentations were data sources. See Section 5.2.

Action research final reports

Each school prepared a final action research report. Each report was reviewed by 2 COs and feedback provided. Most schools responded to the feedback and presented a final version. Final reports were analysed for the case studies. The reports recorded the impact and outcomes of the project for the school. See Section 5.2.

Reflections

Curriculum officer and teacher reflections

The purpose of the CO and teacher reflections was to collect anecdotal evidence of the effectiveness of the project methodology including perceptions of impact and evidence of outcomes. At the end of each term from 2018, COs reflected on their schools' progress and the project in general by recording reflective podcasts in response to a series of questions.

Teacher reflections were recorded to capture insights about the project. The reflections were recorded by COs for school stories published on the DTiF website and state and territory final reports; and during webinars such as the DTiF Leadership discussion. See Section 5.2 for findings.

Review scale

The review scale provided a template for reflection on the outcomes and sustainability of implementation. It was a final reflective activity with schools to consider how far they had come and what their next steps would be. The review scale was completed by the school in collaboration with the curriculum officer. See Section 5.2.

Data analysis

There was a very large volume of data collected over a 4-year period. The researchers analysed data progressively and produced progress reports and an

interim final report to not only capture regular snapshots of progress but also to inform next steps.

Quantitative data

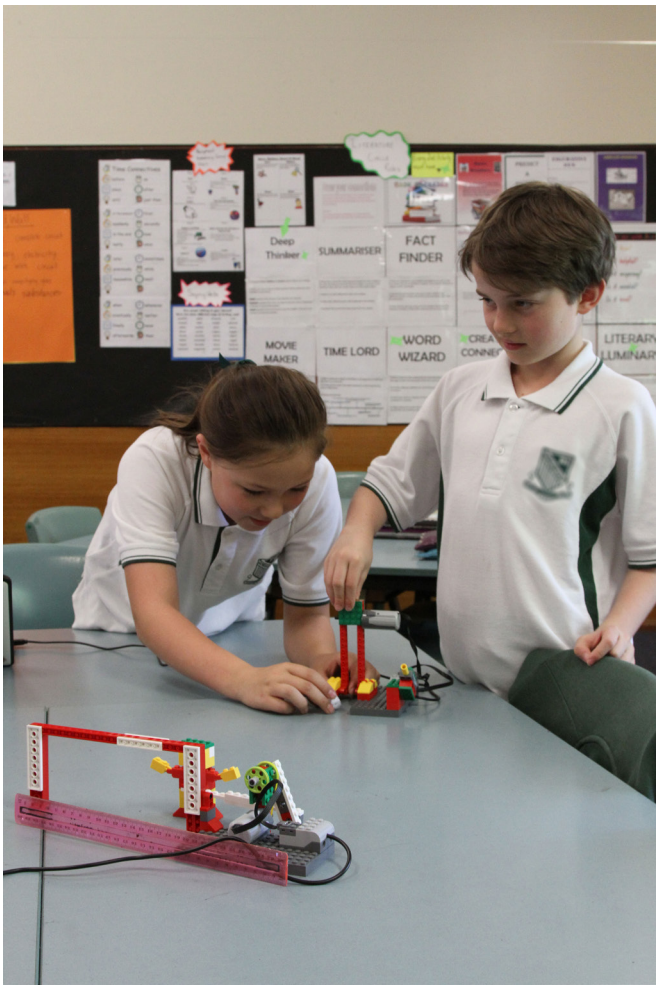
Quantitative data was collected through SurveyMonkey. Various data points were exported from SurveyMonkey and imported to other programs for further analysis. Student assessment data, for example, was exported to FileMaker Pro. A report was generated for schools including advice from COs on the strategies the school could use to improve results.

Qualitative data

Qualitative data included school progress report webinars (audio), final reports (text), and CO and teacher reflections (text and audio). Audio data was transcribed and uploaded to NVivo where text files and transcripts were coded according to largely predetermined categories related to impact, outcomes and methodology. The data was collated as school case studies and CO reflections.

Case studies

The case studies provide a descriptive authentic account of the DTiF project in a purposeful sample of representative schools. See Appendix. Sixteen of the 160 project schools were selected for analysis to be representative of the project schools, based on school size, geolocation, and proportions of Aboriginal and Torres Strait Islander and EAL/D students. Table 8 provides a description of each school and shows the different approaches to the research question adopted by the case study schools. These approaches are broadly indicative of the project schools in that some focus on cohorts of students or contextual factors (Aboriginal and Torres Strait Islander students, high staff turnover) that are of particular interest or relevance to many disadvantaged schools. Some focus on integrating Digital Technologies in other learning areas; others align with school priorities or jurisdictional strategic plans; while some focus on pedagogical change or generic skills or capabilities.



Data analysis of the case studies involved devising a coding system (code book) for conceptual analysis. Coding categories were added as new measures were identified for each measure of success. The coding used a detailed grounded theory approach to break open the data. This was a slow, regular process over 2 years by the project lead and project officer. Data provided evidence of impact and outcomes, and gave insights into the effectiveness of the project methodology.

Within-case analysis was done for each completed case study (11). Each of the within-case analyses were summarised and then reviewed to identify common themes in relation to the measures of success. Cross-case analysis allowed for common patterns to emerge and for connections to be made between impact, outcomes and methodology.

Four cross-case analysis themes emerged:

- curriculum implementation as a framework for pedagogical change
- planning teaching, learning and assessment skills and strategies
- effective curriculum implementation support in disadvantaged schools
- sustaining change.

Table 8: Descriptions of case study schools and their research questions

Name	Description of school	Research question	Name	Description of school	Research question
SCH01	Metropolitan government primary school in the ACT with 32 teaching staff and 12 non-teaching staff. School population of 418 students: 53% boys and 47% girls. 6% of students are Indigenous and 21% have a language background other than English. ICSEA value: 1009.	How can we develop student capacity to be creative problem solvers?	SCH02	Provincial Catholic primary school in NSW with 10 teaching staff and 10 non-teaching staff. School population of 122 students: 51% girls and 49% boys. 3% of students are Indigenous. ICSEA value: 1005.	How can staff at this small rural school be supported to use digital technologies and ICT to enhance student engagement and learning outcomes?
SCH03	Provincial government secondary school in NSW with 72 teaching staff and 20 non-teaching staff. School population of 834 students: 53% boys and 47% girls. 14% of students are Indigenous and 6% have a language background other than English. ICSEA value: 914.	How can we upskill our TAS staff in ICT capabilities and Digital Technologies to be comfortable to teach the new Technology curriculum?	SCH04	Small provincial government primary school in NSW with 1 teaching staff and 3 non-teaching staff. School population of 10 students: 60% girls and 40% boys. 30% of students are Indigenous and 18% have a language background other than English. ICSEA value: 901.	What impact will a multistage, integrated scope and sequence for small schools have on student achievement in STEM?
SCH05	Remote government combined school in NSW with 24 teaching staff. School population of 227 students: 55% girls and 45% boys. 47% of students are Indigenous and 3% have a language background other than English. ICSEA value: 830.	Is there evidence of improved engagement, knowledge and understanding/ skills of both students and staff?	SCH06	Provincial independent primary school in NSW with 4 teaching staff and 7 non-teaching staff. School population of 39 students: 51% boys and 49% girls. 46% of students are Indigenous and 6% have a language background other than English. ICSEA value: 856.	Can we use digital technology to enhance Literacy and Numeracy skills, increase the confidence of staff and students and engage the school community?

Name	Description of school	Research question	Name	Description of school	Research question
SCH07	Remote Catholic primary school in the NT with 9 teaching staff and 11 non-teaching staff. School population of 143 students: 54% boys and 46% girls. 11% of students are Indigenous and 4% have a language background other than English. ICSEA value: 1010.	Can we highlight the importance of our location in relation to our culture, well-being and lifestyle, through Digital Technologies?	SCH08	Very remote government combined school in the NT with 40 teaching staff and 16 non-teaching staff. School population of 608 students: 52% boys and 48% girls. 99% of students are Indigenous and 99% have a language background other than English. ICSEA value: 716.	How can the school develop the technology/ pedagogy/content capability of teaching and support staff to enhance digital technologies learning of our students?
SCH09	Remote government primary school in Qld with 22 teaching staff and 19 non-teaching staff. School population of 239 students: 51% girls and 49% boys. 53% of students are Indigenous and 18% have a language background other than English. ICSEA value: 839.	How can we use the digital technologies curriculum to create links between students and the local community that encourage growth of the local tourism industry whilst teaching students how to create digital solutions to real world problems?	SCH10	Very remote government combined school in Qld with 35 teaching staff and 10 non-teaching staff. School population of 325 students: 54% boys and 46% girls. 97% of students are Indigenous and 61% have a language background other than English. ICSEA value: 687.	How do we structure the planning, teaching and learning of Digital Technologies to improve the quality of the learning outcomes?
SCH11	Metropolitan independent combined school in Qld with 25 teaching staff and 54 non-teaching staff. School population of 251 students: 50% boys and 50% girls. 100% of students are Indigenous and 73% have a language background other than English. ICSEA value: 653.	How can we develop best practice for delivery of the Australian Digital Technologies Curriculum to Aboriginal and Torres Strait Islander students from diverse cultural backgrounds?	SCH12	Metropolitan government primary school in SA with 23 teaching staff and 16 non-teaching staff. School population of 272 students: 53% girls and 47% boys. 14% of students are Indigenous and 10% have a language background other than English. ICSEA value: 880.	How can Digital Technologies be used to enhance and develop: 1) mathematical thinking and 2) computational thinking and problem-solving skills?
SCH13	Very remote government primary school in Tasmania with 7 teaching staff and 6 non-teaching staff. School population of 51 students: 53% girls and 47% boys. 18% of students are Indigenous. ICSEA value: 885.	How will we create a sustainable culture to embrace and implement the Digital Technologies curriculum with a 3-year turnover cycle (on average) of teachers?	SCH14	Provincial government primary school in Victoria with 3 teaching staff and 3 non-teaching staff. School population of 30 students: 53% girls and 47% boys. ICSEA value: 975.	How do we use the Digital Technologies curriculum to help shift the traditional gender stereotypes?

Name	Description of school	Research question	Name	Description of school	Research question
SCH15	Remote Catholic primary school in WA with 9 teaching staff and 7 non-teaching staff. School population of 44 students: 54% boys and 46% girls. 7% of students are Indigenous and 7% have a language background other than English. ICSEA value: 1004.	How can staff increase their Digital Technologies knowledge in order to integrate the new curriculum content and skills across all learning areas on a daily basis?	SCH16	Provincial government secondary school in WA with 62 teaching staff and 47 non-teaching staff. School population of 792 students: 51% boys and 49% girls. 32% of students are Indigenous and 6% have a language background other than English. ICSEA value: 885.	How can teachers effectively implement the Digital Technologies curriculum and integrate computational thinking into their teaching practice across all learning areas?

Challenges

One of the main challenges was the inconsistent completion rates of the pre and post teacher surveys and student assessments. Much larger numbers completed the pre-project activities than post project, which made it difficult to make valid judgements about impact and outcomes.

Also, the original plan for the data analysis had been for some of the COs to help but the demands of the intensive engagement with schools, the challenges faced by schools through COVID-19, and competing priorities in 2020–21 resulted in them having limited time to assist.

4.1.2 External evaluation

Deakin University's School of Education was contracted to complete an external evaluation of the project from 2018 to 2020 to assist in determining the extent to which the DTiF project achieved its aims, specifically with respect to its impact on schools and the transferability of the project methodology to other initiatives.

