PROGRAMMING THE FUTURE:

Harnessing the Transformative Potential of New and Emerging Technologies with Children and Young People in Regional NSW

PROJECT REPORT OCTOBER 2019

Dr Mohamed Moustakim
Associate Professor David R. Cole

WESTERN SYDNEY
UNIVERSITY

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Save the Children
Australia

Authors

Dr Mohamed Moustakim
School of Education
Western Sydney University.
m.moustakim@westernsydney.edu.au

Associate Professor David R. Cole
Centre for Educational Research
Western Sydney University.

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Executive Summary

PtF builds on the findings and recommendations of a series of initiatives developed by Save the Children in the past 3 years.

Firstly, an evaluation conducted by Western Sydney University researchers on the progress of the Mobile Youth Van project towards achieving its overarching aims to promote the strategic and purposeful use of digital media in a safe and positive learning space, and to improve the health, education and wellbeing of children and young people in Claymore (Orlando and Moustakim, 2016). Save the Children subsequently piloted a series of coding workshops aimed at addressing the risks and social consequences associated with digital inequality in Claymore, one of the most socio-economically disadvantaged locations in NSW. By the end of the pilot coding workshops, Save the Children decided to focus on narrowing the gap in children and young people's access to new and emerging technologies between metropolitan and regional areas of NSW, where they had provided Mobile Youth provision for several years, and had established an extensive network with youth and community organisations. The coding workshops were extended to Bathurst and Dubbo in regional NSW in 2017.

PtF used a hub and spokes model in the delivery of its training programs, and in the provision of technical support to 'champions'. Champions are typically professionals who work with children and young people in education, welfare or youth services, such as teachers, librarians or youth and social workers – they have been recruited and upskilled in the use of new technologies by Digital Education Specialists employed by Save the Children in two fully resourced Digital Excellence Hubs, or DigiEHubs located in Bathurst and Dubbo, respectively. In turn, the champions deliver training to children and young people in smaller satellite nodes, or spokes, in Cowra, Orange, Parkes, Young and Wellington. The rationale behind the hub and spokes setup was to maximise the reach of the service provided, ensure efficiency of service delivery, and to avoid the duplication of resources.

PtF created a dedicated Google Classroom containing a wide range of resources and training materials, including tutorials and lesson plans to support champions in delivering a total of 145 classes. This active resource gave children and champions access to a suite of online lessons in the use of a range of new and emerging technologies: i.e., Coding, Augmented Reality (AR), Virtual Reality (VR), Robotics, 3D Modelling and Printing, Wearables, Electronic Circuits and Microcontrollers, Digital Music, and Cyber Safety.

A project co-ordinator was recruited to spearhead Save the Children's new goal to 'enable disadvantaged and at-risk youth to embrace the digital age and to become leaders of tomorrow' (PtF/StC promo video, 2018). The coordinator was supported by an Advisory Group consisting of 14 researchers, educators and digital Education specialists, who informed the design and implementation of training materials in the use of a range of new and emerging technologies. The diversity of expertise in the Advisory group in terms of knowledge of new technologies, and extensive experience of youth development and project management, was crucial to mitigating the challenges presented by the Hub and Spoke sites model employed in the design and delivery of the PtF project.

PtF initially aimed to provide computer programming workshops to a total of 900 young people through 2x 'DigiEHubs' and 5x 'Spoke' sites in NSW. However, due to repeated staff changes in the leadership of PtF during 2018 and 2019, coupled with the absence of mechanisms for consistent monitoring and the capture of crucial data relating to the number of spokes, champions, children, and young people who benefited from PtF workshops, the total number reached fell significantly below the ambitious target set. Despite this, some of the champions saw an increase in the number of children and young people taking up the workshops as a result of engaging in outreach and multi-agency partnerships. At the time the research team visited Dubbo DigiEHub, a total of 163 children and young people has taken part in a series of 62 coding, AR and VR workshops. However, the capacity of Dubbo DigiEHub, located in the Macquarie Regional Library, to attract large numbers of children and young people was difficult for PtF to replicate. The Bathurst DigiEHub provided training to a total of 182 champions in coding, Augmented Reality (AR), Virtual Reality (VR), 3D printing and modelling, Wearables and Digital Music, but the take-up of the workshops organised by the Bathurst DigiEHub by children and young people was limited to coding in smaller groups, and was much more suited to Headspace informal education settings. Evidence from the research data sets suggests that the Bathurst DigiEHub helped to train up to 12 members of the Aboriginal Education Consultative Group (AECG), who in turn, have worked in three schools in the Bathurst and Kelso districts, where they have specifically targeted Aboriginal children to enhance their high-tech skills, for example, by using Augmented Reality (AR), to depict and make Indigenous sites 'come alive' through digital media.

> **...some of the champions saw an increase in the number of children and young people taking up the workshops as a result of engaging in outreach and multi-agency partnerships**

1.1   Research aims

An Action Research approach was originally planned for this project in a bid to increase the capacity of PtF to offer children and young people in regional areas of NSW an early intervention programme to address the risks and consequences of digital inequality through the standard processes of planning, implementation, evaluation and review. PtF was hoping to build on recent research that has examined how to address the risks and social consequences of digital inequality of children and young people in socio-economically disadvantaged locations (Helsper, 2016). To achieve this, PtF drew conceptually on the digital theory of change (Dellow, 2017), which seeks to take children and young people through a gradual process, from discovering new and emerging technologies, to creating and making, acting and accelerating to the use of these technologies. The central aim of the digital theory of change is to encourage young people to use new and emerging technologies to resolve social issues that they have identified in their communities (Dellow, 2017). However, staff changes in PtF leadership led to extensive delays in the selection and recruitment of potential research participants and a shift to a more broadly interpretist and qualitative approach to data collection and analysis.

The resultant research design used interview data sources to:

1. assess the outcomes and impact of PtF on children and young people's access to and purposeful use of new and emerging technologies;

2. gain a deeper understanding of the nature and purposes of Aboriginal children, young people and their communities' use of new and emerging technologies and the impact that these have on their lives, and;

3. analyse current research focused on redressing digital inequality and test its efficacy through the recorded transcripts of PtF champions, digital education specialists and members of PtF Advisory Group.

To achieve this, the research was guided by the following questions:

1. How can progress or success be understood in term of the pedagogy of PtF?

2. What are the educational parameters involved with teaching and learning of skills in new and emerging technologies in regional and rural NSW?

3. What is known in the field of Indigenous Australian education and outreach projects such as PtF?

4. What are the relationships between Indigenous Australian populations and the types of new technologies & skills offered by PtF?

Expected outcomes

The researchers expect that these understandings will lead to the following outcomes:

1. Identification of pedagogies that are conducive to children and young people's purposeful engagement with new and emerging technologies;

2. Analysis of social and cultural factors that impact on Aboriginal children and young people's access and engagement with new and emerging technologies;

3. Contextually specific, empirically grounded new theoretical insights into the capacity of projects such as PtF in redressing digital inequality in regional and rural areas of NSW.

1.2   Key findings

The findings of this report indicate that PtF has shown many distinctive characteristics of innovation and significant potential for engaging children and young people in harnessing new and emerging technologies to achieve the outcomes they have reasons to value. The evidence also points to identified areas for improvement, refinement and scalability, should Save the Children decide to extend the work of PtF to other areas of NSW, as originally planned. The key findings of this report are outlined below:

- PtF initially aimed to provide a series of workshops in new and emerging technologies (i.e. coding, Augmented Reality (AR), Virtual Reality (VR), 3D printing and modelling, Wearables and Digital Music) to approximately 900 children and young people in disadvantaged locations in rural and regional areas of NSW. While it could be claimed that the hub and spokes model is ideally suited for the delivery of training schemes across sparse and expansive geographies, such as regional and rural NSW, and as evidenced by recent research in Education and Health (Elrod and Fortenberry, 2017), the approach used by PtF did not fully achieve its desired outcomes. The main reason for this was the disruption caused by two successive changes in the leadership of PtF staff team in 2018 and 2019, respectively. However, data obtained from the two DigiEHubs indicate that a total of 163 children and young people participated in a total of 62 workshops in coding, AR and VR at Macquarie Regional Library. The DigiEHub in Bathurst worked with a much smaller group of children and young people at Headspace site, but offered training and Masterclasses to a total of 182 champions, including members of the Aboriginal Education Consultative Group.

- PtF did not have the mechanisms for capturing and monitoring crucial data to be able to assess its progress towards achieving its objectives in relation to the number of spokes, champions, children and young people who specifically benefited from the PtF workshops.

- This research found that champions whose job roles included an inherent element of a digital education specialism, such as librarians for example, were more effective in engaging children and young people in PtF workshops. Despite the enthusiasm of some of the champions whose involvement with new and emerging technologies was incidental; it was found that particular champions in spoke sites located at significant distances from the DigiEHubs, lacked the technical know-how and in the absence of ongoing support, felt powerless and unable to provide training in the use of high-tech resources, such as AR and VR.

- The distance between the hub and spokes made it difficult for champions and children in remote areas of NSW to have access to some of the expensive PtF equipment such as the 3D printers, as these were solely located in Bathurst and Dubbo DigiEHubs. This has meant that some of the champions could only offer workshops in coding, as they did not have access to resources to engage children and young people in more exciting AR and VR activities.

- Meaningful engagement with children, young people in their communities, rests on enduring and reciprocal relationships built over time. What makes community engagement meaningful is its flexibility and willingness to address issues that are important to the community. The collaborative multi-agency approach adopted by champions at the Macquarie Library DigiEHub in Dubbo is correlated with an increase in the number of children and young people who took part in the workshops they organised between 2018 and 2019. The champions established collaborative partnerships with local community groups to celebrate high profile events ranging from the Youth Council to Dads' literacy Days and NAIDOC Day.

- The masterclasses of AR and VR delivered online to students, teachers and champions, one of which was observed by the researchers during a visit to Bathurst DigiEHub, used high-tech apps, but the delivery was sometimes fast paced and too rushed, resulting in some participants feeling left behind. A more engaging, and therefore more effective pedagogic approach, that was more 'easy going', could encourage children and young people to work together towards a communal goal, for example, and therefore participate in an exciting, collective approach to acquiring high-tech skills.

- It is clear that the set-up and maintenance of the relations between the proponents of PtF and the Aboriginal communities which they are serving, is crucial in the ways in which PtF is to function in the context of rural NSW. It is when one encounters a knowledgeable and passionate educator such as Mike that the pieces of the puzzle fit together, and the way forward in terms of learning the high-tech skills, and doing something with them with the community, becomes apparent. Librarian enthusiasts such as those in Dubbo, also show how Aboriginal communities may be engaged and given meaningful tech-skills through informal learning networks which are flexible, and able to be relocated to the places where the Aboriginal communities feel most comfortable.

- Support in schools for Aboriginal learners, and the coding clubs of libraries, serve as important markers for the development of high-tech skills amongst Aboriginal youth in rural and remote areas in Australia. With better high-tech infrastructure, improved internet access, and investment in the requisite hardware to make the PtF skills come alive (for example, investment in 3D printers), the Aboriginal communities in Australia will respond positively to initiatives such as PtF in the future.

- Enthusiasm and relational change agents such as Mike and the Dubbo librarians will help to make a difference in the lives of Aboriginal youth. Evidence from the fieldwork for this project found that Aboriginal youth are susceptible to high-tech habits such as online gaming and using devices such as PlayStations. A scheme such as PtF, if well managed, and if it gets the groundwork right, and attracts successful change agents to guide and help the youth sustain their interest in positively building their high-tech-skills, might be a way forward to at least partially address these contemporary malaises in outback Australia, and provide pathways into jobs that do not currently exist.

1.3   Recommendations

This research focused on the work of PtF in Bathurst and Dubbo, within NSW; however, should Save the Children secure funding to continue this initiative, the findings from this report will have implications for other areas where PtF originally planned to engage learning communities, including Orange, Parkes/Forbes, Young, Cowra and Wellington. The findings from this report have implications beyond the region given the New Work Order (FYA, 2015) and predicted growing prevalence of new and emerging technologies in Education, the labour market, and in everyday life. The following recommendations are put forward to Save the Children, should the development of a similar initiative to Programming the future be considered in the future.

1. **To operationalise the digital theory of change in a meaningful way, PtF should work with smaller youth organisations to help them develop long-term goals for addressing local concerns.** The aim of the digital theory of change is to encourage young people to use new and emerging technologies to resolve social issues that they have identified in their communities (Dellow, 2017). This is a laudable goal, particularly when working with children and young people in socio-economically disadvantaged locations, but necessitates working closely with children and young people in their communities as equal partners, and over a significant period of time.

2. **Consider adopting a peripatetic Mobile Youth provision** to support a hub and spokes model for delivering training in new and emerging technologies in regional areas of NSW. Deploying 3D printers as a high-tech skill development area, for example, could act as a focal point of interest to engage young people in a process that could lead to tangible results (printed objects). A peripatetic mode of provision through the Mobile Youth Van could make such equipment accessible to a larger number of champions, children and young people in NSW on a frequent basis. This set of actions could also enable the champions to build long lasting relationships with young people and their communities over time.

3. **Developing collaborative communities of practice:** The evidence from Macquarie Regional Library in Dubbo, and the case studies from The Learning Space in Rhodes, have demonstrated that developing collaborative communities of practice is pre-requisite to success in engaging children, young people, and their communities in the productive and purposeful use of new and emerging technologies. Building collaborative communities of practice rests on promoting reciprocal relationships as well as flexibility and willingness to address issues that are important to the community in real time and as part of the lessons.

4. **More effective mechanisms for capturing and monitoring data required:** A more systematic approach to the collection of data should be used in initiatives such as PtF to provide the means for detailed analyses of the reach and impact of the provision as well as the potential for ongoing formative improvements and refinements where needed as an ongoing concern.

5. **PtF should engage in more multi-agency collaborations with local community organisations:** Evidence from The Learning Space and Macquarie Regional Library have demonstrated the benefits of engaging in multi-agency and partnership work with organisations to celebrate high profile events.

6. **Better selection and recruitment of champions:** A more strategic selection and recruitment of champions is key to the success and continuity of training workshops in new and emerging technologies. PtF should recruit champions whose current roles involve aspects of a digital education specialist.

7. **Champions should use more engaging dialogic pedagogies:** PtF champions should use a more engaging pedagogic approach, based in dialogue and genuine inquiry, to encourage children and young people to work together towards achieving common goals using new and emerging technologies.

8. **Promoting the use of new technologies through detached and outreach work with Aboriginal communities:** establishing and maintaining relations between PtF and the Aboriginal communities through detached and outreach work is crucial to developing engaging Aboriginal children and young people, their communities, in equity focused interventions that utilise new and emerging technologies to address social issues.

9. **Liaise with Aboriginal Education and Communities Directorate to engage in work with Aboriginal learners in schools:** PtF should liaise more with the Aboriginal Education and Communities Directorate to support Aboriginal learners in the use of new and emerging technologies in schools.

10. **Champions as change agents:** PtF should seek to attract successful change agents to guide and help the youth sustain their interest in positively building their high-tech-skills. This will be a way forward to at least partially address these contemporary malaises in regional and rural Australia, and to provide pathways into jobs that do not currently exist.

1.4 Conclusion

Evidence from the research suggests that the essential principles and methods for good PtF pedagogy were understood. The PtF sessions have to be run enthusiastically. The leaders of the sessions need to be confident with the new technologies that are on offer. The sessions require a social or cultural purpose, so that they are more than just the abstract teaching and learning of high-tech skills. Sessions should therefore be run around projects that reflect agreed upon social or cultural purposes, which could be for the greater good, for example, the watering system for the community centre, as described in the transcript analysis below (Section 6.2.3), or for a new video game that the participants in the sessions want to play. Materials and other strategies should be available if the way to achieve the social or cultural goals through the new technology is not well-understood. These materials can be as simple as a whiteboard or pens and paper, through which the group can work out what to do. This research project shows that all of these principles for making PtF pedagogy work were to an extent understood, but were not always successfully implemented due to:

1. The distances that PtF tried to cover, which made the reinforcement of the masterclasses for the champions and the spokes hard to achieve. It can therefore be assumed that some champions and the spokes were not able to carry on the PtF sessions in the desired manner, and with this would negatively impact the PtF pedagogy achieved.

2. The feedback system between the masterclasses, the running of PtF, and the actual PtF sessions, does not seem to have functioned well-enough. Without reliable data from the sessions, it is impossible to know how to modify and adjust the PtF pedagogy in situ and on the ground, and what were the continuous needs of the champions.

Given these difficulties for implementing PtF pedagogy, the two bright sparks, and positive outcomes from the evidence that we were able to collect comes from the Macquarie Regional Library DigiEHub in Dubbo, and Mike's work through the AECG with Aboriginal youth in local schools (see relevant sections below 7.2.1 and 7.2.2). In these two instances, one can say with some certainty that Programming the Future has made a real difference in children's lives in rural and remote Australia.

2

Introduction

Programming the Future (PtF) was launched in late 2017 by Save the Children Australia with the aim to offer children and young people in regional areas of NSW opportunities to develop skills in the use of a wide range of new and emerging technologies, such as coding, Augmented Reality (AR), Virtual Reality (VR), 3D printing and modelling, Wearables and Digital Music.

PtF builds on the findings and recommendations of a series of initiatives developed by Save the Children in the past 3 years. Firstly, an evaluation of the progress of the Mobile Youth Van project toward achieving its objectives, namely, the strategic and purposeful use of digital media, in a safe and positive learning space to improve the health, education and wellbeing of children and young people in Claymore. As part of the evaluation, interviews and focus groups were conducted with children and young people, youth workers, parents and other stakeholders, in order to identify gaps and opportunities in service provision.

The evaluation of the Claymore Project, conducted by Western Sydney University researchers (Orlando and Moustakim, 2016) made original observations about the significant positive social impact of this highly innovative mobile technology provision, and culminated in a set of recommendations for spreading identified examples of good practice to other parts of NSW. One of the key recommendations in the evaluation that is of high import to PtF was for Save the Children Mobile Youth Van provision to make greater use of new digital media programs to engage children and young people in coding, building apps and experiment with hands-on maker technologies such as 3D printers, – to tinker, play and create.

In 2016, Save The Children piloted a series of coding workshops, as part of the Mobile Youth Van provision, to address the risks and social consequences associated with digital inequality in Claymore, one of the most socio-economically disadvantaged location in NSW, with an Aboriginal community of 7.9%. The pilot coding workshops helped Save the Children staff gain insights into the kinds of interventions that were most conducive to making new and emerging technologies more accessible to children and young people in under-privileged NSW. Additionally, PtF sought to harness the potential of new technologies to achieve positive personal and social development goals with children and young people in informal education settings, including the productive and purposeful use of technology as a catalyst for awareness raising about important local and global issues, and a positive concern from the neighbourhood to the planet. PtF aimed to build on recent research that examined how to address digital inequality with youth at risk of social exclusion in informal education settings (Helsper, 2016) as well as the Claymore experience.

To achieve this goal, PtF drew on the digital theory of change (Dellow, 2017), which seeks to take children and young people through an educational journey, beginning with *discovering new and emerging technologies* and moving through a process of *creating and making*, acting and *accelerating*. The central aim of the digital theory of change is to encourage young people to '*use new and emerging technologies to resolve social issues that they have identified in their communities*' (Dellow, 2017, p.1). The digital theory of change is particularly important for equity focused initiatives that seek to enable young people from marginalised communities to develop 'enterprise skills' for the New Work Order because it provides a framework for the uptake of high-tech skills. The findings of recent research conducted by the Foundation of Young Australians (FYA, 2015) suggests that '*For the first time, big data analysis shows us that the New Work Order is here*' and that '*We can no longer delay investing in the future of young Australians*' (p.3). FYA research used big data derived from 6000 websites comprising of 4.2 million job advertisements and found that 70% of '*jobs of the future*' demand 'enterprise skills'. Further, these jobs of the future demand a set of transferrable skills that young people need to acquire to be able to secure better life chances. Enterprise skills include digital literacy, problem solving,

creativity, communications, critical thinking, teamwork, financial literacy and presentation skills. The imperative for children and young people to develop enterprise skills has never been greater, but this imperative largely rests on having access to, as well being competent, in the use of new and emerging technologies that PtF seeks to offer.

PtF was supported by an Advisory Group consisting of 14 researchers, educators and digital Education Specialists, who informed the design and implementation of locally-run Digital Excellence Hubs (DigiEHubs), and who provided cutting-edge resources and training in the use of a range of new technologies. As an outreach program, PtF sought to benefit children and young people in regional NSW by giving them access to high-tech skills as contained in their suite of online lessons: i.e., Coding, Augmented Reality (AR), Virtual Reality (VR), Robotics, 3D Modelling and Printing, Wearables, Electronic Circuits and Microcontrollers, Digital Music, and Cyber Safety. These skills are intended to help children and young people in their future careers, by making them more employable and/or able to start their own business that could exploit these skills in some way. This imperative works in the face of growing digital inequalities among Australian children and young people, that has compounded the effects of intergenerational poverty in socio-economically disadvantaged locations in rural and regional areas of NSW, particularly for Aboriginal Children and young people coming from under privileged areas in places such as Bathurst and Dubbo.

While digital inclusion for Indigenous people in rural and remote areas of NSW is improving, the Australian Digital Inclusion Index (ADII, 2018) has found that they are 5.8 points below the national average in terms of measures relating to Access, Affordability and Digital Ability. For this reason, and given the population profile of Bathurst and Dubbo, where this research was conducted, a significant proportion of this report is dedicated to the direct and indirect influence that PtF has had on making new and emerging technologies accessible to Indigenous children and young people in Bathurst and Dubbo. This work is examined in the context of a wider discussion about:

1. what is known in the field of Indigenous Australian education and outreach projects such as PtF;

2. the relationships between Indigenous Australian populations and the types of new technologies & skills offered by PtF.

In an attempt to gain an understanding of the potential outcomes and impact of the purposeful use of new and emerging technologies to promote community engagement, the researchers conducted two visits to The Learning Space in Rhodes, during which they interviewed The Learning Space Co-ordinator, who oversees the operation of programs and services delivered to the local community as part of the City of Canada Bay Library and Community Services. Two examples of the work of The Learning Space on engaging members of the community in the creative and purposeful use of new and emerging technologies are captured in two case studies, described in pages 54 and 55 of this report, to showcase models of good practice that can help to inform this report on PtF. The text and images in the case studies were produced by The Learning Space and are included in this report with their permission.

The report concludes with a brief discussion of the main findings and a set of recommendations that – should Save the Children secure funding to develop a similar initiative to PtF in the future, are intended to inform the development of refined strategies to scale the project up to 5 other locations including Orange, Parkes/Forbes, Young, Cowra and Wellington. The findings could also, potentially, have implications beyond the region given the New Work Order (FYA, 2015) and predicted growing prevalence of new and emerging technologies in Education, the labour market and in everyday life.

Rein Turley, the Digital Education Specialist and Angela Beard (Program Coordinator) showcase the potential of PTF At Bathurst DigiEHub.

The imperative for children and young people to develop enterprise skills has never been greater, but this imperative largely rests on having access to, as well being competent, in the use of new and emerging technologies that PtF seeks to offer.
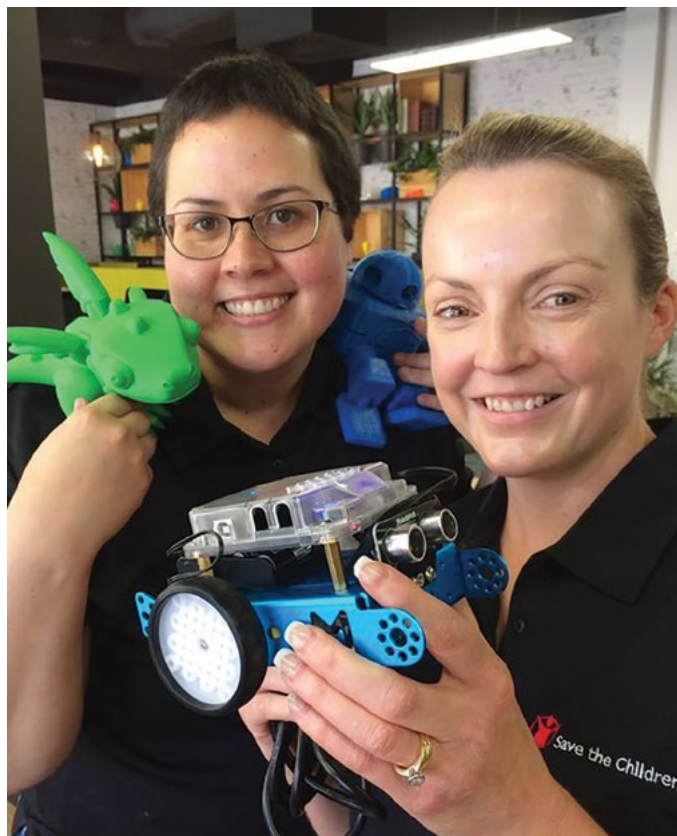
3

Methodology

The research sought to elicit individual insights and experiences of PtF Advisory Group members, Save the Children staff and the champions, who were actively involved in the work of the two DigiEHubs in Bathurst and Dubbo.

Semi-structured interviews were used to ensure that there was an agreed protocol to provide a basic structure for interaction and information giving and receiving, whilst giving the participants the opportunity to expand on or shift topics, then shift the focus back on the broad themes of the research. Furthermore, the researchers visited The Learning Space in Rhodes, Canada Bay, where they observed examples of the creative use of new and emerging technology with youth and community groups. The Learning Space has been included in this report as case study highlighting models of good practice and comparison with the results from the PtF research.

The researchers also visited a youth centre, situated in a socio-economically disadvantaged location in Dubbo, where 90% of the children and young people were Aboriginal, many of whom had taken part in PtF coding workshops organised by Macquarie Regional Library in Dubbo. The purpose of this visit was to elicit further information with respect to the outreach nature of the PtF program, and the ways in which it had been taken up by the local Aboriginal community. Further, the researchers observed a Masterclass on using AR and VR delivered to champions and school children face to face and online and examined the teaching materials used by PtF to train champions, contained in PtF Google classrooms online folder. Data collected from these sources helped assess the effectiveness of PtF in making new and emerging technologies accessible to children and young people and helped identify characteristics of good practice and where improvements can be made in similar initiatives in the future.

Lastly, the results of the semi-structured interviews were transcribed, and coded for relevant information, given the research questions and aims of this project. This research was interpretive and qualitative in nature, which means that fundamental points of relevance had to be understood conceptually in advance to enable accurate and worthwhile codes to be added to the transcripts. To enable this process, an extensive literature review was embarked upon that examined literature in the fields of:

1. Indigenous education and the high-tech skills of PtF, and;

2. The relevant pedagogies that have enabled outreach projects similar to PtF in the past in rural and remote Australia.

As a result, robust and meaningful codes were produced that helped to break down the transcripts into relevant sections, and have aided in the analysis of their meanings for the PtF project. The qualitative assessment of the transcripts based on what is known in the field, resulted in the non-subjective interpretation of the data, to help provide recommendations and guidance based on knowledge and the facts around PtF provision.