Deakin adopted a case-study approach. It collected rich datasets for analysis from 6 schools across 4 states and territories – in urban, regional and remote settings – with all sectors being proportionally represented. Over a 2-year period, at 3 different stages, data was collected from key stakeholders (school leaders, teachers and education assistants) about the impact of historical and contemporary factors on each school's ability to implement the Digital Technologies curriculum, the teaching and learning changes, and levels of teacher and school engagement as a result of participating in the DTiF project. Of special note was the high level of staff turnover during this project – only 8 of the 30 teaching staff participated in all 3 data-collection stages and it is hoped that the positive experiences gained in a school will be transferred to new school settings.

Ongoing communications between Deakin's team and ACARA's project lead and COs also informed Deakin's evaluation. This case-study methodology provided opportunities for individual school leaders and teachers to tell their stories about the challenges and successes of the project. It also allowed the evaluation team to undertake a cross-case analysis, acknowledging the fragilities, complexities and innovative practices experienced in these schools.

See Section 5.3 for high-level findings and a link to the published report.

5. FINDINGS

The purpose of this section is to provide a summary of the internal evaluation findings (Section 5.1), more detailed findings of the internal evaluation (Section 5.2) and the findings from the external evaluation report (Section 5.3).

5.1 Internal evaluation findings summary

An overview of the internal evaluation findings is presented under 3 headings relating to the measures of success: impact, outcomes and methodology. Table 9 indicates which data sources have contributed to each measure of success providing a chain of evidence that links data together.

Validity

Internal validity was achieved through triangulation. DTiF project findings were identified from the analysis and interpretation of 2 or more data sources. Many findings are supported from 3 different viewpoints – teacher, student and participant-observer (mentor).

The multiple sources of data:

- improve the reliability and validity of the data and findings
- corroborate the findings
- provide high-level congruence between findings from different data sources.

Construct validity was improved by using multiple sources of evidence to demonstrate convergence of data from all sources.

Findings

The internal evaluation findings are presented in terms of the measures of success: impact, outcomes and methodology. See Section 5.2 for more detail for each measure.

Table 9: Data sources for each measure of success

Data source	Impact	Outcomes	Methodology
Teacher surveys	X		
Teacher self-assessment matrices	X		
Student assessment		X	
PL evaluations	X		X
Progress report webinars	X	X	X
Action research final report	X	X	X
Case studies	X	X	X
Reflections	X	X	X
Review scale		X	

5.1.1 Impact: success including sustainability within each participating school

All schools indicated substantial progress on the measure: teaching, learning and assessment plans for Digital Technologies developed for all band levels. Teachers reported on their progress on this measure in progress reports and final reports. The impact for teachers in case study schools was increased understanding of Digital Technologies with flow-on effects for students.

Teachers

By the end of their time in the project, teachers from most case study schools had embedded Digital Technologies into other learning areas and were confident to have done so. They highlighted the importance of integrating Digital Technologies in terms of manageability of the curriculum and rich connections to other learning areas to enhance learning and transfer.

Final reports from case study schools indicate that there were significant increases in engagement with the Digital Technologies curriculum and how best to teach it. Teacher reflections indicated that teachers and students were engaging collaboratively with digital technologies.

Final reports from case study schools and teacher reflections indicate an increase in Digital Technologies knowledge, understanding and skills. This was evidenced by improved use of terminology by teachers and students, and increased confidence using digital technologies. COs found that teachers and students used more technical language and teachers took the initiative to ask for specific PL to support the activities they were planning.

Many schools included their education assistants in PL. Often these staff members live locally and are the constant in schools with high staff turnover, and can therefore assist in sustaining the use of digital technologies.

COs noted changes in pedagogical practice in the classrooms they visited over the 2–3 years of the project. They indicated that teachers were applying new approaches to foster an open and engaging student-driven learning environment.

An unintended impact reported by teachers was increased collaboration within schools and between cluster schools. Final reports from case study schools highlighted there was increased sharing of ideas and resources, team teaching, planning and support.

Teacher reflections at the close of the project affirmed

the positive impact of the project for professional practice. They noted increased awareness of educational technologies, increased ICT capability, and improved understanding of the Digital Technologies curriculum and how to most effectively implement it.

School community

Teachers and COs through reflections and final reports indicated that the impact for school communities was an increased understanding of the place of digital technologies in their school and local community, and a greater understanding of the importance of online safety and teacher and parental or carer responsibilities.

Students

Based on the data collected from pre-project and post-project student assessment across all tests and levels, there appears to be improved student capability that could be attributed to the DTiF project. Final reports from case study schools indicate gradual improvements in students' Digital Technologies knowledge, understanding and skills. Increases in computational thinking were particularly noted.

Teacher reflections and final reports from case study schools indicate that students enjoyed the purposeful application of their Digital Technologies knowledge, understanding and skills to create digital solutions. COs also observed increased confidence in students as the

project progressed. Many Aboriginal and Torres Strait Islander students benefited from learning opportunities that were offered as part of the DTiF project which included a focus on story, exploring their local language, learning on Country/Place and programming robotic devices. They showed increased engagement and confidence.

Students in areas classified as regional, remote and very remote often had limited understanding of how digital technologies were used in their local communities. The DTiF COs helped teachers and students to see where and why digital technologies were being used and how to make connections within their local area. PL for teachers and workshops for students helped to improve student engagement and confidence.

External connections

Progress reports from case study schools indicate that connections with local schools, industry and community organisations increased. COs indicated that those schools that made strong connections beyond the school were more likely to sustain change.

5.1.2 Outcomes: including transferability of outcomes to schools outside the project

The key outcomes for teachers were increased understanding of Digital Technologies curriculum; increased ICT capability; effective implementation of Digital Technologies; deeper understanding of computational thinking and how to integrate it with other learning areas; professional confidence to plan teaching, learning and assessment; and increased collaboration with teachers and students.

The key outcomes for students were increased confidence and independence in using digital technologies; increased engagement in their learning; increased ICT capability; and improvements in computational thinking; and design thinking, problem-solving and resilience.

The project team published 15 newsletters sharing stories and resources. The newsletter has more than 800 subscribers and archived newsletters are published on the DTiF website. The website had more than 100,000 unique page views from its inception to June 2021.

A total of 1,716 people benefited from PL workshops and 934 (54 per cent) responded to the survey. Average overall satisfaction with all workshops was 4.4 out of 5.0. This high level of satisfaction was also reflected in the comments, which were mainly positive. The DTiF team appears to have delivered workshops that met the needs of the participants.

5.1.3 Methodology: including transferability to similar initiatives

The people, processes and products of the DTiF project methodology all contributed to the positive impact and outcomes for participating schools. While some elements could be further enhanced, many proved to be very effective and have been shared with educators planning similar PL.

The importance of the school principals, leaders, teachers and education assistants cannot be underestimated; without their engagement in the project and their commitment the elements of the project cannot be realised. The success of the project in schools is determined by the 'people'.

People

Professional learning ecosystem

The key 'people' methodology was the PL ecosystem for each school. Eighty-one per cent of case study schools identified that they had made connections outside their school including other local schools, communities, jurisdictions and industries. The PL ecosystem formalised the identification of people who could help them to support implementation or to help students see why learning Digital Technologies was of value.

Mentors

The mentors (COs) were the critical part of the project. They provided effective strategies for implementation, assisted with planning and provided a sounding board for ideas. Their commitment to their allocated schools over 2 to 3 years made a significant difference for schools. The role of the COs was highly valued by schools. Case study schools and teacher reflections reiterated this on multiple occasions.

Processes

All schools were able to develop a project proposal; however, those who participated in the introductory workshop found this easier as they had already begun to explore ideas for their action research in the workshop.

COs reflected at the end of each term on those strategies that were most effective. A key message was the importance of developing teacher expertise in planning teaching, learning and assessment.

The opportunity for schools to develop their own action research projects to suit their unique school context was very positively received, with most identifying extra opportunities to collect data and evidence of growth. Eighty-one per cent of case study schools conducted

research on Digital Technologies implementation in their schools and indicated they were using that data to inform teaching and learning.

Templates

Schools indicated that the templates were easy to use and manageable in terms of expectations; for example, how much detail to provide. Final reports were completed by 85 per cent of project schools. The progress report (5 slides in 5 minutes) was a relatively quick way for teachers to reflect on their progress at points in time. Most schools found the progress reports as webinars manageable and a good way to make connections with other schools. However, some found them challenging to prepare. There may need to be more flexibility around how to manage progress reports for any similar projects in the future. As a data collection source the webinars were invaluable as they provided not only a visual artefact but also an audio record.

Workshops

Eighty-seven per cent of case study schools identified upskilling staff as pivotal to implementing Digital Technologies, whether that was attending DTiF workshops or other PL.

Products

Professional collaboration was a feature of the DTiF project. At the micro level, the COs as a team were very supportive of each other and contributed to each other's PL. Positive collegial relationships between COs and school personnel were critical to the success of the project. Many schools had rarely had visitors to their schools to provide PL. The collaboration between staff within schools and with local schools was also enhanced.

The DTiF team collaborated with state, territory and jurisdiction education consultants to develop PL. The collaboration between COs and regional officers was very positive. The regional officers co-presented, organised venues, promoted PL and shared their knowledge of local custom and practice.

The team also collaborated with other projects, particularly those funded through the NISA, for example the Australian Computing Academy, the Computer Science Education Research Group (CSER) Digital Technologies project; and organisations including Education Services Australia. Also, COs built relationships with government organisations such as CSIRO, and industry and business groups providing implementation support such as Google and Apple, and professional teacher associations such as the Australian Association for Computers in Education and state affiliates. The PL and resources developed by these organisations both informed DTiF and were informed by DTiF.

5.2 Internal evaluation detailed findings

The detailed findings for each of the impact, outcomes and methodology questions are presented below. The sources of data are teacher surveys, teacher self-assessment matrices, student assessment, PL evaluations, progress report webinars, action research final reports, case studies, reflections from COs and teachers, and the review scale.

The evidence for most questions has been triangulated.

5.2.1 Impact: success including sustainability within each participating school

What was the impact of the DTiF project in each school for a) schools/teachers and b) school community?

a) Impact of DTiF for schools/teachers

Teaching, learning and assessment plans for Digital Technologies developed for all band levels

All schools indicated substantial progress on this measure. Teachers reported on their progress on this measure in progress reports and final reports. The case studies also provide evidence of an increase in teaching, learning and assessment plans for Digital Technologies, often using an integrated approach. COs provided evidence of success for this measure when they reviewed teaching, learning and assessment plans and used the review scale to reflect on the depth, rigour and sustainability of these plans. COs also documented progress in schools in regular reflective podcasts.

Final reports from case study schools indicate that teaching, learning and assessment plans were in development. The impact for teachers in case study schools was increased understanding of Digital Technologies with flow-on effects for students. Teachers in 2 case study schools indicated they were confident in teaching Digital Technologies and integrating with other learning areas.

> ***The most significant things are that 5 teachers have written their own units for teaching Digital Technologies. This is significant since we are a small school and that number represents a significant proportion of our staff. (SCH11, final report)***

> *Improved teacher capacity to effectively plan, implement and assess student learning in DT... Capacity to teach, assess and report against each band of the Digital Technologies curriculum [has improved]. (SCH04, final report)*

Integration

Most case study schools have embedded Digital Technologies into other learning areas and were confident to do so. They highlighted the importance of integrating Digital Technologies in terms of manageability of the curriculum and rich connections to other learning areas to enhance learning and transfer. Others planned to develop integrated units. Final reports and teacher reflections demonstrate this.

> *All classroom teachers have been involved in planning for integrating Digital Technologies into other curriculum areas. Some (not all) teachers have followed through with this and taught Digital Technologies within their classroom (COVID-19 has had an effect on this). (SCH01, final report)*

> *Staff ... that are engaging in Digital Technologies are, where possible, integrating their activities into broader curriculum areas to include Literacy, Numeracy and other curriculum areas. (Teacher reflection)*

COs noted the increase in integration and also that teachers were more proactive in seeking advice not just for activities but for whole school planning.