3.1 Ethics

Ethical approval for this Programming the Future research project was granted by Western Sydney University Human Research Ethics Committee (Application 2018/H12968). The highest ethical standards have been maintained by the research team throughout this project.

4

In Search of a Pedagogy for Teaching New Technologies

4.1   Introduction

Since the 1980s, there has been a concerted global push to increase the scope and reach of the Information and Communication Technology (ICT) revolution through computation. The interior of Australia holds a particular fascination for this push, and the specific, technical problematic to the spread, usage and evolution of ICT. The uptake of ICTs in the interior of Australia, which could be characterised as being sparsely populated, and can lack the basic technological infrastructures of the Australian cities and coastline (e.g., reliable internet); has, despite these potential shortcomings, followed waves of technological, educational, and commercial innovation (such as the use of satellites), that have attempted to link up the interior of Australia with the rest of the world. One of the driving notions that has worked in unison with this intention to link up the middle of Australia with the outside world, and therefore to improve communication and potential commercial opportunities connected to digital technology, are the specific educational parameters that may be associated with the teaching and learning of high-tech skills in rural and remote areas, such as the interior of Australia. In this section, these specific parameters will be analysed in terms of the pedagogy required for a project such as PtF to function successfully. This analysis will proceed in terms of two questions:

1. What are the educational parameters involved with teaching and learning of high-tech skills in rural and remote areas?

2. How can progress or success be understood in term of the pedagogy of PtF?

4.2   Teaching and learning of high-tech skills in rural and regional NSW

Talk about the digital divide (Broadbent & Papadopoulos, 2013), and the digital inclusion index (Barraket et al., 2018), belies the social and economic realities that underpin living in rural and remote Australia. The truth is that in the bush, jobs can be hard to come by, and that there are pockets of endemic and widespread poverty, specifically located outside of Australian cities that have not dramatically changed over many years. In these areas, the spread and success of an outreach project such as PtF, could have potentially life-changing consequences if the educational parameters are fully attended to, and the youth and unemployed in these areas are able to pick up high-tech skills and interests that could make them more attractive in the jobs market, and/or be able to deploy these high-tech skills themselves in new enterprises and potentially commercial and useful ventures for them and their communities. To break down this knowledge field that can become tangential because of the diversity of approaches that have been taken, into digestible bites, the literature has been analysed according to:

a.   The overall characteristics of the technology specialists leading the sessions. The teaching and learning of high-tech skills has the potential to get very complicated, very quickly. Therefore, and to counter this potentially abstract and off-putting beginning, the teachers or 'champions' (in the PtF scheme) leading the teaching and learning of the high-tech skills should be approachable, overall affective in their demeanour, and create what has been termed as 'warm connections' (Douglas et al., 2018). Yes, it is important that the teachers or champions understand and are confident in what they are meant to be talking about and demonstrating, and in the case of PtF, this is in the particular subjects of VR, AR, coding, robotics, etc., but more importantly, they have to generate a warm and inviting atmosphere that creates buy-in from the groups and individuals having joined in with the PtF sessions, that are hopefully wanting to continue and make the sessions flourish through the learning and sharing of specific high-tech skills.

b.   Enthusiasm and experimentation. Along with the recommended, warm and inviting, community and personable approach to the teaching and learning of high-tech skills that creates 'warm connections' throughout the sessions and beyond, the teacher or champion has to exhibit 'enthusiasm and experimentation' in terms of what he or she can do with the technology. In contrast to a formal body of knowledge that has to be transmitted in a certain way, in a certain order, or as a bland list of instructions to be followed blindly, it has been found that the teaching and learning of high-tech skills works in a different order, usually created from dynamics coming from the bottom-up, and subject to change, given the sometimes chaotic and unpredictable local teaching and learning conditions and connections (e.g., Twyford, Crump & Anderson, 2009).

In part, this characteristic of the educational parameters of teaching high-tech skills in out of the way places such as rural Australia, comes from the specific history of the personal computer (PC) in the lineage of ICT development, which was personified by the enthusiastic hobbyist, who learnt how to build, program, and deploy his or her computer in a time when everything was not uploaded and searchable through Google (Williams, 1997), or accessible through a 'how-to' video uploaded on YouTube. In short, the pedagogy of the teaching and learning of the high-tech skills of the type contained in the suite of PtF lessons, requires a type of inspiration and innovation that comes from leaders with hands-on, practical, and the real experience of making these types of technologies work in sometimes difficult circumstances, which leads to the next aspect of teaching and learning high-tech skills in rural and remote places.

c. Overcoming infrastructure problems. High-tech companies are often concentrated in specially prepared and funded high-tech precincts in the cities. Further, mobile devices such as phones, iPads and tablets have contributed to making technological access and usage ubiquitous in these cities, and beyond the specific precincts. Schools and colleges have participated in this technological density and proliferation, sometimes making usage and expertise in the pedagogy of high-tech matters an assumed, residual set of skills, often understood by the general population, and merely to be 'brought out' and run with by the teacher by providing infrastructure and project leadership (e.g., Burnip, 2006). However, the assumption of having an effectively working technological infrastructure cannot be made in rural and remote areas (e.g. the latest in IT equipment). Rather, the pedagogy of teaching and learning the high-tech skills such as programming (coding), AR & VR, requires the invention of proxies of the techniques to be learnt if necessary, and especially if the technology is not functioning well in situ, or if the hard- and software that is on offer for the groups does not produce the buy-in and results required (e.g., not having access to 3D printers or good iPads).

An example of such creativity and innovation, and thinking beyond 'screen-only' activities to achieve the same goals as online sets of specific high-tech instructions, can be found in the online web site and non-profit organisation 'Dynamicland': dynamicland.org. Here, participants interact with lights projected from the ceiling, and rearrange real objects to make changes to the light patterns. This interactivity simulates the ways in which computer programs work, and therefore gives the users a physical, hand-on, social, and interactive experience of computer programming, rather than learning how to do it from a screen on one's own. This type of innovation and thinking beyond subjective digital mediation is necessary to bridge the gap between the reality of, for example, learning how to code in rural and remote regions, and having access to good technology and infrastructure (such as the latest computers), which if not in place might hold back the full enjoyment and immersion of the experience to code. This point about simulating learning beyond the screen, leads to the final but vital aspect concerning the educational parameters connected to teaching and learning high-tech matters in rural and remote areas.

d. Social, cultural and collective goals. Highly motivated students, who are introduced to the high-tech skills transmitted by PtF, may be able to learn for themselves, as there are interactive, well-organised, and clear web sites where these skills can be systematically learnt, for example: www.codecademy.com. However, literature in the field points to these types of students as being exceptional (e.g., Rooksby, Weckert & Lucas, 2002). Even though teaching and learning through ICTs does lend itself to conceptualising a mode of digital constructivism (Chaudhary, 2018), evidence in the field points to the centrality of having clear goals for the teaching and learning of these skills, which is beyond the individual construction of knowledge.

Having a clear social, cultural, or collective purpose for the deployment and use of high-tech skills, allows the pedagogy to move beyond the technicality and potentially frustrating aspects of getting the programming right first time, or doing everything in the correct way to make the program work on your own and on every occasion. Rather, a pedagogy that proceeds through trial and error, with the larger, clearly defined and agreed upon goals in mind, functions to create a harmonious and inclusive atmosphere, and that would encourage PtF participants to create their own goals for the technology to achieve. Such an orientation has been shown to work in rural and remote Australia in the past, where new technology has been proven, for example, to have educational benefits when tied to local farming matters (e.g., Wilde & Swatman, 1997).

4.3 How can progress or success be understood in term of the pedagogy of PtF?

Educational practice oscillates globally between the widespread application of summative assessment through and in exams, and the deployment of different modes and types of formative assessment (Black & William, 2005). As PtF is largely organised as informal, out of school and class, and does not follow a set and examinable curriculum, formative assessment, wherein the processes of teaching and learning are observed, communicated, and potentially measured, is more appropriate than summative assessment. A recent diagram charting the different potential modes and forms of integration of formative assessment that could be deployed by and for PtF to gauge its success and progress, helps to formalise and understand the application of formative assessment to PtF and its necessary pedagogy (Duckor & Holmberg, 2017):

Figure 1: Formative Assessment Moves (Duckor & Holmberg, 2017)
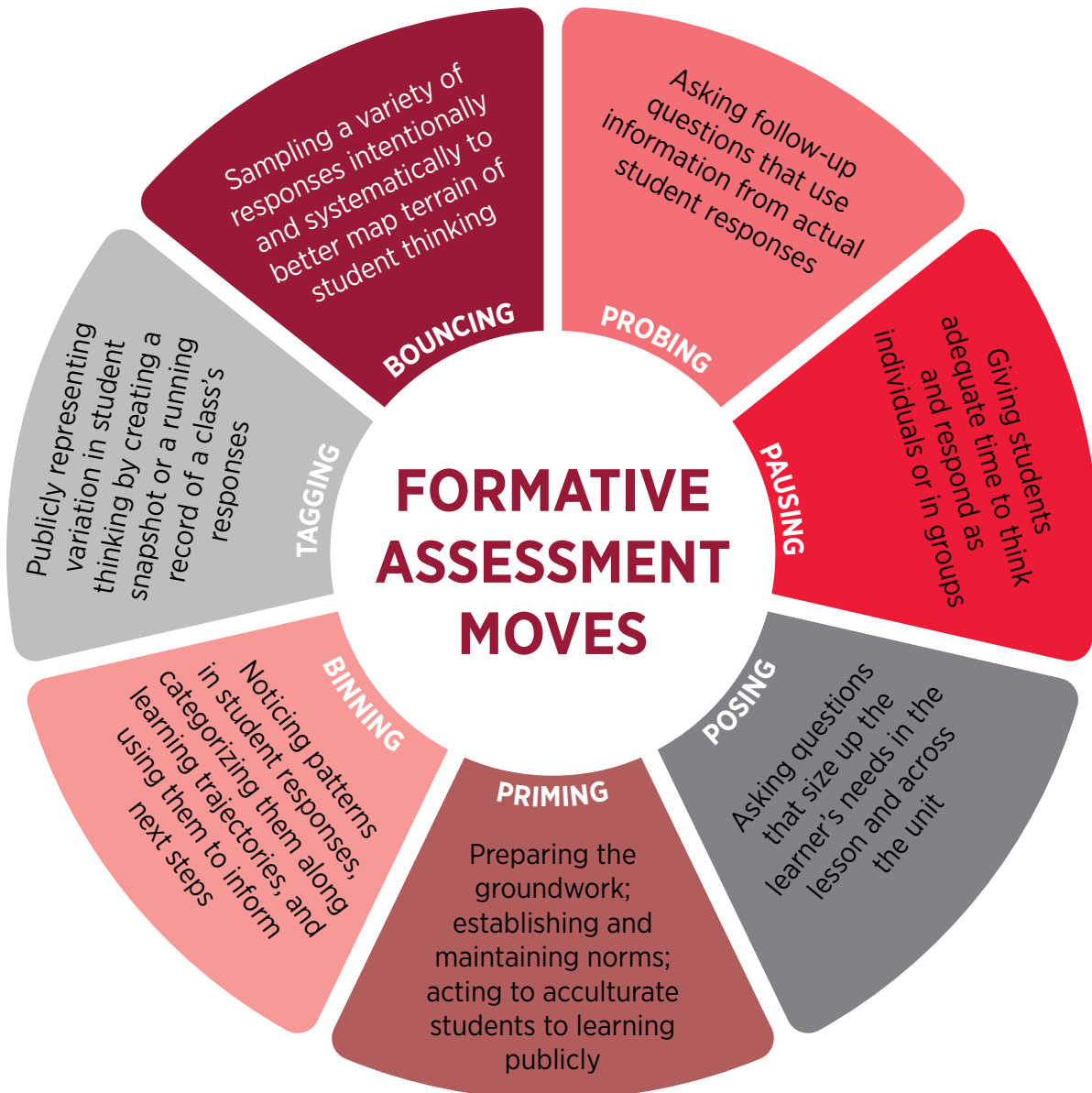
– From *Mastering Formative Assessment Moves: 7 High-Leverage Practices to Advance Student Learning* by Brent Duckor and Carrie Holmberg, 2017, Alexandria, VA: ASCD.