> *... the literacy and numeracy integration of the curriculum has made a much greater sense of purpose for those teachers. They now see that working together around the digital literacies and Digital Technologies curriculum, alongside the literacy and numeracy planning and programming, has made it a much more relevant opportunity for those teachers to continue working in this area. They are more embracing of the curriculum. I appear to be finding that when I come to school now they are asking for support. (CO, Reflective podcast, Term 4, 2018)*

> *... they're really getting a better understanding of the curriculum itself and they're now moving to the next level where they're actually asking for suggestions on how to plan across bands and across year levels and even across the whole school and they're also looking further into ways in which they can incorporate other learning areas and asking what it should actually look like in my classroom and looking for those real relatable ideas. (CO, Reflective podcast, Term 4, 2018)*

Application of computational thinking and systems thinking in other contexts

Final reports from case study schools indicate that teachers were transferring their learning from Digital Technologies to other learning areas. For example, they showed understanding of the place of computational thinking and systems thinking not only in Digital Technologies but in other learning areas and used opportunities to make connections.

> *Classroom teachers have begun to make links between computational thinking strategies and problem solving in other learning areas. The use of algorithms in Science to differentiate investigation methods for students has proved effective and decomposition is employed in both the Arts and Humanities and Social Sciences curriculum, particularly in relation to storyboarding. (SCH09, final report)*

> *An unintended effect is the development of colleagues understanding of how to integrate the computational thinking strategies into other key learning areas. This has been a fairly recent effect and has occurred as a result of the team-teaching context of the curriculum delivery as well as support from our Curriculum Officer. (SCH09, final report)*

> *Systems thinking techniques are being used to decompose complex systems being studied such as the Solar System and planning for Natural Disasters. (SCH09, final report)*

Increased engagement with Digital Technologies

Final reports from case study schools indicate that there were significant increases in engagement with the Digital Technologies curriculum and how best to teach it.

> *At present, some teachers have begun to implement parts of learning experiences in Digital Technologies lessons and have expressed enthusiasm at their involvement. They are engaging with the content and delivering lesson activities planned by the lead teacher enabling them to focus on pedagogy. To date, all staff members have felt confident in their delivery of learning outcomes. (SCH09, final report)*

> *Increased Collective Teacher Efficacy and decreased anxiety in teaching DT and using ICT (SCH07, final report)*

Teacher reflections indicated that teachers and students were engaging collaboratively with digital technologies.

> ***Students and teachers openly discuss digital technologies and are constantly looking for further ways to integrate. Teacher feedback indicates greater confidence in integrating and teaching the DT curriculum. (Teacher reflection)***

Measurable shift in teacher ICT Capability and Digital Technologies knowledge, understanding and skills

Teachers and school executive completed pre-project and post-project teacher surveys and teacher self-assessment matrices to measure the shift in teacher ICT Capability and Digital Technologies knowledge, understanding and skills.

For the teacher self-assessment matrices teachers rated each statement on a scale of 1 to 4, with 1 being uncertain and hesitant, 2 being willing but dependent, 3 being confident and proficient and 4 being leading and enabling others.

As the number of teachers completing the pre- and post-project self-assessment matrices were significantly different, Cohen's d test was used to determine the effect size. Cohen's d test was modified by the Hedges g method to account for the different sample sizes.

Increased ICT Capability knowledge, understanding and skills

In addition to the pre-project Digital Technologies matrix, some teachers opted to complete the ICT capability matrix. The matrix was based on the Australian Professional Standards for Teachers (AITSL) standards related to ICT proficiency.

Ninety-three teachers completed the ICT capability post-project matrix, considerably fewer than the pre-project matrix.

The highest gains were made in Standard 3: use effective classroom communication; evaluate and improve teaching programs; and engage parents or carers in the educative process. Negative effect sizes were noted. The negative effect size could be due to teachers over assessing in the pre-project matrix and then realising that their skills were not as comprehensive as they had first thought. Other data sources do not provide evidence of a reduction in capability.

Final reports from case study schools indicated increased levels of ICT Capability.

> ***All teachers are more confident in teaching the Digital Technologies curriculum as well as integrating ICT into their daily lessons. … Teacher confidence and use of ICT and evidence of Digital Technologies with reports and showcases. (SCH15, final report)***

Increased Digital Technologies knowledge, understanding and skills

Teacher surveys

Before the project began, respondents had different levels of awareness of the Australian Curriculum: Digital Technologies. A quarter of respondents (25 per cent) indicated they were starting to engage with the Digital Technologies curriculum or implementing some of it. However, two-thirds (66 per cent) were aware to a lesser extent and 8 per cent had no awareness.

For the teachers in project schools that completed the post-project teacher survey they are now all aware of the Digital Technologies curriculum and have participated in Digital Technologies professional development. Seventy-eight per cent of schools are implementing the curriculum. Eighty-one per cent of schools are assessing and 18 per cent are planning to; 66 per cent are reporting with 16 per cent planning to in the near future.

Teacher self-assessment matrices

A total of 491 teachers across Australia completed the pre-project Digital Technologies matrix. There was also

a mid-project teacher self-assessment matrix; this had a low completion rate and was not reported on. Ninety-four teachers completed the Digital Technologies post-project matrix, considerably fewer than the pre-project matrix.

The highest gains were made in learning environment, assessment, abstraction, systems thinking, and specification, with all 5 having an effect size of more than 0.8.

Final reports

Final reports from case study schools indicate improvements in both ICT Capability and Digital Technologies knowledge, understanding and skills, and an understanding of the difference between the 2.

> ***We can now understand ICT and Digital Technologies knowledge and understandings, processes and production skills, [and] regularly use Digital Technologies Hub and ACARA website to better understand the requirements of the DT curriculum. (SCH01, final report)***
>
> ***As the project progressed our staff gained a better understanding of the differences between ICT capabilities and Digital Technologies curriculum. This was evident at a regional staff meeting, where a number of schools still did not understand the difference between the two. (SCH15, final report)***
>
> ***Teachers are feeling more confident overall with their knowledge and understanding of Digital Technologies and with the differences between ICT and Digital Technologies. (SCH11, final report)***
>
> ***[COVID-19] Particularly this year with online learning, the students and staff have both developed their digital technology and ICT capabilities as there has been increased opportunities to think outside the square. (SCH14, final report)***

Final reports from case study schools indicate an increase in Digital Technologies knowledge, understanding and skills. This was evidenced by improved use of terminology by teachers and students, and increased confidence using digital technologies.

> ***Evidence of Digital Technologies specific vocabulary being used across the staff as demonstrated through observation of lessons, posters, class displays and student interviews. (SCH15, final report)***
>
> ***Staff now more confident in using digital technologies and, while often partnering with ICT, acknowledge that it is its own area of the curriculum with skills and understandings that need to be explicitly taught. (SCH07, final report)***
>
> ***They [teachers] have planned short units of work and we have recently held a staff meeting where all teachers got to have a go at some basic coding using the spheros the school has just purchased. It has improved their knowledge and understandings of the difference between Digital Technologies and ICT capabilities. They have a better understanding of some of the terminology and what it means. This was evident in our recent staff meeting as they were able to articulate this to other staff. They also know where to access support for activities and lesson ideas. (SCH12, final report)***

Teacher reflections also indicate an increase in understanding of ICT Capability and Digital Technologies:

> ***The perception that has changed school-wide was through the understanding of the differences between ICT capabilities and the Digital Technologies curriculum and how one, ICT, supports students to be effective users of technology and the other, DT, builds and extends by trying to move students from being users to creators. (Teacher reflection)***
>
> ***There definitely has been an increase in student and teacher capacity … the students [are] starting to use a lot of language between themselves when they're talking about Digital Technologies or within the lesson itself and the teachers can showcase this within their daily work. (Teacher reflection)***
>
> ***It has been phenomenal the increase in student and teacher capacity; the project has really facilitated that … the project provided the structure for the improvement. It's helped us develop a vision in this area. (Teacher reflection)***

This evidence was reinforced by COs, who found that teachers and students used more technical language and teachers took the initiative to ask for specific PL to support the activities they were planning. COs reported teachers had a deeper understanding of the curriculum and attributed this to regular workshops, staff meetings and mentor support.

> ***Teachers are … now saying, "Right, I would like to know how to make a maze game in Scratch," or "I would like to have a little bit more professional learning on how to create an interactive spreadsheet so that I can deliver the curriculum". So, really good to see that sort of questioning and the language coming from teachers and students***

> *as to an increased understanding of the curriculum itself (CO, Reflective podcast, Term 4, 2018).*

Many schools included their education assistants in PL. Often these staff members live locally and are the constant in schools with high staff turnover, and can therefore assist in sustaining the use of digital technologies.

> *By targeting PL for teaching staff in the use of ICT we have also seen an increase in confidence in ICT use by teaching staff and also Education Assistants. (SCH16, final report)*
>
> *I think that it's particularly valuable that the teacher aides have been included in that staff training as well. I think that is really lovely to involve them as learning partners for the teachers and the students ... (SCH02, progress report 2, CO comment)*
>
> *In the [state], teacher aides have taken to story writing with Book Creator and ScratchJr with a passion because they can see that these are engaging vehicles for the teaching of language. (CO reflection)*

Change in pedagogical practices

Teachers noted in their final reports that there had been changes in pedagogy as a result of participating in the DTiF project. DTiF provided opportunities to change pedagogical practice, such as allowing students to have a voice in planning learning, and using the SAMR model to progressively modify teaching strategies. Teachers acknowledged there had been professional growth and an increase in a growth mindset for students and teachers.

> *The use of content knowledge from Science lessons as a context for implementation of systems and computational thinking problem-solving strategies has proved a more engaging pedagogy for the students. (SCH09, final report)*
>
> *Evidence of real-life application for Digital Technologies in planned teaching and learning activities through the LEADing Lights platform. (SCH15, final report)*

COs noted changes in pedagogical practice in the classrooms they visited over the 2–3 years of the project. They indicated that teachers were applying new approaches to foster an open and engaging student-driven learning environment. There were increasing requests for demonstration lessons and in some cases requests for COs to observe lessons and give feedback.

> *I'm seeing quite a large shift in pedagogy where teachers are now actively thinking about DT and ICT and if it can integrate … Many schools are now having regular tech time at staff meetings and led by teachers, which is good, and many educators are now aware of the engagement drawcard when you apply DT and ICT in lessons (CO, Reflective podcast, Term 4, 2018).*
>
> *Teachers are also changing in the way that they are thinking about how they would teach it in the classroom; they're starting to move from what am I going to do, as in what are the activities that we can run, what's this, what's that, to looking at what they are doing and what students are doing, and the shift in the focus in the room has been really interesting to observe. Teachers are observing that there's more collaboration, there's richer problem-solving, and the role of the teacher has evolved into one that is more of a guide on the side, and they've been observing student interactions and listening and shaping their thinking along the way (CO, Reflective podcast, Term 4, 2018).*

Increased collaboration

An unintended impact reported by teachers was increased collaboration within schools and between cluster schools. This was reported by 8 of 11 case study schools. Final reports from case study schools highlighted there was increased sharing of ideas and resources, team teaching, planning and support.

> *An unintended effect of all these changes was that the existing staff really pulled together to ensure that the standards for the Digital Technologies Curriculum were set high and that they were on hand to help the new staff with the integration process. The intended effects of actions include that most staff are delivering DT at a high level and all staff have increased their ICT Capabilities which is now assisting that to be implemented in the classrooms. (SCH15, final report)*
>
> *… the whole COVID-19 thing, … how dreadful it's been and so disruptive for everybody health wise and so many other industries that we've seen a huge increase in the uptake of teachers, … sharing ideas and creating … one of the other lovely outcomes is a lot of the teachers have been helping one another negotiate video conferencing and planning online lessons and sharing resources. (SCH01, progress report 4)*

Increased confidence and leadership

The DTiF project provided the opportunity for project leads and teachers to not only further develop their Digital Technologies expertise but to increase confidence and to become leaders in their schools and local networks.