Following on from (Duckor & Holmberg, 2017), the specific modes of formative assessment that would help to comprehend how one might conceptualise progress or success criteria for PtF pedagogy are:

a. **Bouncing:** This aspect of formative assessment is designed to assess in a flexible manner the progress made by the students in terms of their artefacts, or what they have done in any of the PtF units; e.g., to see what they have made according to an Augmented Reality (AR) unit. 'Bouncing' should be a multiple directional process, wherein the artefacts can be shown at any stage or development, and the bouncing can happen between any members of the group. Feedback and the attribution of progress or success can happen in any manner according to 'bouncing', but should veer away from the awarding of marks, or the formalisation of the products made according to a hierarchy (i.e., better or worse). Evidence from the literature has shown that students in rural and remote areas respond better to this type of formative artefact analysis (bouncing) in their digital ICT projects than to the formalisation of their work in terms of a simple, definite mark (Bell, 2009), as this implies that the activity was only valuable for that mark, and not as part of the complex digital learning process that respects the place where they learn.

b. **Probing:** Asking good questions based on the actual products that the students have produced in the PtF sessions, is the key linking activity that should guide the assessment of progress and success. Good questioning and their responses avoids the trap of attributing failure and/or blame to the products, and the necessary teaching and learning that has gone into the production of the artefacts (or lack of); but instead looks to found a mode of digital literacy (Gilster, 1997). Digital literacy in this context involves the students and champions being able to engage in informed, purposeful, and critical discussion about what they have done, and how they have got there. This formative process implies that learning is explicit, and the participants in the group can explain how they have got to make their products. The explicit and expressive probing of the learning process has been shown to be highly beneficial in previous digital projects in rural Australia (Vichie, 2017).

c. **Pausing:** The pedagogy of PtF cannot be packaged into standard time slots, as is often the case for much of the mainstream curriculum and secondary schooling. Rather, a different, reflective, more intensive time should be nurtured, one which allows for and encourages variant and collective rates of learning, understanding, execution and production of PtF artefacts according to the different suites, and having the time to stop completely and start something anew. This opening up of the time frame for education is part of the re-evaluation of teaching and learning in terms of the rhythms of life (Cole, 2011), rather than trying to tie education and learning to artificial and imposed parameters such as the 'school day'. Further, such an opening up will be more in line with the actual rhythms that are present and discernible in rural and remote Australia.

d. **Posing:** Beyond probing, 'posing' acts as part of a more expansive mode of questioning, wherein 'what if' questions can be asked. 'What if' questions extend towards the speculative and imaginative aspects of thinking, and in the specific terms for the PtF project, can be used to assess whether or not the social, cultural and collective goals have been attended to, reached and/or surpassed. This type of learning, questioning and skill building has been understood educationally through concepts such as multiliteracies (Cole & Pullen, 2010), and multiple literacies theory (MLT) (Masny & Cole, 2009), and has been shown to expand expressive learning beyond narrow focuses, as the notion of 'digital literacy' could imply, to include the broader, bigger syntheses of learning that are required to purposefully incorporate high-tech skills into the everyday life of rural and remote areas of Australia.

e. **Priming:** Formative assessment is non-linear, anti-foundational, and interrogates the assumptions of the learning process. In line with these precepts, the success and progress criteria of PtF pedagogy need to be able to be revaluated and reassessed in situ and in real time, so that the groups and individuals are able to continually ask basic questions about why they are learning the high-tech skills, and to what purpose. The high-tech skills transmitted by PtF lend themselves to collective project work, and these projects need to be adjusted and redirected at any time given local, unpredictable, shifting teaching and learning conditions, as has been mentioned above in the infrastructure section (4.2). This priming approach to flexible ICT project work in outback Australia has been proved to be efficacious in previous research-based studies (Freeman et al., 2016).

f. **Binning:** Once the previous aspects of formative assessment have been completed, it should be able to discern definite through lines for the group based on the five aspects of formative assessment listed above. 'Binning' does not imply negatively reacting to any members' contribution to the group effort, or criticising anyone for their lack of technical skills acquisition. Rather, binning as a formative assessment practice, and part of the PtF success and progress pedagogy criteria, points to recognising how and why certain projects successfully optimise the teaching and learning of the PtF and others do not. For example, the group dynamics of a collective AR project that present the history of their local town might determine that the AR presentation of these events is too dispersed and incoherent. The group will therefore fall back to the start and reformulate their AR project in terms of a more specific focus, for example, the mining history of the town. Such formative binning processes have been shown to be successful in research-based studies in outback Australia on extending digital ICT teaching and learning to specific youth communities through media literacy (Notley & Dezuanni, 2018).

g. **Tagging:** The aim of every suite of high-tech skills taught through PtF should be to give public performances of the skills learnt that showcase the effort and teamwork of the participants. For example, the AR products may be displayed in the entrance to the local library, the robotics results can be displayed in a robot fight for the local RSL club, a VR creation of a local beauty site could be used as a temporary display in the local tourist information centre. The point of tagging is to give the PtF participants a feeling of satisfaction, pride and a sense of the power that their new high-tech skill sets can give them. Tagging should not be the endpoint of the learning, but set as a criterion for success and progress that demonstrates what the group have and can achieve. Tagging should identify the group aims of the project and give group members the opportunity to speak with outsiders about their experiences of learning high-tech skills. Research in hard to reach Australian contexts has shown the power of using public display to enhance formative assessment with ongoing youth ICT projects (Shaw, 2005) and the direct feedback which this provides.

In sum, these entwined and inter-related aspects of formative assessment can be used to determine the success criteria and progress of the PtF suite of high-tech skills and their requisite pedagogy.

5

Programming the Future (PtF) and Indigenous Education

5.1   Introduction

The Aboriginal Australian communities represent the oldest living culture(s) in the world. Oral traditions amongst these communities date back 60,000 years, when the first Aboriginal peoples journeyed to what we now call Australia. Aboriginal communities are rightly proud of their culture and traditions, that are perhaps globally one of the most firmly embedded in the places that they call home, and this powerful connection is embodied by the phrase 'country', which denotes their complex relations to their places, environments, ancestry, and traditional stories. However, one may state that this base and connection has been disrupted and challenged on many different levels since the first white permanent colonial settlers came to Australia in the eighteenth century. These displaced connections and complex relationships must be taken into account when evaluating a project such as 'Programming the Future' (PtF), which purports to work in places where there are high populations of Indigenous children, such as regional NSW (i.e., the Bathurst and Dubbo areas). In order to do this, this section of the report can be divided into 3 inquiry sections:

1.   What is known in the field of Indigenous Australian education about projects such as PtF?

2.   What are the relationships between Indigenous Australian populations and the types of new technologies & skills offered by PtF?

5.2 What is known in the field of Indigenous Australian education about projects such as PtF?

In broad terms, the literature in this field can be broken down into projects and follow up research that has fully taken into account, and attempted to understand the specific cultural heritage in the working through of the outreach programme, and those that have started from a deficit model of social change, often after reading socio-cultural indicators, such low literacy rates amongst Indigenous youth, or high poverty, unemployment, and significant recidivist rates in the respective communities[1]. Amongst the positive outreach projects that have worked with Indigenous communities, and have looked to improve Indigenous educational outcomes, there are:

a. Projects that have attempted to work with Indigenous languages, and have incorporated ICT into Indigenous education, using language as a medium for instruction. For example, Auld (2002), reports on a picture book project with Kunib dji, a remote, Indigenous Australian group in the Arnhem Land region of Australia's Northern Territory. The project deployed talking books in Ndj bbana, a language with only 200 speakers; the books were displayed on touch-screens at various locations in the community. Auld (2002) found that, "[w]hile the Kunib dji are interacting around the

touch-screens, they are integrating new literacies into their complex lifeworlds. The computer was used in this study to represent a hybrid form of Ndj bbana, which also supports the transformation of Kunib dji culture. The inclusive nature of Ndj bbana talking books allowed a range of Kunib dji voices to be spoken across a variety of channels which could be heard on demand in the Kunib dji homes (p. 55)." The author also reports on other similar projects, which show that educational ICT programs that incorporate Indigenous languages into their operations, attract interest and local 'buy in' into their functioning, due to the cultural novelty and community investment into seeing their predominantly oral languages represented in new ways. For example, Darvall (1986), has looked at an ICT project that translated Wytaliba word lists into English to help Indigenous students function in the mainstream curriculum in remote schools. Similarly, Czerniejewski (1989) has reported on a project that used ICT programs to improve literacy acquisition in Aboriginal children's first languages, and therefore engaged them in ICT and henceforth in other school work.

Aboriginal Art by the Bachelor of Education (Primary) Aboriginal and Torres Strait Islander Education and the MTeach (Primary & Birth-5 years / Birth–12 years) pre-service teachers, Bankstown campus, Western Sydney University.

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1 For example, Aboriginal people are massively overrepresented in the criminal justice system of Australia. They represent only 3% of the total population, yet more than 28% of Australia's prison population are Aboriginal.

Such a use of ICT software shows the possible role of the computer in providing structural educational support and an expansion of predominant oral Aboriginal learning forms, as Aboriginal literacy has previously not been passed on generationally through writing. Dench (1991) found that computer usage in particular remote locations around local language use, can result in enhanced educational outcomes, because the formality of the learnt written (and read) curriculum and lesson directed by a 'power-wielding' (often non-Aboriginal) teacher had been bypassed. In short, the literature in this field proves that remote Indigenous communities and their children are highly receptive to programs and software that utilise and present their specific languages. These Aboriginal languages provide the motivation and specific interest to engage with the technology, and even though other educational goals may be difficult to reach, evidence certainly points to the benefits of ICT programs in Indigenous languages as providing increased engagement, a pivot and talking point that can lead to improved bilingualism, enhanced educational outcomes and engagement, and better community cohesion as a result of these enhanced educational matters (Trinidad, 2007). However, the time, effort and bilingual expertise that it takes to produce such ICT educational materials in specific Aboriginal languages, may prove to be prohibitive in terms of their large-scale production, and explains why 'Save the Children' have not been able to incorporate Indigenous languages into their suite of high-tech skills called 'Programming the Future'. However, a perhaps less labour and culturally intensive approach to Indigenous educational engagement with ICT matters, is to deploy popular elements of Aboriginal culture such as song, art, and dance into the high-tech lessons.

b. The mainstream educational curriculum could be seen as a race to premier qualifications (e.g., high ATAR scores), and to provide the basis to succeed in a world dominated by capitalism. In contrast, Aboriginal Australian cultures contain a curriculum that is specific to their places, holds inter-generational knowledge about their ancestral lands and peoples, and is passed down orally and enacted through ancient rituals such as 'walkabout'. Research into outreach ICT projects that incorporate authentic elements of Aboriginal culture into their functioning have proved to be very effective in engaging Indigenous youth (Krakouer,

Wise & Connolly, 2018). For example, Buchtmann (2000) has analysed why the Warlpiri have adopted modern communication technology, and whether or not there have been any substantial social changes as a result of the use of ICTs by these people. The paper also examines the innovative media work of the Pitjantjatjara people at Ernabella, in the far north of South Australia, and shows how both the Warlpiri and the Pitjantjatjara have made such use of the technology to further their songlines.

In short, it was found that the Warlpiri and the Pitjantjatjara peoples have embraced the latest in communication technology to broadcast and expand the reach of their storylines through song. In an effort to stave off eradication in a western mainstream media saturated world, these Australian Aboriginal groups have grasped available technology with the specific purpose of extending their particular cultural voices as far as possible into the world, and for anyone to hear. Similarly, Jones & Birdsall-Jones (2014) have shown how the establishment of art centres can act as catalysts for positive social change in Aboriginal communities. Aboriginal art is a readily recognisable cultural artefact and form that can be deployed for educational purposes and represented using ICT platforms. Evidence in the field demonstrates the positive benefits of incorporating Aboriginal art as a medium and a focus in any activity designed to engage and attract Indigenous participation, including educational outreach of the type organised by PtF in remote communities (Carty, 2011). Lastly, the deployment of Aboriginal music and dance are important cultural activities, that would enhance any educational outreach activity, such as the 'Programming the Future'. For example, Gibson (1998) has shown how Aboriginal music artists have been 'writing themselves into being' through their music and dance, and that their cultural productions are more important to them than mere music and dance, because they communicate the deeply held beliefs of their culture. In a similar and parallel way to the production and broadcasting of songlines through digital media, the extension of Aboriginal culture as music and dance, and as potentially represented through and by ICTs (e.g., in podcasts), is an important means of contact between Aboriginal and other cultures. Significant evidence in the field shows that Indigenous children will engage with ICTs from an

early age if culturally relevant material such as their own music and dance forms are included in the curriculum (e.g., Kirkwood & Miller). In addition, the third factor that could be said to have a positive effect on the uptake of outreach projects such as PtF, is the specific training of Aboriginal mentors in the locations of the outreach, and in the particular goals, skills and outcomes of the particular project.

c. This aspect of the Save the Children approach to PtF was termed as 'the champions'. The champions were to be trained in situ to deliver the elements of the Save the Children PtF suite of high-tech skills to local communities. There has been a push to implement effective strategies in educational leadership from within Indigenous communities for at least the last thirty-five years (Purdie & Wilkinson, 2008). Purdie and Wilkinson (2008) list the five characteristics necessary to make Indigenous leadership in education work as:

    i.   Leadership starts from within;

    ii. Leadership is about influencing others;

    iii. Leadership develops a rich learning environment;

    iv. Leadership builds professionalism and management capability;

    v.   Leadership inspires leadership actions and aspirations in others (p. 14).

Clearly putting these principles for leadership in place takes time on the part of the educational authorities, and perhaps the most notable recent push in this regard around Australia has been the 'Stronger Smarter' program in Indigenous education in Queensland (SSI, 2017) that has been running for the last 10 years. The Stronger Smarter Institute have been implementing on the ground educational training courses and deploying metastrategies to encourage Indigenous educational leadership in Queensland schools and more recently elsewhere.

These metastrategies of the Stronger Smarter Institute are:

a. Responsibility for change (professional accountability);

b. Taking a strengths-based approach;

c. Embracing a positive Indigenous student identity (Strong and Smart);

d. Building High-Expectations Relationships (SSI, 2017, p.1).

The Stronger Smarter approach to changing the experience and quality of Indigenous education in remote areas is a comprehensive one, that involves local communities at all levels, and has simultaneous research programmed into its functioning. Indicators for the effects of this project are framed as being very positive, but one wonders how sustainable such an approach might be, as it inevitably involves substantial long term investment and commitment from all concerned. At the very least, 'Smarter Stronger' proves that to improve Indigenous education for remote communities requires a connected suite of socio-cultural strategies, aimed at encouraging, inspiring and including all members of Aboriginal communities, and in convincing them that the program is worthwhile, communal, and positive on every level. Such an approach to embedded Indigenous leadership could be seen to be aspirational for Save the Children and PtF at the current time.