Final reports from case study schools indicate professional growth for principals, project leads and teachers.

> *Have improved confidence (3 out of 10 average to 7 out of 10) to access and use a wider variety of DT to enhance learning … Overall improved confidence in our school to embrace the DT curriculum and understand the aims of it. As a result, we are now collaboratively planning online together and utilising the STEMT4L coordinator to assist us in setting up a [SCH04] Planning TEAMS site. (SCH04, final report)*
>
> *While we have seen a large staff turnover during the project, leaders have emerged as our collective efficacy has grown (SCH07, final report)*
>
> *The lead teacher has been able to develop a deeper knowledge of the curriculum requirements and effective pedagogical strategies that can be utilised to improve learning experience delivery. (SCH09, final report)*
>
> *Two of the teachers who have participated … indicated through their Performance Development conversations that they are interested in leading some learning next year with the staff group in Digital Technologies. I am in talks with the new principal about how we can support them and provide time for them to do this work. (SCH12, final report)*

Teacher reflections at the close of the project affirmed the positive impact of the project for professional practice. They noted increased awareness of educational technologies, increased ICT capability, and improved understanding of the Digital Technologies curriculum and how to most effectively implement it.

> *Being involved in the DTiF project for the last three years has greatly affected my teaching in a positive way. I have become more aware of a variety of technological resources that are available for use in the classroom, as well as a range of teaching resources that appropriately link into other areas of the curriculum. I look for ways to incorporate digital technology into the classroom and embed them into my practices and am more confident teaching the Digital Technologies curriculum due to a greater understanding about the curriculum content. (Teacher reflection)*

> *Through DTiF I have become more aware of how to embed Digital Technologies rather than teach alone. We have made a decision to still include this in our scope and sequence … there is also a focus on the general capabilities as well as curriculum. I can honestly say that I do not believe our school would be as well resourced and informed in Digital Technologies if we were not involved in this project. Through the support of our curriculum officer, and his natural approach with staff, we have made significant changes in this area. The 'in house' support as well as resources have been instrumental in embedding both plugged and unplugged activities. (Teacher reflection)*

Teacher reflections and final reports from case study schools indicate a positive impact for schools of the DTiF project when COVID-19 school closures occurred. Schools indicated they were able to respond more quickly and effectively.

> *[COVID 19] The surprise was that everyone was in a state of readiness to learn and move quickly; if we had gone back to the start of the project we wouldn't have been able to move as quickly … (Teacher reflection)*
>
> *I really think everything we've done in the last two years prepared us beautifully for remote learning with COVID-19 because the kids just took it on well … [and] Improved teacher confidence to use platforms such as ZOOM to conduct lessons. (SCH04, final report)*

b) Impact of DTiF for the school community

Teachers and COs through reflections and final reports indicated that the impact for school communities was an increased understanding of the place of digital technologies in their school and local community, and a greater understanding of the importance of online safety and teacher and parental or carer responsibilities.

Eighty-three per cent of case study schools indicated that the project had a positive impact on the school community.

Digital Technologies in the school and local community

Some schools in their final reports indicated they shared the Digital Technologies journey through their school communications including newsletters, Facebook posts and face-to-face meetings. Some reported that parent/carer knowledge increased and one school reported increased engagement of parents/carers with the school. Open days and showcases helped to celebrate student learning and also provided authentic audiences for students.

> *Word of the week in newsletters, open afternoons and information sessions: Term 3 Week 5, 20 parents in attendance (66% of total parents) … Increased parent knowledge in relation to the Digital Technologies curriculum (SCH15, final report)*
>
> *The [SCH13] Facebook page over the past two years has included Digital Technologies photos of events and learnings, which were liked by parents and the community. (SCH13, final report)*
>
> *Some participation of parents/community in students' learning. Some parents/ community have engaged in ICT when sharing student work. This includes QR codes at the shop, reviewing online Seesaw Portfolios. We would like to increase the engagement in the learning process. (SCH10, final report)*

Online safety

One case study school had a number of parents/carers concerned about online safety. The principal and CO held 2 meetings to provide information about online safety. This helped parents/carers feel more confident in their own use of online content and also in supervising their children's online use.

> *Our parent meetings, I just I was just blown away with how engaged they were and how interested they were. I really do think it was some really authentic conversations yesterday and they want to continue on with a couple more. So, kudos to [the CO] there. You did really well; you kept it real. (SCH04, Webinar 4)*
>
> *Parents have an increased understanding about online safety and their responsibilities as parents to ensure this for their children. This has included meeting parents online using Zoom. Parents asked for a second session as a result of the first session. (SCH04, final report)*

What was the impact of the DTiF project for students?

Schools and COs observed and reflected on the increased adoption of pedagogical practices suited to the Digital Technologies curriculum. The impact for students in DTiF project schools was increased student:

- knowledge, understanding and skills
- engagement
- agency and confidence.

Increased student Digital Technologies knowledge, understanding and skills

Noting that the numbers of students who completed the post-project assessments were considerably smaller than the pre-project student assessments, for example for Year 2 Computational thinking pre-project (n = 1032) and post-project (n = 296), the results do show an improvement in student ability from the start to the end of the project. However, the data would need further analysis to determine the effect size.

Based on the data collected and improvement from pre- to post-project student assessment across all tests and levels, there appears to be improved student capability that could be attributed to the DTiF project. In comparing the pre- and post-project student assessments, the following areas of highest growth were noted:

- Year 2: logical thinking and pattern recognition in computational thinking, and investigating in ICT Capability
- Year 4: digital systems in Digital Technologies, and investigating in ICT Capability
- Year 8: logical thinking in computational thinking, representing data in Digital Technologies, and applying social and ethical protocols and practices in ICT Capability.

Final reports from case study schools indicate gradual improvements in students' Digital Technologies knowledge, understanding and skills. Increases in computational thinking were particularly noted.

A number of case study schools collected data either using the DTiF student assessments, developing their own assessments or using the Bebras Computational Thinking Challenge.

> ***Through the process of this project and research questions we have been able to improve our pre-existing processes by critically analyzing the extra data collected through the project. Analysing this extra data this has allowed us to make more informed judgements on implementation and the students current computational thinking skill level. We found through the project we increased student engagement in DiT, had a 9% increase of students attaining a C grade or better within the LA, and an increase of confidence in teachers' use of ICT in the classroom.***
> ***(SCH16, final report)***

> ***An analysis of A to E data indicates a gradual improvement in achievement across semesters, particularly in the lower grades where implementation and exposure has occurred since Prep. Gradual improvements in achievement are also evident in the upper grades as well however this has been more difficult to achieve due to gaps in understanding resulting from exposure to the curriculum for only part of their previous schooling experiences. (SCH09, final report)***

Increased student engagement

Teacher reflections and final reports from case study schools indicate that students enjoyed the purposeful application of their Digital Technologies knowledge, understanding and skills to create digital solutions.

> ***Students enjoy the hands-on activities and are developing skills like computational thinking, data collecting, while using techniques such as algorithms and visual programming. Students are beginning to make connections between models and 21st century real-world systems. (Teacher reflection)***

> ***I noticed increased engagement from students when they were able to physically program the Bee Bots and teach the receptions how to program as leaders. In particular, one student who was always difficult to engage (Autism) found he was exceptional at programming and digital technologies became something he looked forward to every week. (Year 5 teacher, SCH12, final report)***

Increased student agency and confidence

Final reports from case study schools show examples of student agency and confidence within their own classrooms and other parts of the school where they mentored teachers and younger students. Students also became less fearful of failing and began to understand that they could learn through their mistakes. They also started sharing ideas with their teachers about how digital technologies could be used in other learning areas to collect data or to demonstrate their learning.

> ***The approach will be around student voice, agency and leadership. Instead of worrying about the expertise of the teacher, let the students run with it. Look for leadership opportunities for the students to lead others. (SCH14, Final report)***

> ***Persistence and communicating (asking another student to help and Digital Technologies language/ terms) have improved. (SCH13, Final report)***

COs also observed increased confidence in students as the project progressed.

> *... the risk-taking and the resilience of the students. They just dive in without any fear ... (CO, Reflective podcast, Term 2, 2018).*

What was the impact of the DTiF project for particular groups of students?

The project had positive impacts for the following groups of students:

- Aboriginal and Torres Strait Islander students
- girls

and for students located in areas classified as:

- Metropolitan
- Regional
- Remote and Very remote.

Aboriginal and Torres Strait Islander students

Many Aboriginal and Torres Strait Islander students benefited from learning opportunities that were offered as part of the DTiF project, which included a focus on story, exploring their local language, learning on Country/Place and programming robotic devices. They showed increased engagement and confidence.

> *Students are beginning to show more desire to pursue their own projects outside of class time and developing an understanding of how you'd go about developing a project ... Students in 7–9 have recently completed their own stories in both English and [their Indigenous language]. These 'bilingual' stories will form basis of work in Term 3. Students have begun to develop simple literacy games using Scratch. (SCH08, progress report 2)*

> *We have improved our understanding of the importance of hands-on learning for our students. We have implemented Digital Technologies in a way better related to the ways that Aboriginal students like to learn. We have made this achievable by teaching in topics and from an unplugged approach that moves to using devices such as Surface Go, Bee-Bot and Makey Makey when the students are ready. (SCH11, final report)*

Girls

Gender stereotypes

One of the case study schools had a particular focus on gender stereotypes. As the project progressed they could see evidence of changing attitudes.

> *As a part of respectful relationships, we did pre- and post-testing and it was looking at girls in jobs that involve technology. If we looked at our graph. ... At the beginning we had the really typical gender stereotypes where the mum took him to the doctor, it was a male, that the patient was a boy and the nurse was a girl. You can see the results there that changed. We're really pleased with the changing of their gender stereotypes. (SCH14, progress report 2)*

A number of case study schools indicated an increase in engagement and confidence by girls, which they attributed to Digital Technologies activities. When female staff upskilled they provided positive role models for students. However, in one case study school they felt the balance had been tipped too far and they needed to reflect on the needs of the boys.

> *One of things that we're finding is that we've got a lot of girls engaging … (SCH13, Progress report 3)*
>
> *[Our school is] promoting participation of girls by role modelling (SCH14, Progress report 4)*
>
> *… our data showed girls were more engaged (SCH14, Teacher reflection)*

COs noted that girls were engaging to a greater extent with digital technologies and with more enthusiasm than before the project.

> *One student came up to me and told me last week that she really loves coming to school … 'there's so many exciting things that happen now … I really love exploring technology'. And this was a student that really hadn't touched much technology. She's in Year 4 and this is a student who also had a very high rate of absence last year and would openly admit that she hated school, but that has really turned around now in her excitement and her thinking. She's probably one of the more confident students in that class now. (CO, reflective podcast 3)*

Metropolitan

Progress reports and final reports from metropolitan schools indicate greater confidence using digital technologies. Students often did not have access to any devices other than phones at home so their exposure at school was critical to developing their ICT capability.

> *… there's definitely been a change, like [teacher] said, in the attitudes of our students towards tackling tasks. Kids who would never, never pick up a computer or a laptop in school will now happily go and collect one and have a go if it's time to do something, which is a great change. (SCH06, progress report 3)*

CO and teacher reflections indicate increased engagement with and increased confidence to use digital technologies.