5.3 Indigenous Australians and the new technologies

As stated in the above section, research in the field has shown that Indigenous Aboriginal communities are particularly interested in ICT applications that carry their cultural messages, as they are deeply connected to their oral traditions that place them on all levels in their locations around what we have called Australia. However, Indigenous children are often seen to be failing in mainstream education due to their high school drop-out and absence rates, and low academic achievement (e.g., in English literacy and numeracy) statistics, which are compounded by many entwined socio-cultural issues such as poverty, domestic violence, and in general challenging home environments (Purdie & Buckley, 2010). Such failure may extend to the learning of the types of high-tech skills contained in the PtF suite, especially if they are delivered as part of the mainstream school curriculum; e.g., as supplements to school science, as this is where the failure seems to congeal. Therefore, the role of the specific type of 'out of school', informal learning offered by Save the Children in PtF may have particular significance for Aboriginal youth.

Research in the field has focused on the ways in which digital teaching and learning has been understood through 'learning styles' (Hughes & More, 1997), which can be summarised for Indigenous children as 8 'strengths':

1. Learning through observation and imitation rather than verbal instruction;
2. Learning through trial and feedback;
3. The group is more important than the individual;
4. Holistic (global) learning;
5. Visual spatial skills;
6. Imagery;
7. Contextual Learning;
8. Spontaneous Learning (p. 13).

Aboriginal Art by the Bachelor of Education (Primary) Aboriginal and Torres Strait Islander Education and the MTeach (Primary & Birth-5 years / Birth–12 years) pre-service teachers, Bankstown campus, Western Sydney University.

Therefore, the teaching and learning of high-tech skills should be to align the particular skills to be learnt, e.g., 'coding', how to do things with Augmented Reality (AR) and Virtual Reality (VR), with the Indigenous learning proclivities, by using the 8 strengths as listed above. However, the danger of applying learning styles in terms of the take up and learning of a set of high-tech skills such as those offered by PtF, is the possible subjectification of the learning process that 'learning styles' implies. Rather, it is known that Aboriginal learning is more than a style or strength, but happens in the collective, it is necessarily a collaborative and communal process, and should in no way individualise or isolate the person by themselves or away from their clan and country. Halsey (2018) suggests that a key way to achieve this outcome is through ICT facilities connected to out of school, informal learning centres, that focus on a community and culturally based teaching and learning approach (p. 5).

The relation between Aboriginal communities and the teaching and learning of high-tech skills must therefore be part of and connected to inter-related 'communities of practice'. What these communities of practice precisely consist of, and how they change must be flexible, open to local innovation, and completely situated in the environments where they exist, due to the high need of the Aboriginal community to be connected to country. These caveats to connecting Aboriginal communities with ICT learning have been well-explored in the research literature (e.g., Dyson, 2004; O'Donoghue, 1992), and projects that have taken on board the principles of community based learning and communities of inquiry, have been more successful than those which do not. Wenger's principles for communities of practice have become the dominant paradigm in this field, and have come to theoretically and practically organise the ways in which learning communities and ICT may be linked. These principles may be summarised as:

1. Design for evolution;
2. Open a dialogue between inside and outside perspectives;
3. Invite different levels of participation;
4. Develop both public and private community spaces;
5. Focus on value;
6. Combine familiarity and excitement;
7. Create a rhythm for the community (Wenger, McDermott & Snyder, 2002, pp. 1–3).

These principles may seem to be very difficult to completely enact on the local level, and at the same time; however, they may serve as a guide to what it takes for communities of practice to emerge of the kind the Save the Children have been looking to produce through PtF. The embedding of the teaching and learning of high-tech skills in remote Indigenous communities requires the precept of communities of practice to be in place to connect the communities with the specific objects to be taught, and to avoid the litany of failures that have dogged educational reform in this context in the past (McTaggart, 1991). Ultimately, the high-tech skills and learning objects that the Save the Children PtF have proposed must fit in with a functioning community of practice with and in the Aboriginal communities that are being served, otherwise the desired skills and suite of programs will miss their mark.

... research in the field has shown that Indigenous Aboriginal communities are particularly interested in ICT applications that carry their cultural messages, as they are deeply connected to their oral traditions that place them on all levels in their locations around what we have called Australia.

6

A Hub and Spokes Model for Training in New & Emerging Technologies

6.1   Introduction

PtF used a hub and spokes approach to the delivery of training in new and emerging technologies to champions, children and young people from digital hubs in Bathurst and Dubbo to spokes in other suburbs in regional NSW. Initially, two Digital Excellence Hubs (DigiEHubs) were set up within existing public service providers, namely Headspace in Bathurst and Macquarie Regional Library in Dubbo, where digital technology expertise, cutting-edge computer equipment and resources were maintained. To explain the rationale behind PtF training distribution model, Belle[1] said: '*So, the original thinking was along the lines of being able to train the hub centre a bit more intensively and for them to then support the spokes in those outlying areas*'. To achieve this aim, PtF established partnerships with several local community services by recruiting and upskilling local leaders, or champions, who in turn delivered training to children and young people in smaller spoke sites, with fewer resources, located in other suburbs in regional NSW. This qualitative transcript analysis will proceed by examining:

1.   The pedagogic strategies that have been deployed by PtF.

2.   The relative success or failure of these strategies.

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1 All names in this analysis are pseudonyms to protect the anonymity of the respondents and in line with the ethical clearance to carry out this research project (REDI Reference: H12968).

6.2   The pedagogic strategies that have been deployed by PtF

The fieldwork for this research project has allowed for the conceptualisation of the pedagogy of PtF thus:

Figure 2: Diagram to explain the pedagogy of PtF
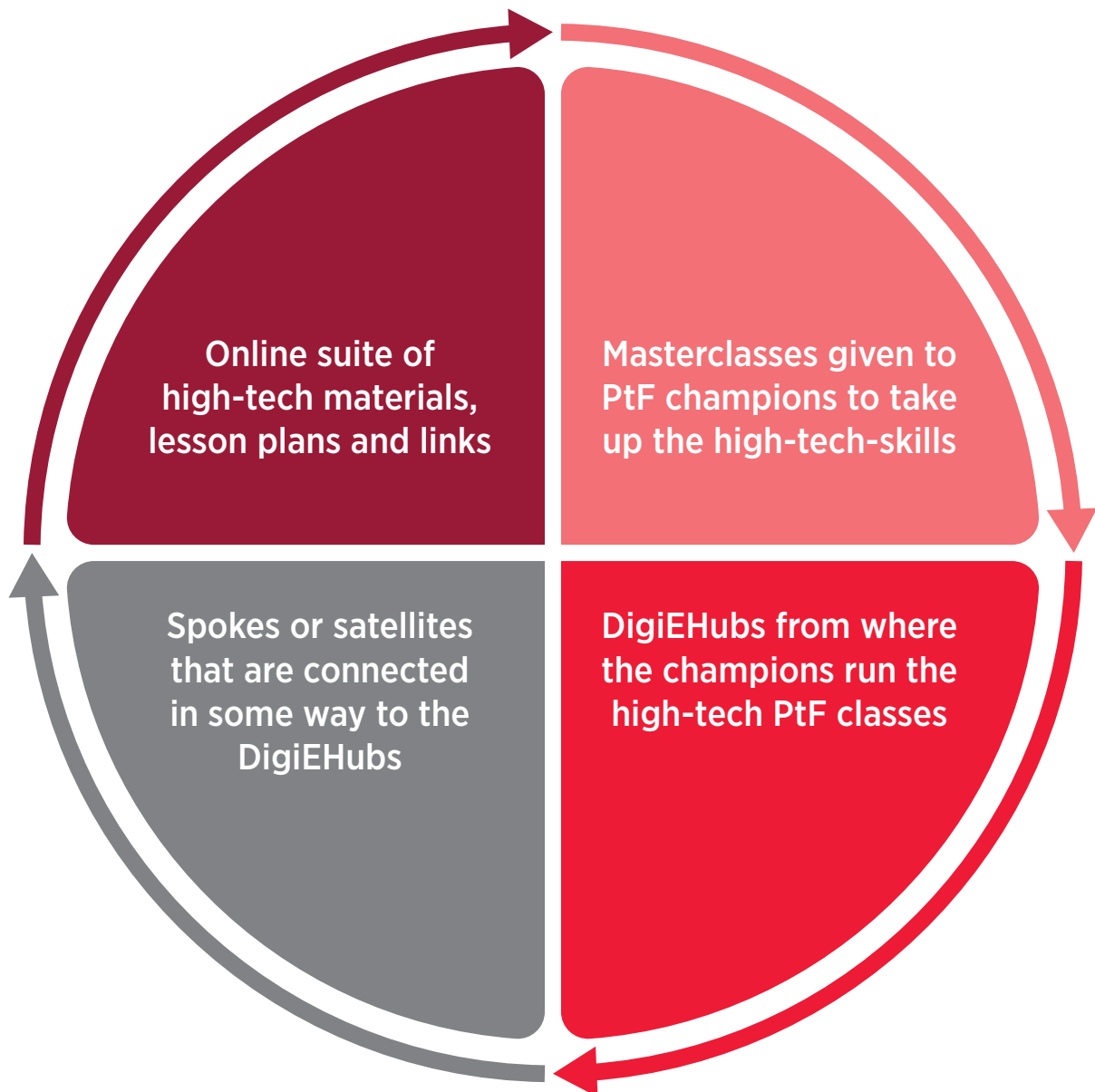
In sum, the strategy of PtF was to upload the materials into the PtF Google classroom, facilitate masterclasses in the high-tech skills sets for 'champions' to disseminate the skills, and to allow for and encourage the champions to teach the skills in their particular locations. Further, spokes or satellites were derived from the existing networks of the DigiEHubs, from which the champions could help to coordinate further PtF sessions. The masterclasses were enhanced by video conference technology, that helped to include champions from other DigiEHubs who could not attend the particular masterclasses. To aid with the analysis of the teaching and learning strategies used by PtF, the strategies have been broken down, as explained in the following pages.

6.3   Analysis of specific high-tech skills

The transcripts from the qualitative fieldwork indicate that high-tech skills have been taught through the PtF pedagogic strategies, for example, as related by Daisy, a facilitator of the masterclasses:

> ...VR is very similar to the way we make VR. The way they're teaching Scratch coding is – universally everyone teaches Scratch very similarly with similar goals, whether it be gameplay or animation, just depending on what you're doing. The way they're teaching augmented reality, I think they're still developing some stuff on that...

According to this fieldwork evidence from the masterclass facilitator, Daisy, VR, coding (using Scratch), and AR high-tech skills have been taught by PtF. The extent or coverage of these high skill developments is unknown, as the masterclass facilitator only spoke from the perspective of teaching champion masterclasses. Evidence seems to point to singular classes, where the high-tech skills were taught through direct instruction, practical, hands on experience, whereby the participants worked through their skill acquisition, and the direction to online links and web sites (e.g., Scratch/Metaverse) that further help to explain how to work with the requisite high-tech skills under instruction. An introductory course to Scratch, delivered in two parts, covered basic principles of coding in graphical programming language, including, familiarisation with the Scratch interface; coding a basic game in Scratch, and transferability of coding concepts to other coding languages, for example, as expressed by Daisy:

> Then they built augmented reality experiences using Metaverse as well.

This evidence is backed up by statements from the champions in Dubbo library, who were responsible for running a 'DigiEHub'. They related how the high-tech skills they focused on were coding and robotics, which had online resources readily at hand to back up their library PtF sessions:

> A lot of the things like Scratch and the Micro:bit[2] and the robotics have a lot of really good online resources all ready to go. Free to use which has been really helpful...

PtF Google docs tutorials provide project ideas for harnessing AR and VR for educative purposes and with minimal resources, such as: a journey through a family history; storytelling; local guides for a community; language and cultural tours. For example, the Google Cardboard can be used in conjunction with a mobile phone and compatible 3D app, that can be downloaded for free to create a virtual reality of, for example, a capital city, such as London, and be able to virtually explore it. Similarly, Smartphones can be used to create AR with the aid of free apps, such as Metaverse, that allow users to create characters, dialogue and scenes, and which can be accessed by others so that the AR can be experienced collectively.

...a wide range of Coding, AR and VR activities require minimal resources and were therefore more accessible universally.

PtF participants engaging in creating AR at the Dubbo DigiEHub, Macquarie Regional Library

2 https://microbit.org/

There was further evidence from a former leader of PtF, Belle, who described how the notion of deploying 3D printers as a high-tech skill development area, could act as a focal point of interest to engage young people in a process that could lead to tangible results (printed objects). However, it was also commented on that the deployment of 3D printers is to an extent a 'double-edged sword', in that it is entirely dependent on having the resources to supply the printer to the sessions, and if these resources are cut off, the skill of being able to use a 3D printer becomes immediately obsolete:

> *Do young people have access to 3D printers to then go on with it if they wish, or are we just teaching a skill that as soon as we're gone, all of the resources are gone and there's no follow-up?*

Belle attributed the shortcomings of the hubs and spokes model in this regard to the distance between the hubs and some of the spoke sites. She said:

> *I actually appreciate that the hub and spokes model was great in theory, but in practice, what we found was that between some of those hub and spokes - like Young was a spoke of Bathurst, that's actually two hours' drive away. So, the physical distances between those two places actually made that model a little bit difficult.*

While the distance between the hub and spokes made it difficult for champions and children and young people in remote areas of NSW to have access to some of the more expensive PtF equipment, such as the 3D printers, as these were solely located in the DigiEHubs, a wide range of Coding, AR and VR activities require minimal resources and were therefore more accessible universally. Some of the champions were aware of the potential for AR and VR to be used as a catalyst for achieving collaborative personal and social educative goals. Explaining how she encouraged young people to think about applying AR and VR to real life situations, a Macquarie Library librarian said:

> *Basically, we just start off introducing what is augmented reality and what it can be used for in real life? Then we give a demonstration and get the kids to have a go and then we start to go into the instructions of how it can be done.... So, the last session we did, we got the kids to make a trivia game with questions based on the library. We're going to start to do more just walk in type of thing, especially with the virtual reality; where kids can come in and just use the virtual reality for half an hour by themselves.*

VR headsets open the door to new realities

Dubbo DigiEHub, Macquarie Regional Library participants explore the world of coding

On the other hand, evidence from another champion, Wendy, who has taken masterclasses through PtF and was running her own sessions in a DigiEHub, shows that the approach that she took to teach the high-tech skills was to concentrate on one skill per week:

> *like alright we'll teach about AR this week; we'll teach you about VR this week; we'll teach you about this next week.*

However, in Wendy's transcript, she expresses the frustration that she didn't feel that she could devote enough time to properly teaching the high-tech skills contained in the PtF suite of Google online classes. Certainly, only spending one week on VR, then another week on AR, could lead to an unsatisfactory, and superficial teaching and learning experience of these high-tech skills. As expressed by Wendy, she would have preferred to devote a whole term to one skill, but she was for some reason unable to do this:

> *…so whether or not it was alright so this term we're going to just look at Scratch and look at coding and you can then run a program in coding for the term. Then next term we might look at VR for the entire term…*

Also, she notes how many children were already receiving similar if not more advanced high-tech skills at school. Around the time PtF was launched, a NSW state funded initiative called STEMShare offered a wide range of resources to support schools in developing VR, AR and coding. STEMShare project made 660 technology kits available for schools to borrow for a term. This made Wendy unsure about how the high-tech skills that she was teaching matched up and cohered with the school curriculum. This could be a problem in terms of the repetition of the same skills, and the engagement of the youth in the PtF sessions, if the PtF suite of skills is too basic or too complex for the level of the children involved with the program:

> *I talk to young people and they say oh, yeah, we're learning Python at school*

Lastly, evidence from the transcripts points to how Mike, a member of the Aboriginal Education Consultative Group (AECG), had used the high-tech skill sessions that he had attended with Daisy, and had been able to specifically match them with school curriculum and the interests of the Indigenous children. These processes will be analysed in more depth below. For now, it is worthwhile to note that the high-tech skill of Augmented Reality (AR) was taught in some way through the AECG and its contact with PtF sessions, and Mike's ability to partner up with interested parties to make the high-tech skill learning happen for Aboriginal youth:

> *Indigital Storytelling[3] which was a company – so what they've done was, through AR, they once again were out on country learning local stories, put that into artwork and then through the app the students, through AR, developed a series of cards…*

3 https://www.indigital.net.au/

6.4   Characteristics of PtF pedagogy discernible

This section will analyse evidence from the transcripts that points to the ways PtF high-tech skills have been taught. Clearly, there is a progression and differential here, from the online resources and links, that are static, and can be taken up in any way by interested parties, but may have instructional strategies embedded in them such as: game playing, staggered rewards, animation and interactive/dynamic digital elements such as quizzes, graphics and video; to the pedagogy discernible from the masterclasses, to the pedagogy of the champions, and the peer pedagogies, that are prevalent in high-tech skill acquisition, because of the ways in which many of the skills have already been learnt by students acquiring them for themselves online. Evidence from Daisy, the leader of the masterclasses, suggests how in her mind, PtF should be taught:

> So, the way I've tried to lay out my lessons is by saying well let's discover the technology and let's really talk about where it came from.

In other words, this points to a 'hands-on' mode of pedagogy, wherein the 'discovery' element of the technology and how it functions is maintained, whilst providing practical lessons explaining how it works. Later in the transcript, Daisy elaborates further pedagogic principles, that one might infer would inform her practice and that of the PtF masterclasses:

> It's about – yeah – so no, it is a form of entertainment but it's about teaching all this stuff while having fun and you know, engaging the kids. Because at the end of the day, the libraries are running these things for the kids but it's there to be fun and for the kids to get something out of their community, not necessarily at a school where you've got learning outcomes.

This last statement shows how the PtF pedagogy was directed from the masterclass level as being interactive, informal, and not following the definite learning outcomes that one might expect from school curriculum, and it requisite pedagogy (i.e., leading to testable skills). The fun and engaging aspects of the pedagogy are worth keeping in mind, as the PtF pedagogy looked to engage as many young people as possible. With this aspect of the PtF pedagogy as prescribed from the masterclasses, and as part of the evidence going forward for this transcript analysis, one might consider the pedagogic perspective of the Dubbo librarians, who took part in the masterclasses, and were responsible for a 'DigiEHub' operating from their library:

> Our philosophy is all about learning, but not everyone having an exact same project at the end. So, it's a bit more about creative freedom and thinking. We're great because we are a great place to find information. So, if they need help with something we can reinforce our message about lifelong learning and libraries are a great place to learn more and find information and you can be eight or 80 and still learning...
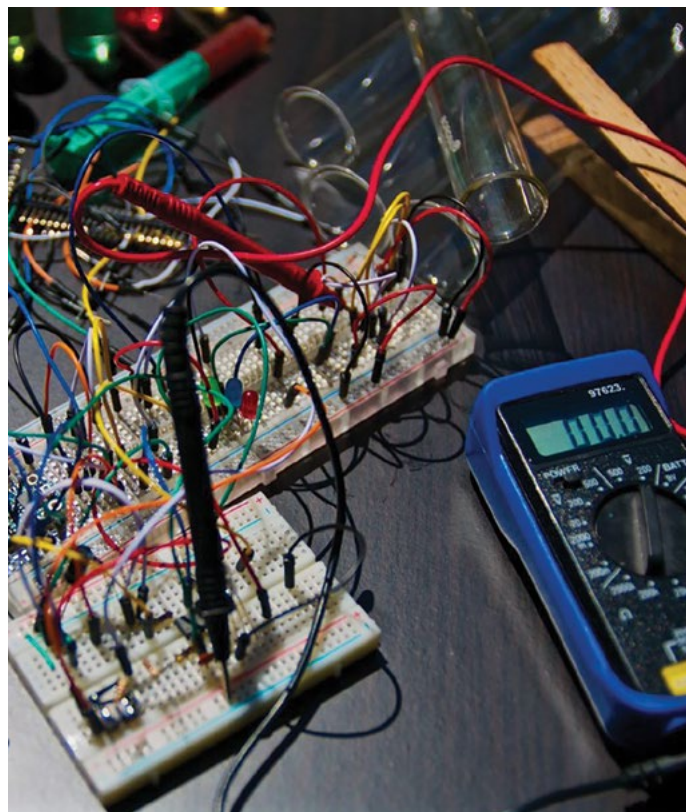
Technology continues to advance at a rapid pace

Thus, the specific teaching and learning of high-tech skills becomes secondary to the learnings that the sessions can produce. One way to understand this approach as a mode of 'affective literacy' (Cole, 2013), whereby direct instruction becomes subsumed by a mode of constructivism that is not individualistic. Rather, the mode of learning achieved defies conventional power movements (e.g., teacher-students/learnt knowledge-exams), and produces chaotic, bottom-up, and potentially subversive movements in thought that do not respond to the normative pre-coding of schooling. This means, if it is enacted, that the participants are able to (re)design their own high-tech projects based on personal and collective interests. This pedagogic approach, that was apparent according to the PtF fieldwork transcripts in the Dubbo DigiEHub, concurs with an analysis of a parallel high-tech hub and project, directed by a PtF advisor, Joy Suliman:

> At that level, that's going to be happening in what we do but also just being able to talk about it in a meaningful way and to make people aware of what is available and what the possibilities are so that we are on a journey from being consumers to being collaborators and creators in this world, that we are actively shaping it and able to bring it to bear in ways that are meaningful for us and our communities…

VR headsets do not need to be expensive

In effect, the pedagogy advised for the PtF suite, and that has been shown to work elsewhere, enables a reversal of traditional teaching and learning rituals, whereby a power relation is realised from teacher to students, or from learnt curriculum knowledge to examination results and the designation of high-value qualifications. This schema for high-tech PtF pedagogy, in many ways, replicates much of the literature in the field, that suggests that digital pedagogy turns away from instructionalism and correctionalism to designing new socially agreed upon futures (e.g., Cole & Pullen, 2010a). This pedagogic approach merges with evidence from the fieldwork, that suggest that the methodology of the PtF supported by the AECG, mimics how Aboriginal teaching and learning functions in mainstream education as suggested by Mike:

> Then I know one school in particular 'K'. Public which we were working with, they actually [innovated] this around curriculum and started embedding some of this into their day to day teaching around a couple of stage areas. There was that ripple effect I guess when we started small and then once we started getting confident and we started getting some end results then the impact on not only the students but how that spread through the, in particular K. Public, by implementing and building programs around Aboriginal sites …

This was also expressed by Mike as being 'authentic learning', wherein the use and instruction for using the new technologies was subsumed within Aboriginal rituals and practices in their country:

> …was around being as - making sure that the learning was authentic, that the links to culture were authentic and it was a way of engaging young students through new and emerging technologies.

In effect, this characteristic of PtF pedagogy and evidence was realised through the support and guidance of Mike and the AECG. The overall relay pedagogy from the online materials, through the masterclasses, and to the champions and the spokes (Figure 1) was bypassed by and through Mike's experience and confidence in making a connection from the high-tech skills sets and Aboriginal culture and vice versa. The social and cultural purposes of the PtF pedagogy that was noticeable from the transcripts will be analysed in the next section.

6.5   Social and cultural purposes of PtF pedagogy:

Literature in the field points to the importance of having social and cultural purposes embedded in the pedagogy of high-tech, digital skills (e.g., Cole & Pullen, 2010b). Evidence from the transcripts shows that the PtF pedagogy that has been evolved has gone some way towards these embedded social and cultural goals, as explained by Daisy:

> *The difference we're doing is that we're trying to bring it into communities and we're not - we haven't laid it out like lesson by lesson. We're teaching - or what I've aimed to teach is along [one of the architects of PtF] layout of you know, discover, create and make, accelerate and then bring it into the community, [take action].*

Daisy's statement resonates with the principles of the digital theory of change (Dellow, 2017), which informed PtF original project design, as it sought to take children and young people through a process ranging from *discovering new and emerging technologies*, to *creating and making*, *acting* and *accelerating*. The central aim of the digital theory of change is to encourage young people to '*use new and emerging technologies to resolve social issues that they have identified in their communities*' (Dellow, 2017). Explaining why it is important to adopt a critical approach to engaging children and young people in learning about new technologies and emerging technologies, Daisy pointed out:

> *So, we're all playing on computers now and as much as we talk about it being really part of their life, you know, kids getting phones at eight, nine years old and they're not - it's not learning about how this stuff is made. It's about learning about the critical knowledge behind what it is you're doing. It's just kind of we've become this consumer culture of let's play Fortnite or whatever it is and not think about the overall aspects of the game design or the gameplay and areas like that.*

What was not clear from the transcripts and the qualitative analysis of the fieldwork for this project, was whether or not these embedded social and cultural goals were realised, or if any substantial action was being taken due to the pedagogy of PtF. The original leader of the PtF masterclasses, Belle, expresses this desire to link up the specific pedagogy of PtF and the teaching and learning of high-tech skills, with social and cultural aims, when she mentions a watering system for a community centre:

> *So, select some partners, have them bring along their clients, and actually do a project-based learning thing. So, say for example, if you wanted to do some sort of - well, we'll go back to an example that [originator of Digital Theory of Change] uses, so if it was to code a watering system for a community centre; find your partner for that, who brings along their client base, you work through that actual project, you have funds to actually deliver that project, so to purchase the tech needed, to purchase the watering system, whatever you need, and go through that entire project from start to finish with that group and be able to collect all of your data directly yourself.*

A PtF Champion facilitates an AR workshop

Macquarie Regional Library in Dubbo DigiEHub

This plan sounds as if it makes up a very complete and useful social project that would deploy the skills learnt through the PtF suite in a real-life problem. However, there is no evidence from the transcripts that this kind of complex activity was realised due to the pedagogy of PtF. Such an activity, with a definite social purpose, would motivate the participants in terms of understanding what coding was necessary to make the system work. In rural and remote Australia, where water is a critical issue, anything that can positively help with water infrastructure would galvanise the community and make people work together towards the common goal of better water management. Thus, the dry, intellectual, and potentially abstract skill of learning how to code may come alive when it is part of a social action to make lives better. The best example that was found from the transcripts that describes a social purpose in action attached to the teaching and learning of the PtF suite of high-tech skills comes from Mike:

> *...for us it led to more opportunity for community members to engage in classroom discussion and meant that we did a lot more outdoor learning for students. So, taking the kids down to the riverbank and having stories with their elders around the fish traps and the significance of it...*

This example shows how cultural values can be linked to the acquisition of high-tech skills. The lesson has been taken out of the classroom, and into the environment, where the Aboriginal children would traditionally learn from their elders. Thus, the depiction and capture of this traditional, culturally significant learning can be taken up and disseminated using the high-tech skills contained in the PtF suite, e.g., the use of Augmented Reality to modify and enhance video and images (of the fish trap). The Indigenous use and stories around the fish traps is exactly the kind of social and cultural purpose that can make the teaching and learning of high-tech skills come alive, and be engaging, communal and seen universally as worthwhile.