> *… the students really enjoyed the things that were done and would like to continue learning more and engaging with the digital technology side of things. (Teacher reflection)*
>
> *Teacher engagement in those times was fantastic, as was student engagement … some really good ideas were added and students really seem to love the activities.*
> *(CO reflection)*

Regional

Students in regional settings often had limited understanding of how digital technologies were used in their local communities. The DTiF COs helped teachers and students to see where and why digital technologies were being used and how to make connections within their local area. Students and school communities began to appreciate why ICT capability and knowledge of Digital Technologies was important. PL for teachers and workshops for students helped to improve student engagement and confidence.

> *Students have been having access to externally offered opportunities, which is absolutely great … We've been taking kids to a lot of workshops and things like that which have been linking onto the STEM, which has been absolutely fantastic. (SCH16, progress report 2)*
>
> *When the project was first introduced, our students were using the devices for very limited purposes. Now they are more confident and are willing to try different things with the use of these technologies … Students were disappointed that we didn't have timetabled digital technologies sessions every term. (SCH14, final report)*

Remote and Very remote

The impact for students in geolocations classified as remote and very remote was significant. Progress reports and final reports indicate it was very rare for external support to be available so frequently and for such a long time. The frequency of the visits over a few years was key to building relationships with students and teachers alike.

> *Increased student engagement and an illustration of improved computational skills indicated via the BEBRAS Challenge results. (SCH15, final report)*
>
> *Students have gained more independence in relation to the process of designing and generating digital solutions to real world problems … Perhaps the most telling evidence of the impact of this project on student engagement and understanding are the visits from past students who have entered secondary schools and have been disappointed by the lack of understanding and/or implementation of Digital Technologies at their new schools. (SCH09, final report)*

CO and teacher reflections also showed increased student confidence and capability.

> *I look at our students to show them something and then they pick it up and they run with it. They can program something that is beyond my capability. (Teacher reflection)*
>
> *Tied in with that is an increasing ability of students*

> *to ask questions rather than ask for answers. This is becoming more prevalent, particularly in the primary school where the students can stay focused on a problem but ask a whole bunch of questions rather than simply look for the first solution that comes to mind. (CO, reflective podcast 3)*

What was the impact of the exogenous influences from the schools' professional learning ecosystems? Did those schools engaging with more external influences demonstrate higher levels of impact?

The PL ecosystems provided a tangible way for COs to communicate with schools about the resources outside the school gate. Progress reports from case study schools indicate that connections with local schools, industry and community organisations increased.

> *We're going to make stronger links to our feeder schools, because this is actually going to help our transition program and hopefully increase participation in all these great initiatives that have been offered. (SCH16, progress report 3)*

One of the case study schools in a remote area partnered with another DTiF school to apply for another national program which required further engagement with other schools in their location and with local industry. COs indicated that those schools that made strong connections beyond the school were more likely to sustain change.

> *... as part of the grant, [we've] got to connect with community and also with businesses and industries. (SCH13, progress report 4)*

COs reflected on whether schools that had engaged with more external influences demonstrated higher levels of impact. The conclusion was mixed, but there were some powerful examples of the impact external parties can have on schools.

> *All of my schools that seem to have demonstrated more sustainability of the project were engaged with external people/organisations ... My schools that didn't look outside the walls of their classroom really didn't get much traction and are probably still at the beginning stages. Those schools that did have projects in place or understand how to implement them better where digital solutions are being designed and not just 'programming things' for the sake of it. (CO reflection)*

> *Some [state] schools engaged with outside sources and were quite successful delivering DT and/or high achieving projects ... They also all had admin that cracked the whip and ensured all staff engaged not only with the project but with implementing DT. I'd*

> *say the admin role was the most critical aspect. (CO reflection)*

5.2.2 Outcomes: including transferability of outcomes to schools outside the project

What outcomes were achieved in each school?

Schools recorded their outcomes in their progress reports, final reports, teacher reflections and collaborative discussions with COs for the completion of the review scale.

> *The effects of these actions have been an enhanced and deeper understanding of the Digital Technologies curriculum, which has led to what could be deemed as a successful implementation of the DT curriculum. This is evident through the expansion of our course offerings and the improvement of the learning area grade allocation. (SCH16, final report)*

The key outcomes for teachers were:

- increased understanding of Digital Technologies curriculum
- increased ICT capability
- effective implementation of Digital Technologies
- deeper understanding of computational thinking and how to integrate it with other learning areas
- professional confidence to plan teaching, learning and assessment
- increased collaboration with teachers and students.

The key outcomes for students were increased:

- confidence and independence in using digital technologies
- engagement in their learning
- ICT capability

and improvements in:

- computational thinking
- design thinking, problem-solving and resilience.

See Section 5.2.1.

How was the learning from the project shared and transferred with schools within and beyond the project?

Newsletters and website

The project lead and COs published 15 newsletters sharing stories and resources. The newsletter has more than 800 subscribers and archived newsletters are published on the DTiF website. The website has had more than 100,000 unique page views.

PL workshops

Throughout the DTiF team offered workshops to further assist teachers in implementing the Digital Technologies curriculum. In addition to providing PL to teachers in the project, teachers outside the project were invited to attend workshops. Just over half (53 per cent) of participants were from non-project schools. Workshops and modules were rated on a scale of 1 to 5, with 1 being of limited use and 5 being very useful. Industry standard for survey response is 30–40 per cent. A total of 1,716 people participated in PL workshops and 934 (54 per cent) responded to the survey.

Average overall satisfaction with all workshops is 4.4 out of 5.0. This high level of satisfaction is also reflected in the comments, which are mainly positive. The DTiF team appears to have delivered workshops to meet the needs of the participants.

5.2.3 Methodology: including transferability to similar initiatives

How effective was the methodology of the DTiF project?

The people, processes and products of the DTiF project methodology have all contributed to the positive impact and outcomes for participating schools. While some elements could be further enhanced, many have proven to be very effective and have been shared with educators planning similar PL.

People

The key 'people' methodology was the PL ecosystem for each school.

PL ecosystem

The post-project teacher survey indicates that 81 per cent of case study schools identified they had made connections outside their school. This is a 22-percentage-point increase from the pre-project survey (59 per cent).

> *Accessing local experts and universities has helped a great deal. (Teacher reflection)*
>
> *Networking with Dept of Ed staff in Sydney that I never would have known about, so that we are now part of the Minecraft online community chat and have made contact with staff from the T4L team. We were successful in being given a small grant from [organisation] to build a wicking garden as part of our Science and Technology unit. (SCH04, final report)*
>
> *The support that was given from [jurisdiction], and also from our local curriculum officer here, was very beneficial. (SCH02, progress report 2)*

COs were surprised that many schools were not seeking or making connections with their communities or others before the project started. The PL ecosystem formalised the identification of people who could help them to support implementation or to help students see why learning Digital Technologies was of value.

> *... one of the things that has surprised me is a lot of these schools are doing it [implementing curriculum] on their own. They're not networking, they're not talking to each other, they're not supporting each other along the way and so a lot of these schools feel like they're very isolated. So being able to bring schools together has been really good... (CO, reflection)*
>
> *... teachers have stepped up their level of understanding and started to connect what they're doing to their communities and to industry. (CO, reflection)*

Processes

Introductory workshop

The introductory workshop was presented nationally in 25 locations at the start of the project. Its purpose was to introduce the project, give an overview of the Digital Technologies curriculum and guide participants through the action research process.

The average overall satisfaction score was 4.1 out of 5.0. Some schools that joined the project late were introduced to the project by a 90-minute vodcast or informal face-to-face discussion.

All schools were able to develop a project proposal; however, those who participated in the introductory workshop found this easier as they had already begun to explore ideas for their action research in the workshop.

Mentoring

The mentors (COs) were the critical part of the project. Their commitment to their allocated schools over 2 to 3 years made a significant difference for schools. The role of the COs was highly valued by schools. They provided effective strategies for implementation, assisted with planning and provided a sounding board for ideas. Case study schools reiterated this on multiple occasions:

> *[CO] came and modelled lessons in each of our classes and then we had a debrief session with staff, at our staff meeting. Staff found this to be really valuable and managed to see how easy digital technologies is (Progress report 2, SCH07).*
>
> *It's been through this process of being part of this project that we've actually been able to improve these processes that we've been going through ... I've never done much data collection before, even though you know teachers are supposed to, but I've actually been sitting down with some very knowledgeable people and I have learnt a lot. I'm able to read it, I'm able to bring it out and I'm actually able to do something better with it. So thank you for that [CO], for being part of that. (SCH16, progress report 3)*
>
> *[CO] has been a huge resource to us over the period and it's just great to walk around and see [CO] in action. She was out last week with our students and with our staff and just providing that support is invaluable. (SCH15, progress report 4)*
>
> *Coming in and having [CO] into the classrooms to showcase what DT is all about has been the most effective strategy that we have utilized. (Teacher reflection)*

COs used a range of strategies to help teachers to feel more confident in implementing the curriculum, including lesson demonstrations, side-by-side planning, lesson observations and providing PL for staff.

> *The most effective strategy is running a lesson demonstration followed by a debrief with the teachers ... at some schools ... I spend one day working in each of the classrooms so spending around an hour running a session that is focused on current curriculum within the school that integrates Digital Technologies and then the following day spend an hour with that teacher looking at the lesson demonstration exploring the lesson, identifying the learning intention and exploring next steps and working with the teacher to discuss and build capacity around the Digital Technologies curriculum (CO, Reflective podcast, Term 2, 2019).*
>
> *... the schools who have had staff stability are most likely to sustain the project outcomes. Schools who continue to offer support and mentoring to incoming teachers are most likely to succeed. Schools who work collaboratively with like schools or geographically close schools are also likely to result in more sustainable outcomes. (CO, Reflective podcast, Term 1, 2021)*

Teacher reflections were positive about the role of the mentors:

> *... having the curriculum officer come into the classrooms to showcase what Digital Technologies is all about has been the most effective strategy that we have utilised ... and for them to share*

their knowledge about what they know. (Teacher reflection)

Being able to work closely with [DTiF CO] at [school name] during the project supported us to develop collaborative cross-curricular units of work in this area. As the new STEM specialist teacher, I worked with [DTiF CO] to design and implement units of work across the Science, Maths and Technologies curriculums, incorporating these subjects with our Stephanie Alexander Kitchen Garden program. The units involved using micro:bits for soil moisture testing as well as creating websites and QR code signs in the garden to encourage community access of our students' research on the plants. Future collaboration … we are putting plans into action for skill and resource sharing workshops [with another school] once a term. (Teacher reflection)

COs reflected at the end of each term on those strategies that were most effective. A key message was the importance of developing teacher expertise in planning teaching, learning and assessment.

… a key strategy that I've attempted to use also is to just focus on getting [primary] teachers to understand the Australian Curriculum as a whole and how to source the resources that they might need and how they might integrate their units, because I've engaged with a lot of schools that are still teaching each individual subject as a silo and they're struggling with that, with the context in which they're teaching, so if I can focus on giving the teachers the skills to manage the curriculum as a whole then we can deep dive into particular learning areas … but if they've got the skills to manage the curriculum and integrate it into their units of inquiry then they've got some skills that can continue into the future (CO, Reflective podcast, Term 3, 2019).

Action research and an iterative process

The opportunity for schools to develop their own action research projects to suit their unique school context was very positively received, with most identifying extra opportunities to collect data and evidence of growth. Eighty-one per cent of case study schools conducted research on Digital Technologies implementation in their schools and are using that data to inform teaching and learning. The case study for SCH13 is one such example. See Appendix.

… we surveyed our teachers' perceptions in their confidence using ICT in the classroom. We administered this survey at the beginning and at the end of our project. This data indicated a change in teacher perceptions in regards to the confidence of the use of ICT in their classroom once they have completed the identified targeted professional learning relevant to the learning areas that was provided. (Teacher reflection)

We provided time; our aim was to embed Digital Technologies in our planning across all our teaching. So we provided extra release time for our staff to work together and it became easier for them to embed and made a huge difference. (Teacher reflection)

As COs progressed through the project they developed greater expertise as mentors and highlighted the importance of schools regularly reflecting on the project proposals and using an iterative process as shown in Figure 3 (Section 3). That is, in the words of one CO: 'Treat them more as living documents rather than static'.

Some of them have changed their project plans from necessarily the garden project to a bit more teacher capacity, purely because they realised that the garden projects won't happen unless the teachers feel that they've got some capacity to teach it. (CO reflection)

… began the project with a joint project focus with another school. Both schools quickly realised they had very different student and staff communities and needed to concentrate on their own situation. SCH04 also had a change in teaching principal at the start of the project. The school decided to focus on building teacher and student capability in Digital Technologies. Their capacity with ICT was quite good but [they] had little understanding of the curriculum/syllabus expectations. (CO reflection)

TPACK framework

TPACK along with teachers as designers underpinned the DTiF methodology. While it was important for teachers to hit the 'sweet spot' between the 3 types of knowledge, it was more important that teachers had a deep understanding of the content knowledge, then how best to teach it, and then how to use educational technologies and digital technologies effectively. If teachers did not understand computational thinking then it was difficult for them to teach it effectively and use technologies. There is a progression of learning for teachers too.

Templates

Schools indicated that the templates were easy to use and manageable. The project proposal and final report templates reflected the stages of a design process and

scaffolded a process for 'teachers as designers'. The resulting proposals provided a consistent document for COs to review. Final reports were completed by 85 per cent of schools.

The progress report (5 slides in 5 minutes) was a relatively quick way for teachers to reflect on their progress at points in time. Most schools found the progress reports as webinars manageable and a good way to make connections with other schools. However, some found them challenging to prepare. There may need to be more flexibility around how to manage progress reports. As a data collection source they were invaluable as they provided not only a visual artefact but also an audio record.

Professional learning

Eighty-seven per cent of case study schools identified upskilling staff as pivotal to implementing Digital Technologies, whether that was attending DTiF workshops or other PL.

A total of 1,716 people participated in PL workshops and 934 (54 per cent) responded to the surveys. Average overall satisfaction with all workshops was 4.4 out of 5. This level of satisfaction is also reflected in the comments, which were very positive and included constructive feedback. The number of workshops that could be held in 2020 was constrained by COVID-19. Below are some examples of the feedback given:

Computational thinking

- We were able to spend time on the activities of our choice which meant we learnt at our own level.
- So relevant and can apply terminology for the kids to use.
- Amazing to share and talk with other staff, bouncing ideas off each other.

Key ideas and skills

- Great activities that I will be able to take back to my class and use. We were looking at the implementation from both the mathematics and the digital technology aspect.
- Interesting conversations around project management, particularly helping older primary students become more responsible in their project work.

STEM connections

- The information about STEM dimensions demonstrated a clear link across curriculum areas and the mapping activity was a practical way for me to see these links for myself – across both content and skill development.
- I am dedicated to integration rather than stand-alone so the connecting ideas session showed different ways to do this. Very helpful and practical.

Eighty-seven per cent of the 16 case study schools identified that staff at the school completed the University of Adelaide's CSER massive open online course (MOOC) either as individuals, as a project team or as a whole staff. In one school, teachers also completed the F–6 Extension MOOC.

> ***We have 100% of the people who have completed MOOC and we have them playing, experimenting, using digital technologies in their classroom. (SCH13, webinar 4)***

Products

Progress reports

Progress reports, presented as PowerPoint presentations in geographic cluster webinars, gave an opportunity for schools to reflect and to learn from others. For some this was viewed as a burden, but for most it was helpful to keep them on track and to hear what others were doing. Over time many of these became collaborative discussions about next steps. COs enhanced the templates and improved the agenda. The participation of the COs in webinars for other clusters was very useful for their own understanding of project challenges and also provided extra audience members who were able to comment and critique.

Final reports

Final reports provided an opportunity for teachers to showcase what they had achieved over the project and also an opportunity to develop report writing skills. Each school report was reviewed by 2 COs or critical friends so that teachers and schools could demonstrate all that they had achieved.

Website and newsletters

The DTiF website was updated at the beginning of each term. Updates to school stories shared the story so far in 9 schools from across the country and jurisdictions. Resources were gradually developed and published. Resources include: assessment tasks, classroom ideas, and tutorials and webinars with experts. At the winter school (June 2021), participants were surprised at how many more resources had been added. The reach of the website is extended through updates on the Digital Technologies Hub. The newsletter was published on the website each term and COs were able to highlight successes from their schools.

> ***Two teachers both had opportunities last year to work as part of a grad certificate on digital technologies. Their teacher capacity has been enormous. Both those teachers have had their work published on the Digital Technologies Hub, they've been highlighted in the Digital Technologies newsletter in June this year [2019], and their work has been shared amongst staff around other schools and acknowledged by the department of education. (Curriculum officer, reflection)***

What features of the project could be applied for similar purposes?

Based on the findings above, the following features of the project would be suitable for similar PL and curriculum implementation support.

People

- PL ecosystem
- Mentors

Processes

- Action research
- Iterative process
- Templates
- PL workshops and online webinars

Products

- A website or newsletter

What modifications are recommended?

Based on the findings and final discussions with the COs, there are 7 recommended modifications to the methodology:

1. Mandate leadership involvement from the start.
2. Develop teacher planning skills further.
3. Resource relief teacher supply.
4. Plan for sustainability by developing induction programs.
5. Introduce 'summer' school earlier.
6. Make progress reporting more flexible.
7. Allow more time for reflection.

1. Mandate leadership involvement from the start

While it was strongly recommended that a member of the leadership team participate in the introductory workshop, it should be essential, and leadership must be engaged from the start. In those schools where leadership, in particular principals, strongly promoted the project to staff there were higher levels of engagement and hence increased success with implementing Digital Technologies.

2. Develop teacher planning skills further

The importance of teachers' skills to develop teaching, learning and assessment plans cannot be underestimated. Where staff are provided with plans that they have not contributed to there is less engagement and lower levels of understanding of what is expected. While developing planning skills was a key role for mentors, and the project had a PL workshop that focused on this, there is a need to amplify it, possibly by including it in the introductory workshop, which may need to be 2 days instead of only one day.

3. Resource relief teacher supply

One of the challenges in schools in areas classified as regional, remote and very remote is the availability of relief staff. And this is also sometimes the case in metropolitan locations. The COs were sometimes unable to spend time with teachers because there was no relief teacher for their class. Travelling with a teacher or another CO who could teach classes while the planning meeting was underway could also help with the second recommendation to further develop teacher planning skills.

4. Plan for sustainability by developing induction programs

While part of the final report template includes plans for next steps, sustainability could be enhanced by assisting schools to develop an induction program for new staff. As noted by one of the COs, this is not a common feature in the project schools and could go some way to helping sustainability of curriculum implementation.

> ***It is also surprising to see that, despite a common issue being the revolving door of teacher transfer with concomitant need for frequent and repeated TPL, this issue is often not identified in long-term planning. Suggestions of "perhaps the role of DT could be addressed in new staff induction", or "maybe new staff selection criteria could include demonstrated experience with integration of DT" are met with: "Oh, that's a good idea" or "We don't really do induction". (CO, Term 4, 2020)***

5. Introduce 'summer' school earlier

Introducing an intensive engagement 'school' for project leaders midway through the project could assist in building greater buy-in for the final stages of the project and to allow more time for the professional networks to develop before the project closed.

6. Make progress reporting more flexible

Most schools found the progress reports as webinars manageable. However, there may need to be more

flexibility around how to manage progress reports, for example options such as reflective podcasts.

7. Allow more time for reflection

Scheduling time when some COs do not go out to schools, but rather analyse, interpret and write papers related to the data should become part of the process. While this was planned for the end of the project, the impact of COVID-19 affected the time available, and there would be value in doing this earlier in the project.

Do the outcomes and impact provide evidence of the efficacy and scalability of the methodology?

The DTiF project was modelled on aspects of an ASISTM project, Technology education K–8: Design in practice, which involved 6 schools. The DTiF project involved 160 schools, about 20 schools for each curriculum officer.

Efficacy

The number of schools in the DTiF project was manageable and the length of time working with schools (2.5–3 years) was effective in that it allowed sufficient time to build relationships, understand the school and its community, and provide PL and support to at least one new cohort of staff.

Deploying COs within their own state or territory might reduce travel costs; however, in terms of effectiveness there were benefits to a state or territory to have COs with different experiences working with their schools.

The summer school and winter school proved to be very effective at building teacher confidence and professional networks. Introducing these PL opportunities earlier in the project would allow for participants to become leaders in their local areas. This would help to increase the efficacy of the project.

Scalability

To scale up the DTiF project, a project lead and project management team including a manager in each state or territory would manage up to 10 curriculum officers, supporting potentially 200 schools in larger states. At least one project officer per 150 schools would be needed.

While there would still be a need to create new resources, there are now a suite of resources and PL workshops ready to implement. This would make the project scalable more quickly. Further research on scaling long-term PL projects to reach a broader audience, with a particular focus on project management, would be desirable.

How did the professional collaboration influence change at the following levels: macro (systemic, national, state); meso (district and region); micro (individual and school)?

Macro changes

The DTiF team collaborated with state, territory and jurisdiction education consultants to develop PL and to ensure they presented content appropriate to the location. An example was a small schools conference where teachers from a number of regional small schools invited the CO and jurisdiction STEM officers to present and help them with planning. This informed future PL for small schools offered by the jurisdiction officers.

The team also collaborated at a macro level with other projects, particularly those funded through the NISA such as the Australian Computing Academy (ACA), the CSER Digital Technologies project, and organisations including Education Services Australia. The collaborative assessment task project with ACA informed resource development for both projects.

Also, COs built relationships with government organisations such as CSIRO, and industry and business groups providing implementation support such as Google and Apple, and professional teacher associations such as the Australian Association for Computers in Education and state affiliates. The PL and resources developed by these organisations both informed DTiF and were informed by DTiF.

Meso changes

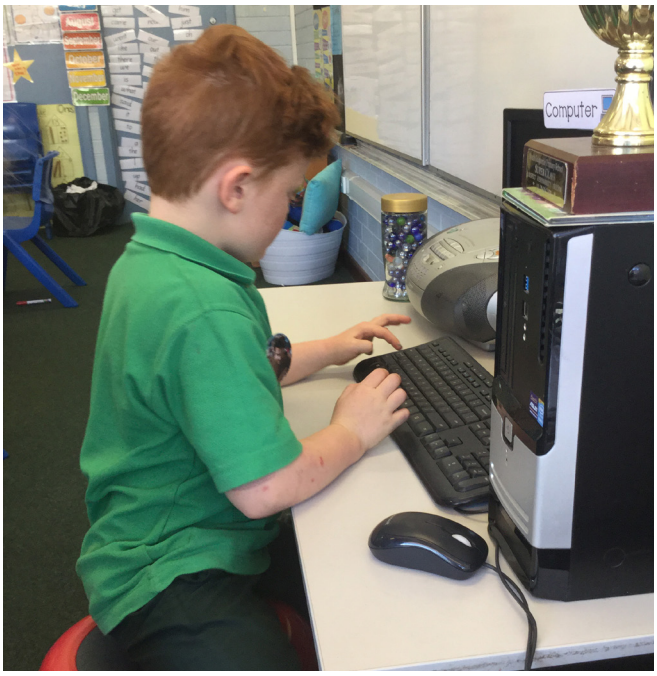
The collaboration between COs and regional officers (meso level) was very positive. Regional officers co-presented, organised venues, promoted PL and shared their knowledge of local custom and practice. Many of the regional officers, particularly those in more isolated locations, indicated their appreciation of the collaboration with DTiF COs as it informed their PL offerings and resource development.