6.6   Effectiveness of the Pedagogic Strategies used by PtF

It is very difficult to precisely evaluate the success or failure of the pedagogic strategies deployed by PtF described above, given the qualitative transcript data collected. However, one may look at the intentionality and plans for this pedagogy, and the ways in which this intentionality and planning has been realised or otherwise. Firstly, as expressed by Daisy, the PtF pedagogy was designed to be complementary to school pedagogy, and open to the bigger picture of what the suite of high-tech PtF skill could do for young people's lives:

> I think a lot of the digital skills that I'm teaching and what they're teaching is quite you know; I think it would complement each other. I think the kids doing whatever they do at school would definitely complement what they do at the libraries. The focus that we're trying to do is not only support the champions at the libraries to make it sustainable, but also for them to teach why it's important in the greater world and in the greater scheme of their futures…

Thus one gets the sense that the intention for the PtF pedagogy was to not be bound by simple lesson plans and objectives. The bigger picture relates to the career paths and potential uses that PtF participants could put their new high-tech skills, such as using them to enhance running their own business through innovative online marketing. However, we found no evidence from the transcripts that this type of take up and follow through has been achieved in terms of youth in the rural and remote areas where PtF has operated being activated to use the PtF skills to enhance their life prospects. Indeed, Daisy expresses the practical problem of getting feedback from the champion PtF cohorts, to know how and why the attendees of the session have fared:

> Yeah. So, I mean it's hard – because we've really focused on a year of teaching the champion and they're just not giving us the feedback we need about what effect it's had on the kids. I can definitely talk about the social - as far as I can see, I mean obviously my opinion is one-sided but I think we've opened up the space for those champions that we're working with to engage with kids on different areas…

Therefore, without hard data on what the youth are doing with their new high-tech skills, it is very difficult to assess the effectiveness of the pedagogy deployed by PtF. There is a missing link in the feedback data from what has been said about PtF in the set-up, to the actual sessions, and what has happened. This point is reinforced by what has happened in the parallel high-tech project that was investigated during the fieldwork, wherein Joy (PtF advisor) was able to speak convincingly about the take up and use of the specific high-tech skills by session participants:

> When I think about what is the value of technology in these informal learning environments, it's about having that opportunity to understand and be literate. It might turn into a career pathway. In fact, most successful career pathways are turned on by someone igniting a passion or an interest or inspiring you…

These statements show how a hands on and real time approach to evaluating the success or failure of the pedagogic strategies is necessary. The problem with Daisy's evaluation of what happened due to the PtF session, was that she was simply not there, so even though she was the facilitator of the masterclasses for PtF, she was not present at the champion run sessions, and therefore has to rely on feedback that might nor might not be forthcoming and of high enough quality. The librarians in Dubbo were better able to evaluate the success and failure of the PtF pedagogy, due to their hands on and continuous approach to observing what was happening at the session, because they were actually present:

> I mean we had, even though it's not children, we have a lot of seniors come in and try the virtual reality headsets back in October. To see them experience something that they were - just couldn't believe that this technology exists as well just reinforces that lifelong learning, which is what we're all about…

This transcript excerpt points to the ways in which the Dubbo DigiEHub have evaluated success or failure of the PtF session, which was through the 'buy in' and the 'buzz' of the sessions. The ability of the VR headsets to draw a crowd is an important factor for this DigiEHub and shows how the high-tech skills can attract attention that might benefit the overall library attendance and usage. The library can be seen to be a self-functioning social centre, with the capacity to run the PtF session and assess their ongoing viability and success. Macquarie Regional Library was established as a DigiEHub for PtF in Dubbo in May 2018. The two Champions in this location have since led the developments of new and emerging technologies training programs in Dubbo and the neighbouring suburbs. The library has had a pivotal role in the transfer of technical expertise to the spoke sites in other regional library branches and youth and community organisations in Narromine, Trangie and Warrumbungle areas. The librarians initially took part in an intensive training program, offered by PtF Digital Education Specialist, Daisy, alongside the two champions from Bathurst. Together, they embarked on a learning journey as a community of practice, grappling with developing skills in new and emerging technologies, while simultaneously passing on their developing knowledge and expertise to others (as presented in Figure 3).

Figure 3: PtF: an evolving community of practice

DOMAIN
Digital inequality; Rural and regional geography.

COMMUNITY
Hubs & Spokes; Outreach; Partnerships.

PRACTICE
Champions; Google Classrooms, Knowledge and Expertise; Technologies
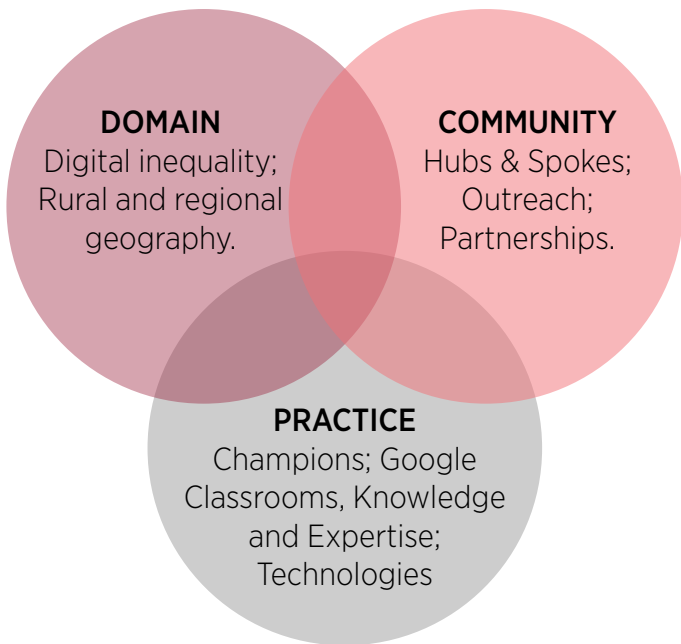
A Champion from Macquarie Regional Library said:

> We are involved in a youth inter-agency group here in Dubbo. It's a community of likeminded organisations, including our Youth Council, that meets regularly to come up with strategies or be part of each other's events to attract young people. We are active in other community groups and events, such as Dad's literacy days and NAIDOC (Macquarie Regional Library PtF Champion).

As such, the Dubbo DigiEHub champions worked efficiently within the Hub and spokes model through establishing collaborative partnerships with groups to celebrate high profile events ranging from the Youth Council to Dads' literacy Days and NAIDOC, and as presented overall by Figure 2. The collaborative multi-agency approach to the provision of PtF training programs in this DigiEHub has contributed to an increase in the number of children and young people taking up the workshops. At the time the research team visited Macquarie Regional Library, a total of 163 children and young people had taken part in a series of workshops in coding, AR and VR in Dubbo.

Table 1: Participants by age, by gender

Age	Male	Female
0 – 7 years	0	0
8 – 12 years	86	50
13 – 18 years	15	12
18 years +	0	0
Total	**101**	**62**

As shown in Table 1 above, the majority of the children and young people who took part in PtF workshops were in the 8 to 12 years of age category, mostly male (62%) compared to the number of female participants (38%). However, the attendance figures do not fully capture impromptu participation by children and young people in the workshops. This is because the library adopts a flexible, informal education approach that is designed with transient participation in mind, for example, that enables children who may briefly participate in the workshops while their parent(s) are collecting or returning library resources.

Macquarie Regional Library ran a total of 62 workshops between 2018 and 2019, as shown in table 2. The year 2019 figures are based on data up to May 2019, which explains a lower number of workshops than in 2018.

Table 2: Number of workshops offered at Macquarie Regional Library in Dubbo 2018/2019

Workshops	2018	2019	Total
Coding	42	16	**58**
AR	1	1	**2**
VR	0	2	**2**
Total	**43**	**19**	**62**

It is expected that the new community engagement librarian, recruited around the time the interviews were conducted, will help maximise children and young people's participation in computer Coding, AR and VR workshops by the end of 2019. Table 3 below shows that although more children and young people have taken part in PtF coding workshops, there has been an increase in the number of participants in AR and VR. Participation rates by gender also show that AR and VR in particular is popular amongst girls and young women.

Table 3: Attendance by activity type.

Gender	Coding	AR	VR
Male	73	6	15
Female	54	3	12
Total	**127**	**9**	**27**

The capacity of Macquarie Regional Library to engage in multi-agency partnerships to maximise children and young people's participation in new and emerging technologies training is difficult for PtF to (re)create overall, as expressed by the former PtF leader Belle:

Because obviously, with a part-time digital education specialist - 250 kilometres between Bathurst and Dubbo and then all of the kilometres between the other spokes that we were meant to get to, the capacity of the digital education specialist to physically co-deliver with those Champions would have been very limited, and the impact on that wouldn't have been as great as the potential that we had with the online learning. Obviously, what you lose in face-to-face we hope to be able to gain more in being able to share with more people and create that community of interest where we've brought those Champions together...

This except expresses the overall problem with the PtF pedagogy, that it was difficult to coordinate and evaluate due to the physical distances involved with the project. Whether or not the champions were properly running the high-tech courses, and exactly what was happening in the sessions, would only be possible to know if you were there, or if very good, high quality evidence was supplied for the sessions.

Another problem with the PtF pedagogy was expressed by the champion Wendy:

In terms of the teaching and the learning for us. I think there was too much thrown in too quickly. While it's great to get a range of different - learning about different technologies – for someone who's very new to it all and technology – lots of people find it scary about venturing into it – spending more time on one particular form of –. Rather than just jumping here and there.

This transcript excerpt expresses the reality of PtF pedagogy for many, and was perhaps an opinion shared widely amongst the champions. There is so much to learn, and there is so much online material, that the teaching and learning of high-tech skills can seem to be overwhelming. Where would one start, how should the lessons proceed? Champions lacking in confidence with the high-tech skills, could become stuck in the many and potentially very complicated ways in which every skill could be taught. This experience stands in contrast to the work done for Aboriginal children by Mike, and the group of champions that he was able to organise to take forward the PtF skills for Aboriginal children through his organisation, the AECG, and their work in local schools:

Yeah. As I said, we had a couple of really good champions, hence the reasons why two of the schools continued to develop programs and embed this into their teaching and learning programs. Obviously with – and I guess one of the - because I was so passionate about this and driving it pretty heavily I think...

It is noteworthy that Mike does not mention any problems with the actual technology itself. This is because these problems have to be overcome and worked out in situ. Rather, he concentrated on getting the children hooked on the potential and functions of the technology in driving Aboriginal education forward, and having a great team of champions clearly would help with this aim. The AECG approach demonstrates the essential success criteria needed to make the PtF suite of skills work: passion and teamwork.

7

Work with Indigenous Communities

Aboriginal cultures have inhabited the place now called Australia for 60000 years. In contrast, the culture, skills and specific learnings that are being offered by Programming the Future (PtF), come from Information and Communication Technology (ICT) development through computers, that has happened primarily in the USA after the 1970s, and has latterly been copied and taken up globally in the race to become technologically competitive. Hence, the analysis of the transcripts for the research project looking at the effects of PtF needs to take into account:

1. The level of engagement of PtF with Indigenous communities.

2. The effects of this engagement between PtF and Indigenous communities.

3. What has happened due to these effects of PtF.

7.1   The level of engagement of PtF with Indigenous communities

Evidence from the fieldwork of this project suggests that an attempt was made to sign a Memorandum of Understanding (MoU) with local Aboriginal communities, that would help to facilitate the acceptance and uptake of the PtF outreach scheme as part of the hub and spoke strategy for community engagement. As suggested by Daisy:

> *[it] was really directed and was great but it's just hard for people to hold to is that we had the MoU and we said we'd like you to do something once a week and we had a digital education for them and we said, this is what you want to achieve and this is what you're going to do but they're all holistic for each group…*

Daisy held an important role in one of the 'DigiEHubs' for PtF, and therefore was responsible for initiating and maintaining a strategy to engage with the local Aboriginal community. However, evidence from this project suggests that even though MoUs were suggested, they were not completed, and signed. Rather, the engagement with the local Aboriginal community came through the informal 'drop-in' nature of the coding clubs at the local libraries and contact with the local AECG (Aboriginal Education Consultative Group), who worked in the local area to improve matters for Aboriginal children in the local schools. Fieldwork for this project suggests that no specific engagement with the local Aboriginal communities was achieved through the location of PtF in the Headspace facilities, as directly stated by, Wendy, a worker at a Headspace, and facilitator or 'champion' of PtF:

> *They don't get young Aboriginal children turning up to use it because they don't feel comfortable going to that space…*

Reasons for the lack of engagement with the Aboriginal community through the Headspace facilities are multiple and complex: for example, the stigma in admitting to having a mental health issue, the mismatch between delivering the suite of high-tech skills, and seeking mental health support, and the fact that local Aboriginal communities may seem reticent at times when using the facilities in the first place (as it is not their place). However, these points were contradicted by another respondent to the qualitative fieldwork, Belle, who had helped set up the DigiEHubs for PtF before Daisy took over. This respondent has said that:

> *Across both Bathurst and Dubbo (the DigiEHubs), we made quite concerted efforts to look at targeting specifically Indigenous groups and Indigenous young people. So, in Bathurst, for example, Headspace has a proportionally higher percentage of young Indigenous people who access their services than is representative of the community.*

Therefore, there was the perception through Belle, and possibly shared more widely by PtF, that using the Headspace facility would be a successful strategy for engaging PtF with Indigenous youth and the wider Indigenous communities. However, as it turned out, this was not the case, and this strategy was not successful. Belle also mentions the strategy of going through the local land councils:

> *We also met with the local Aboriginal Land Council and in particular one elder 'Betty', who's quite prominent in the Kelso community. I don't know whether you've heard much about Kelso, but it's probably fairly similar to the … quite significantly disadvantaged area that you went to in Dubbo. So, my understanding is that Daisy continued those meetings with the Kelso community and [Aunty] Betty…*

However, the fieldwork for this project could find no evidence that the strategy to engage with Indigenous youth had been successfully maintained through contact with the land councils, Betty or with the Kelso community. Belle also suggests that CatholicCare or formerly Centacare were contacted about running and participating in PtF. However, we could find no evidence that this initial contact had resulted in any worthwhile engagement of the Aboriginal community. Rather, the evidence that we found due to the fieldwork for this project was that these contacts (with land council and CatholicCare) were not particularly well-established, or did not result in the substantial or long term engagement of the Aboriginal community with PtF as desired. The reasons for this lack of engagement can be multiple, but point to the ways in which engagement with specific communities requires focused outreach work, members of the community being involved with the work, and taking charge of aspects of the project (more than being called champions), and for substantial benefits to flow to and from the project to the specific communities. It seems that even though this was the intent of PtF, this was not achieved through the hub and spoke model. Rather, each community would have to see themselves as particular hubs, with a focused role to play in the development of the project. Fortunately, this type of engagement was seen through contact with the Aboriginal Education Consultative Group (AECG), and one respondent in particular, Mike:

> Well we got – it was quite – obviously working with the local school we met with local elders, we met with the local Lands Council, we met with the local AECG, so we went through all the key stakeholders, Aboriginal key stakeholders within the community. Obviously, we ran into some challenges...