Micro changes

Professional collaboration was a feature of the DTiF project. At the micro level, the COs as a team were very supportive of each other and contributed to each other's PL.

Positive collegial relationships between COs and school personnel were critical to the success of the project. Many schools had rarely had visitors to their schools to provide PL. The collaboration between staff within schools and with local schools was also enhanced.

> ***Teachers have begun on the road to meaningful integration of technology and the curriculum. The***



> *new staff that have entered the school have picked up on the high standards that we have set in regards to Digital Technologies and are keeping in line with that high standard. (SCH15, final report)*
>
> *I ran a Digital Technologies enrichment workshop with students from ten other primary schools today in the [place], which was great, and implementing some of the things that I've learned from [DTiF COs] around Digital Technologies (Progress report 3, SCH01)*

5.3 External evaluation report findings

Deakin University was contracted to complete an external evaluation of the project from 2018 to 2020. The evaluation focused on 6 schools from 4 states and territories as a representative sample of all jurisdictions. It gathered qualitative data to create rich case study accounts of each school's engagement in the project and the impacts and outcomes. Deakin produced 2 reports: a progress report and a final report. In addition, it developed 4 printable resources to highlight considerations when planning Digital Technologies implementation.

The Deakin team's analysis concluded that in each school, student engagement, inclusion and achievement was high, and this extended beyond Digital Technologies to other learning areas and general capabilities, in particular ICT Capability, Critical and Creative Thinking and Literacy. Similarly, the project stimulated teacher-led innovation and professional networking between schools. It also strengthened the curriculum and pedagogic knowledge of teachers, their technical skills and their ability to design coherent teaching and learning programs, and where these aligned, schools reported the greatest success. However, some schools faced challenges in building teacher capability due to limited funds to support PL and negative teacher attitudes.

Data analysis also revealed the need for schools to be agile when responding to specific contextual circumstances, such as relying on education assistants as a point of continuity where staff changes are high. Some schools faced competing priorities, requiring strong school leadership to maximise the benefits of this project and minimise the risks that threatened its sustainability. For other schools, the ability to implement the curriculum successfully was hampered by a poor technical environment, while for those schools with a robust one, it was considered pivotal to the project's success.

The evaluation revealed many positive attributes of the DTiF project with respect to the transferability of its methodology to other initiatives. A key finding was the critical role of mentoring played by the COs. They were flexible and responsive when providing face-to-face and online support. They also played a vital role in establishing links between schools that shared some common characteristics. This positive finding contrasted with the schools' responses to action research. Unanimously, it was viewed as an extra requirement not aligned to a teacher's main work; however, the schools acknowledged the importance of audit and review, and the value of setting timelines and milestones.

Deakin University's report also highlighted how the successes of this project could be shared with disadvantaged schools outside its reach by curating existing resources into a multimedia package, providing ongoing support to schools, where needed. According to Deakin's evaluation, the DTiF project afforded many positive teaching and learning outcomes for disadvantaged schools, and its model was 'setting the DTiF apart from other shorter-term, less responsive professional learning opportunities' (Supporting the Implementation of Digital Technologies in Disadvantaged Schools, 2020, p. 10).

See the Digital Technologies in focus website: https://www.australiancurriculum.edu.au/resources/digital-technologies-in-focus/about for the progress report, the final report and printable resources.

6. CONCLUSION AND RECOMMENDATIONS

This section focuses on the conclusions drawn from the project in terms of impact of the project for participating schools including sustainability of Digital Technologies implementation within project schools; the outcomes of the project for students and teachers within the project and for schools outside the project; and the effectiveness of the methodology of the DTiF project including its transferability to similar initiatives. It also identifies recommendations for modifications to methodology, future research, resources and PL.

6.1 Conclusion

A key aim of the DTiF project was that implementation of the Australian Curriculum: Digital Technologies be sustainable and not reliant on continued support from the COs. If we consider project proposals; and teaching, learning and assessment plans as the intentions of schools then impact should be reflected in observable classroom practice and student assessment data, and outcomes should be evidenced in student work samples and the project legacy products. The effectiveness of the methodology is evidenced through the collected data on the people, processes and products, in particular the progress reports, final reports, teacher and curriculum reflections and the review scale.

Measuring success

The measurement of the success of the project was based on 3 components:

1. **impact:** success including sustainability within each participating school
2. **outcomes:** including transferability of outcomes to schools outside the project
3. **methodology:** including transferability to similar initiatives.

For each of these components there was a dual purpose. First, to confirm that the 'people, processes and products' were achieving results and to inform next steps, for example clarifying PL needs. Second, the success of these components was measured to contribute to research on Technologies education and TPL, particularly for those working with disadvantaged schools.

Key messages

Four key messages emerged from the project. These are the value of:

- using curriculum implementation as a framework for pedagogical change
- building teacher confidence in planning teaching, learning and assessment skills and strategies
- mentoring teachers in disadvantaged schools to provide effective curriculum implementation support
- ongoing engagement with schools to sustain long-term change.

6.1.1 Impact: success including sustainability within each participating school

The impact of the DTiF project is reflected in the success within each participating school and the potential for sustainability at the close of the project.

Teachers

The impact of the project for teachers was very positive. There was a significant increase in engagement with the Digital Technologies curriculum and an increase in teachers' Digital Technologies knowledge, understanding and skills. This is evidenced through the development of teaching, learning and assessment plans for Digital Technologies for all band levels; improved use of terminology; increased ICT capability and the confidence to integrate Digital Technologies with other learning areas. Teachers also transferred their learning from Digital Technologies, such as computational thinking, to other learning areas.

There were changes in pedagogy as a result of participating in the DTiF project, with teachers and students engaging collaboratively. An unintended impact reported by teachers was increased collaboration within schools and between cluster schools. Final reports from case study schools highlighted there was increased sharing of ideas and resources, team teaching, planning and support.

A positive impact of the project was on teacher professional practice. The DTiF project gave the opportunity for project leads and teachers to increase confidence and to further develop as leaders in their schools and local networks.

Students

Across geolocations, the impact for students in DTiF project schools was increased student knowledge, understanding and skills; increased engagement; and increased agency and confidence. Students enjoyed the hands-on activities and the purposeful application of their Digital Technologies knowledge, understanding and skills to create digital solutions. COs observed increased engagement and enthusiasm from students as the project progressed. Students mentored teachers and younger students. They became less fearful of failing and learning to learn through their mistakes.

Many Aboriginal and Torres Strait Islander students benefited from a focus on story, exploring their local language, learning on Country/Place and programming robotic devices. A number of schools indicated an increase in engagement and confidence by girls, which they attributed to Digital Technologies activities. The benefits of the project for all geolocations were positive; however, students in regional schools gained a deeper understanding of the importance of ICT capability and knowledge of Digital Technologies in their communities. The frequent visits by COs were appreciated by students and the levels of confidence in using digital technologies increased.

School community

There was an increased understanding of the place of digital technologies in school communities and in the local community, and a greater understanding by parents/carers of the importance of online safety and teacher and parental or carer responsibilities. Eighty-three per cent of case study schools indicated that the project had a positive impact on the school community.

6.1.2 Outcomes: including transferability of outcomes to schools outside the project

The outcomes achieved in project schools and partner schools include improved understanding of the difference between the ICT Capability and Digital Technologies; increased confidence to integrate Digital Technologies with other learning areas; enhanced use of technical vocabulary; and deeper understanding of the intent of the Digital Technologies curriculum, particularly in relation to computational thinking.

The evidence of these outcomes is found in the final school reports; the growth from pre- and post-project teacher surveys, teacher self-assessment matrices and student assessments; CO and teacher reflections; and review scale.

The learning from the project was shared and transferred within and beyond schools through the PL workshops, publication of the DTiF newsletter, updates to the DTiF website and more informally through the DTiF wiki. COs shared their expertise at summer school and winter school and participating teachers developed informal networks.

It was particularly pleasing to hear statements from schools that their engagement in the project had allowed them to cope more confidently with students learning from home during COVID-19 restrictions. Project schools indicated that they were more ready to undertake online learning than they would have been without the DTiF project.

The key implications are that the methodology (people, processes and products) of the DTiF project contributed not only to positive impacts for each project and partner school but ongoing support for any school by providing a repository for resources and PL webinars.

6.1.3 Methodology: including transferability to similar initiatives

Based on the data from the progress reports, final reports, CO and teacher reflections, workshop evaluations and qualitative research analysis, the methodology was effective. There was a prolonged engagement in the project by most schools, and an increase in teacher and student capability in relation to ICT Capability and Digital Technologies.

People

Mentors

The feature of the project that seem to be particularly appropriate for similar implementation projects are experienced educators as COs providing a mix of face-to-face and online support. The face-to-face strategy and the length of time that COs were able to engage with the school allowed for critical positive collegial relationships to develop that resulted in the COs becoming part of the school. Teachers and students indicated they liked having access to their expertise. COs working in schools and understanding the school context was key to the success of the project and to developing teacher professional practice.

Professional collaboration was a feature of the DTiF project. At the micro level, the COs as a team were very supportive of each other and contributed to each other's PL.

PL ecosystem

The PL ecosystem was a key element of the DTiF project methodology. It provided a systematic way of communicating to all schools about the support that was available to them and the relationship of their school to others in their cluster. It allowed for clear and consistent messaging for schools across the country and to reinforce the value of reaching outside the school gate. It provided a tool for COs to use in their conversations with schools about project progress. There is evidence that there was increased collaboration with local schools and the school community.

The collaboration between COs and regional officers (meso level) was very positive for the project and for schools. The DTiF team collaborated with state, territory and jurisdiction education consultants to develop PL and to ensure they were presenting content appropriate to the location. They also collaborated with other NISA funded projects such as the Australian Computing Academy and the CSER Digital Technologies project; and other organisations including Education Services Australia, CSIRO, and industry and business groups.

Processes

The processes included data collection through pre-project and post-project school surveys; engaging schools through the introductory workshop; supporting schools to develop and report on an action research project using templates that reflected the Technologies processes and production skills strand; mentoring; developing and providing PL workshops; and building PL communities through regular webinars and project focus clusters and hosting summer and winter schools.

The opportunity for the school to develop their own action research project to suit their unique school context was very positively received by many schools, with some identifying extra opportunities to collect data and evidence of growth. The templates for the project proposal, progress reports and final report provided a clear and consistent way for teachers to provide documentation that was useful to the school as they worked through the project, but also provided reliable data sources for the development of case studies for evaluation.

The impact and outcomes of the project provide evidence that the project methodology is effective and is scalable. Twenty schools per CO was manageable, but if this were increased then their effectiveness would be diminished. Eight to 10 COs was manageable for a project lead in terms of employee management, finance and travel approvals, and logistics. If a project were to have a broader reach then there would need to be a project lead for at least every 200 schools, a project manager to provide oversight and project management for the entire project. Project officer and administration support allowed the COs to focus on their schools and the deliverables rather than logistics.

Products

The products of the DTiF project are the action research projects designed by the schools to facilitate implementation of the curriculum; the case studies created by the external evaluator and the internal qualitative research; the school stories published on the project website; the data repository; and the quantitative and qualitative reports summarising the project findings.

In addition, there are PL workshop materials and a broad range of resources published on the DTiF website.

The website has been well received but needs to be more actively promoted to increase its impact for schools other than DTiF schools.

The case studies were developed for evaluation purposes but could be developed into resources for a teacher

education audience or for a teacher audience.

Reflection on evaluation strategies

The evaluation strategies were mostly successful. They not only informed the project as it progressed and iterated, but also provided evidence of the impact, outcomes and success of the methodology. The qualitative data collection and analysis was reliable because the datasets were more complete than the quantitative datasets. The main challenge was the reduced completion rates post-project for the teacher survey, teacher self-assessment matrices and the student assessments. While the effect size was calculated for the teacher self-assessment matrices and this was positive and supported the patterns in the raw data, further analyses would be required to determine the effect size from the teacher survey and student assessments data.

6.2 Recommendations

This section identifies recommendations for modifications to methodology, future research and PL.

Recommendations for modifications to methodology

The following modifications to the DTiF methodology are recommended:

1. Mandate early leadership involvement

While it was strongly recommended that a member of the leadership team participate in the introductory workshop, it should be essential, and leadership must be engaged from the start.

2. Develop teacher planning skills further

The importance of teachers' skills to develop teaching, learning and assessment plans cannot be underestimated. Side-by-side mentoring is very important as well as targeted PL. To support this, adequate teacher relief is needed.

3. Resource relief teacher supply

One of the challenges for schools in areas classified as regional, remote and very remote is the availability of relief staff. And this is also sometimes the case in metro locations. Travelling with a teacher or another CO who can teach classes while the planning meeting is underway would help with recommendation 2.

4. Plan for sustainability by developing induction programs

While part of the final report template included plans for next steps, this could be enhanced by assisting schools to develop an induction program for new staff.

5. Introduce 'summer' school earlier

Introducing an intensive engagement 'school' for project leaders midway through the project could assist in building greater buy-in for the final stages of the project and to allow more time for the professional networks to develop before the project closed.

6. Make progress reports more flexible

Most schools found the progress reports as webinars manageable; however, there could be more flexibility around how to manage progress reports, for example using options such as reflective podcasts.

7. Allow more time for reflection

Scheduling time when some COs do not go out to schools, but rather analyse, interpret and write papers related to the data should become part of the process. While this was planned for the end of the project, the impact of COVID-19 affected the time available, and there would be value in doing this earlier in the project.

Recommendations for further research

8. Conduct research on assessing achievement, assessment validation, and scaling PL project

a. assessing student achievement in computational thinking, Digital Technologies and ICT capability. The assessments have been developed and validated for Year 2 and Year 4; further use of these by schools would help to provide data on student knowledge, understanding and skills to inform future PL and curriculum refinement.

b. validating the Year 8 questions before using them to assess student achievement more comprehensively

c. scaling long-term PL projects to reach a broader audience, with a particular focus on project management.

Recommendations for further resources and professional learning

9. Develop, publish or offer DTiF resources and PL

a. The Review of the Australian Curriculum will be complete by the end of 2021. DTiF resources should be updated to reflect version 9 of the curriculum.

b. The DTiF website provides a tangible legacy product from the project. It includes information about the project; the reports generated from it; resources including classroom ideas, assessment tasks and tutorials; and PL webinars. The DTiF website should be available until at least December 2023.

c. The PL workshops developed and implemented by ACARA staff should continue to be offered and where possible be developed into online offerings.

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8. APPENDIX: CASE STUDIES

The internal evaluation case studies provided a descriptive, authentic account of the DTiF project in a purposeful sample of representative schools. Sixteen of the 160 project schools were selected for analysis to be representative of the project schools, based on school size, geolocation, proportion of Aboriginal and Torres Strait Islander and EAL/D students. Eleven case study reports were fully completed. Below is one of the case studies as an example.

SCH13 Case study

SCH13 is a very remote government primary school in Tasmania with 7 teaching staff and 6 non-teaching staff. It has an ICSEA of 885 and has 51 students enrolled (53% girls and 47% boys). Eighteen per cent of students are Indigenous. The school was involved in the DTiF project from 2017 to 2019. All staff members were directly involved with the project.

Research question

The school's research question was:

- How will we create a sustainable culture to embrace and implement the Digital Technologies curriculum with a 3-year turnover cycle (on average) of teachers?

Midway through the project the school added the following question to its project:

- How [do we] embed resources and skills into our practice and further illustrate these skills within our practice? (Final report).

Impact

SCH13 identified the impacts that were achieved from the project. Following are examples.

Impact of the project on students:

> **[Engagement]** *... he popped his head into my class once and was so excited to see the robots and just had great things to say about what he learned ... it was pretty cool to see that connection ... it had an impact on him and he was so engaged ... he wanted to use them again and that was telling me all about what he'd learned and it was pretty cool (Progress report 4).*

> **[Confidence]** *... they had great problem-solving skills and resilience. Students learnt a lot of more about themselves and about how they cope when things don't go well ... girls engaged, chance for students to shine (Progress report 2).*

Impact of the project on girls' education:

> **[Confidence]** *We have girls coding and they're really good at it, but they don't think it's long term. They still think it's a boy area and it's not of interest, hopefully we get them to continue (Progress report 2).*
>
> **[Engagement]** *... one of the things that we're finding is that we've got a lot of girls engaging, you see that we've got it on the front page, but when they go off to high school we haven't got that strong connection of continuing (Progress report 3).*

Impact of the project on teachers:

> **[Collaboration and engagement]** *I've particularly noticed as I go into schools now that conversations around robotics and coding, digital literacy activities that children might follow, algorithms, the terminologies we have talked about in our professional learning program with the teachers is starting to appear in the conversations that we have as staff around just general conversations in the staff room or as I speak to staff in our workshops after school or during school time. They're more familiar now with those terminologies that we use (Dec. 2018, CO reflection).*
>
> **[Change in pedagogical practice]** *The pedagogy that the teachers are picking up on has changed in those schools and in general that has changed across all the schools. I'm seeing a greater willingness to take the kits in the schools and to use them in the classroom, to integrate them across different curriculum areas, which has also been very empowering (Dec. 2018, CO reflection).*
>
> **[Reporting]** *Assessment tasks are being developed at school level, and we expect to report student progress to parents across all classes by Term 3, 2020 (Final report).*

Impact of the project on the school community:

> **[Engagement]** *The [SCH13] Facebook page over the past two years has included Digital Technologies photos of events and learnings, which were liked by parents and the community (Final report).*

Outcomes

The school identified the outcomes that were achieved from the project. Below are examples.

Student capability

In SCH13, student capability improved, as the following quotes highlight:

> **[Critical and creative thinking and personal and social capability]** *Problem solving and resilience are two capabilities that we have observed students struggling with in the Digital Technologies learning. Persistence and communicating (asking another student to help and Digital technologies language/terms) have improved (Final report).*
>
> **[Critical and creative thinking, integration and resources]** *And it's true you learn something every day from your students with the gear and like you were saying, it's the problem solving. It's much bigger than just those Digital Technologies outcomes when you look at the understanding of decimals and degrees and all of that. It's just huge. They really, really understand it if they've used EV3s (Progress report 4).*

Teacher capability

In SCH13, teacher capability improved, as the following quotes highlight:

> **[Knowledge and understanding]** *Teachers are addressing the AC DT in their classroom (Final report).*
>
> **[Knowledge and understanding]** *We have 100% of the people who have completed MOOC and we have them playing, experimenting, using digital technologies in their classroom (Progress report 4).*

> **[ICT Capability]** *I am the person who actually takes the ICT in the school and this is the EV3 Mindstorms. I have learnt a lot (Progress report 4).*
>
> *There are champions at every one of those schools. I can't think of any one that hasn't got a champion (March 2018, CO reflection).*

Methodology

Managing the school project

During the project SCH13 and its CO used various strategies to drive the project towards success. Notable aspects are as follows.

PL for staff including participation in the CSER MOOC

The school focused on upskilling teachers through PL in staff meetings and PL opportunities. A key aspect of this was all staff completing the CSER F–6 Digital Technologies foundation course MOOC and applying learning in the classroom. In 2019 a Digital Technologies goal was also identified by each staff member in their annual PL plan.

Research conducted by the school to establish baseline data for teachers and students

Teachers at the school conducted the DTiF pre-project teacher survey and student assessment to see what areas they needed to focus on and conducted them again at the end of the project to measure growth. In its project proposal the school also unpacked:

> *... the Digital Technologies elaborations from the Australian Curriculum and identified natural links to our current school-based curriculum and scope and sequence (Project proposal).*

Integration of Digital Technologies into other learning areas

The school decided to integrate Digital Technologies into other learning areas to help ensure sustainability beyond the project. SCH13 integrated Digital Technologies with English, Mathematics and Science (Final report).

Connections to industries and local schools

A major part of SCH13's project was to make connections to industries and schools. The school was successful in obtaining a grant, which helped it connect to outside organisations. The school connected with [Organisation 2] through the grant and worked collaboratively with it throughout the project to further upskill teacher capacity.

Because the school is very isolated, one of its goals was to connect with local schools to pool resources. The school now works as a cluster of schools. Teachers meet regularly to discuss Digital Technologies planning.

> *We've gone from just being a school to being a cluster of schools (Progress report 4).*

In addition, students compete in robotics competitions once a term.

> *Currently we've got three schools competing ... this year we aim to have all the schools competing from Term 2 onwards (Progress report 3).*

Resources

To successfully implement Digital Technologies in its school, SCH13 used a range of resources. The following resources were used throughout the project.

Grant

As noted, SCH13 was successful in obtaining a grant from [Organisation 1]. It used its grant to fund resources and PL for staff.

> *... all staff were involved in hands-on Digital Technologies professional learning with [Organisation 2] (Progress report 3).*

The school intended to continue using its grant in 2020 and beyond. Refer to the section on sustainability for more information.

Plugged resources

The school used the CSER Lending Library to trial resources before they were purchased. It purchased and used resources in the classroom including drones, 3D printers, Bee-Bots, Lego (robotics), Bebras, Code.org and Scratch to name a few.

Challenges

In every school there are challenges in implementing new curriculum**.** SCH13 identified various challenges when involved in the DTiF project. Some were:

Budget

This was mainly resolved due to the grant it received. However, had the school not received the grant its project would have looked very different in that it would not have been able to access costs associated with bringing in expertise.

> ***Costs involved for experts, accommodation, airfares and other expenses which was covered by … (each school paid a quarter of the cost, when it occurred) (Final report).***

Staff turnover

Being a school in an area classified as very remote, staff turnover is a challenge. With the average stay usually only 3 years, staff turnover:

> ***… does have an impact on what we can do with regards to digital technology. There are positives and there are negatives and the positives are that they're young, they're enthusiastic; the negative is that you get things going and then they actually leave you (Progress report 3).***

Connection between primary school and high school

SCH13 made great connections to other primary schools; however, connections to high schools is still a work in progress.

> ***… continuation of what we're doing in primary going through into the high school as being options, ways that they can actually continue their learning (Progress report 3).***

Where to from here (sustainability)

The school finished the project in 2019 and identified that it would not have the support of the DTiF project after 2019. However, it still had access to the [Organisation 1] grant money and connections with [Organisation 2]. The school indicated the importance of the DTiF project in making sustainable change for its school:

> ***… what we've done is we started with this program with [CO] and now we're moving over into another program where we're going to be accountable and we wouldn't have done this if we hadn't started with your program, but it's got a new direction and it's going to actually have impact on every child, every teacher. So that's what the importance is. So, we've got, as part of the grant, got to connect with community and also with businesses and industries (Progress report 4).***

The school recognised its next steps were crucial:

> ***… we've got all the tools, we've got all the equipment, we've got a cupboard full of items but if you don't know what they can do and how they can be embedded into the ACARA [Curriculum] they're just sitting there, they're just toys. We want them [teachers and students] to move beyond the playthings into something that they're learning devices and that's where we're heading to (Progress report 4).***

With the remainder of the money from the grant, the school planned to employ a retired principal:

> *... to support the Early Adopters (teachers who have an interest in leading Digital Technologies) to explore and practice planning of Digital Technologies. The teams at [Organisation 2] and [Organisation 1] are excited about helping to promote and grow the skills of teachers to improve students' learning in Digital Technologies. In 2020 the cluster of Principals have committed resources to the PLC Digital Technology which will meet twice a term (Final report).*

Furthermore, new staff members would:

> *... be supported to complete the MOOC course (Final report).*