As a member of the local Aboriginal community, a member of AECG, and as an enthusiast with respect to the new technologies and skills that PtF could deliver, Mike was an excellent agent in terms of engaging local Aboriginal communities with PtF. Mike did the groundwork to initiate the contact with the local Aboriginal community, and followed up with his own interest and passion for the technology, and what it could do for the Aboriginal youth. This research suggests that it is exactly this type of passion and dynamism that helps to bridge the potential gaps between a project such as PtF, and the local Aboriginal community. This gap was exemplified by transcripts from one of the designated DigiEHubs, Dubbo library, and a respondent talking about Aboriginal children and PtF sessions:

> ...Promote that inclusivity that they can come in but they hesitate when it's a lot of kids. They'll hover at the door. When we say come in, they hesitate a little...

The libraries ran the PtF sessions as part of their drop-in strategy, wherein, anyone could take part in coding, AR, VR, etc. Therefore, the libraries did not specifically look to engage Aboriginal youth in the activities, but were, of course, looking to include them in their sessions whenever and wherever possible. Interestingly, the fieldwork for this project did uncover a significant connection between the Dubbo library DigiEHub and a social work outreach project located in a housing estate in Dubbo, where the population was 90% indigenous . This youth project was already entirely engaged with Indigenous youth, as they used it as a frequent drop in centre, as well as parents, and older members of the community. In short, the local Aboriginal community were habituated to using the centre, and the contact between the library and the drop-in house encouraged Aboriginal youth to engage with the PtF suite, as stated by one of the library respondents:

> Going to [drop in centre] as well. Even just by doing things like the NAIDOC day, a lot of just Aboriginal mothers, grandmothers approached us just about joining the library in general and they weren't aware of a lot of the stuff that we do and the fact that everything we do is free. It was more of a neutral setting getting out of the library and just taking it to them, for us was more of a successful strategy.

In short, the librarians and PtF champions acknowledge that the best way to engage the Aboriginal youth was to take the sessions to places where they felt comfortable and relaxed, such as the outreach project in the estate. It is possible that the library is too formal and institutionalised for Aboriginal youth, it is also in the middle of town, which could be challenging for youth to access in terms of transport, time and expense. Mike engaged the Aboriginal youth by running the PtF suite through schools, where the youth were located already, and by making a concerted and long-term effort to stay in touch with community elders and to gain their trust. The library DigiEHubs had better Aboriginal engagement when they went to the places where the youth would normally gather and congregate, and run the sessions there.

In short, the librarians and PtF champions acknowledge that the best way to engage the Aboriginal youth was to take the sessions to places where they felt comfortable and relaxed, such as the outreach project in the estate. It is possible that the library is too formal and institutionalised for Aboriginal youth, it is also in the middle of town, which could be challenging for youth to access in terms of transport, time and expense. Mike engaged the Aboriginal youth by running the PtF suite through schools, where the youth were located already, and by making a concerted and long-term effort to stay in touch with community elders and to gain their trust. The library DigiEHubs had better Aboriginal engagement when they went to the places where the youth would normally gather and congregate, and run the sessions there.

7.2 The effects of this engagement between PtF and Indigenous communities

The two discernible avenues for exploration in terms of the effects of the engagement between PtF and Indigenous communities are: what we learnt according to the respondent Mike, the AECG, and their work in schools with Aboriginal youth, and through the DigiEHub in Dubbo library, which had contact with Aboriginal youth through the outreach social project as mentioned above. It is, of course entirely possible that there have been other effects from PtF in Aboriginal communities that we were not aware of, and had no knowledge of, due to the dispersed and hard to track down mode of dissemination of PtF (the Hub and Spokes Model). For example, we are sure that there must have been some effect on the Aboriginal community through the DigiEHub in Bathurst library, but we have no evidence to back up any claims with respect to any effects. Therefore, we must concentrate on the two paths for effect which we have evidence for.

7.3   The AECG and Mike

Mike suggests that he has deployed skills picked up in PtF sessions with Aboriginal youth as part of their mainstream school education:

> *Yeah, so Aboriginal studies and one of the things that I'm working on in my new role is I'm actually looking at - I'm actually coordinating a project that I'm developing at the moment and it fits into the Australian curriculum in those cross-curricula priority areas, so obviously looking at Aboriginal history...*

Technologies are specifically mentioned in the Cross Curriculum Priority of Aboriginal and Torres Strait Islander Histories and Cultures:

> *Students will identify the interconnectedness between technologies and Identity, People, Culture and Country/Place. They will explore, understand and analyse how this intrinsic link guides Aboriginal and Torres Strait Islander Peoples in sustaining environments, histories, cultures and identities through / by creating appropriate and sustainable solutions (ACARA, 2018, online).*

Therefore, one could state that a specific effect of PtF has been to enhance learning in this cross curriculum area for some children in the schools where Mike and the AECG have worked. Evidence from this project points to Mike and the AECG doing work in areas such as VR and AR, there is also evidence from the transcripts that there have been effects in the learning of coding through Mike and the AECG, as stated by Wendy:

> *I went out and co-facilitated with Daisy a Scratch workshop to a group of AECG members so they're Aboriginal Education Consultative Group. That was a group of about 15 to 20 teachers and teachers' aides that work within the Bathurst area in local Bathurst schools who were then going to become - that were signing up for the program*

In terms of the mainstream teaching and learning of STEM, the types of specific high-tech skills contained in PtF (such as coding) can be hard to teach because of a lack of expertise amongst teachers and the crowded nature of the existing curriculum. Therefore, if there has been some useful cross-over from the PtF sessions and the mainstream school curriculum for Aboriginal children through the AECG and Mike, then it could be said that PtF has had a positive effect in this particular context.

7.4   The Dubbo library DigiEHub

The effects of PtF on the Aboriginal community are difficult to precisely discern in this context, due to the informal nature of the drop-in sessions at the library, and the outreach sessions with the youth project. However, transcript data from the librarians does tell us that:

> *[We] had attended with Lego a few times to their actual facility provided Lego sessions. Then they'd come in a few times and they've had a go at using the Ozobots robots and the Edisons. We're trying to offer that technology to that group who we normally wouldn't have access to that kind... was a local Indigenous artist that she's been in touch with to act as a mentor to run some virtual reality. We have a few virtual reality art programs that you can do in the headset, like painting...*

Hence, evidence suggest that the effects through the Dubbo DigiEHub on the local Aboriginal community has been to introduce Lego-play, Ozobots, the Edisons, and how to do artwork using VR through an Indigenous mentor. Ozobots and Edisons are a fun way to introduce children to coding and programming. The linkage of VR with Aboriginal art is an ingenious way to engage Aboriginal children with the technology. These innovative strategies that have been deployed by the Dubbo library DigiEHub show how an informal, drop-in approach to deploying technology educationally, has the advantage of being flexible and being made suitable for the specific cohorts. The physical reality of robots is more engaging than just doing coding on a screen. The result of using VR to make Aboriginal art, shows how the important and highly valued cultural practices of the Aboriginal Australians can be made up to date and relevant to the contemporary world, and at the same time teach valuable high-tech-skills. In this way a cross-over effect between PtF and the local Aboriginal community could have been initiated through the Dubbo DigiEHub.

7.5   What has happened due to these effects of PtF

The effects of the PtF on the Aboriginal youth and communities that have engaged with the new learning technologies embodied by the PtF suite, has been in terms of discernible learnings as listed above (e.g., with the robot-play in Dubbo). These effects have produced several notable happenings according to the fieldwork:

1.   A digitally mediated version of the NAIDOC day celebration in Bathurst was executed using the high-tech skills as disseminated by PtF, as related by Mike:

    One of the events was a march up the main street through NAIDOC week so that was – so the students actually captured all of our NAIDOC week march up the main street and then we were able to put all of that together and then showcase that to the rest of the school through assemblies and what not...

This type of product using the PtF skill set shows how the importance of the skills may be relayed to others and celebrated using an already established event. The NAIDOC day celebrations are a good showcase for the sorts of skills that PtF can teach, as it is highly visible, and an important marker in the calendar for Aboriginal people.

2.   An interactive map of important Aboriginal sites, to be uploaded onto Google maps. It was not clear if this has happened directly because of PtF, or if it has come about due to other factors involved with Aboriginal learning in the context of Bathurst and Mike's involvement with the AECG. Again, evidence for this map came from Mike's transcript:

    What we're working on now is some VR stuff where students are able to - where students are capturing, using the 360 cameras, capturing some significant sites in their local community and being able to pinpoint those onto Google Maps.

This ambitious project shows how the skills in PtF can lead to significant projects. This project could have important consequences, for example, in terms of local tourism and its potential economic benefits, as well as making these sites potentially more visible to the rest of the world. Google are a large and powerful partner to have on such a project, who rely on local peoples having the skills to use their software, and in so doing expand their digital scope.

3.   An expanded informal technology learning network centred on the Dubbo library DigiEHub. As previously mentioned, the innovation and creativity of the library team in Dubbo has led to an increased engagement with and in the Aboriginal community, and specifically with the youth who use their services. As narrated by two of the librarians, this enthusiasm has helped them become agents of change in terms of encouraging more Aboriginal people to become interested in the benefits of technology:

    Outreach for us works really, well. [We] went to the NAIDOC celebration that was happening just in the park behind the library and we just went down, like I said, with some of this technology. We just had some Lego set up, just to not be too pushy and just be approachable...

This evidence show how PtF could be seen to be part of an informal change program that is happening due to the innovation and creativity of the Dubbo librarians. Rather than a Hub and Spokes Model, this shows how high-tech skills can be disseminated through enthusiastic and engaged individuals and groups, who have taken it on themselves to make a difference in the lives of others, often on a voluntary basis. The secret is to make these skills engaging and discoverable for anyone which just happens to be in the vicinity of their practice areas.

8

The Learning Space City of Canada Bay – Library & Community Services

In an attempt to gain an understanding of the potential outcomes and impacts of the purposeful use of new and emerging technologies to promote community engagement, the researchers conducted two visits to The Learning Space at The Connection in the City of Canada Bay, during which they interviewed Joy Suliman, the Learning Space Coordinator.

Joy oversees the operation of programmes and services delivery to the local community as part of the City of Canada Bay Library and Community Services. Joy is also a member of Programming the Future Advisory Group, and has previously worked with Save the Children Young People's Services.

The Learning Space is spread over approximately 400 square metres and is divided into different work zones, including studios, a makerspace classroom and a large open space with a fully equipped computer suite with high speed internet access and a wide range of technology devices designed to offer local residents a space to work, study, socialise or meet with others. Joy said: '*Whoever needs a non-transactional public space to work in is welcome to come through the doors*'. Indeed, on entering The Learning Space, one gets the immediate sense of a welcoming and inclusive learning space. Exhibitions of work undertaken with members of the community are displayed in a digital gallery that captures the stories of a diverse community, highlighting snapshots of its multi-layered past, present and future aspirations. Joy added: '*We always try and make it community relevant… We never forget that our programmes are for and about the community. As much as possible, we try and co-create with the community*'. The Learning Space offers community members a set of training programs around the purposeful use of 3D printing and 3D modelling, augmented and virtual reality, as well as other creative digital productions such as coding and robotics. By way of an example, Joy said:

> *The first thing that we think about – because of the background of the team here – is the creative potentials of technology. That to us is always of great interest and how we can explain and give an opportunity to people to experience those creative potentials in ways that they may not have. For example, something like virtual reality… A lot of people using virtual reality are doing first-person games with shooting and stuff like that. Whereas we pick things that are very family friendly. It becomes a shared activity rather than a single user activity when it's up on huge screens that anyone can see in real time what the person in the virtual reality headset is experiencing and creating and can interact with them verbally and be part of that experience alongside them. It becomes a group activity. You'll see groups of teenagers saying, 'draw this here' or 'look behind you'. Like helping each other out with it, which is not the usual way to interact with that technology.*

What is interesting about The Learning Space's approach to teaching about technology is a strong desire to invite community members to think deeply about the impact of technology on their daily lives. This is an invitation to pose critical questions about the place of technology in society, including, how it can be used as a vehicle for positive social transformations. Joy said:

> *This is where it starts to get interesting where people, from that knowledge and understanding, start to be able to apply that technology to their own life because they now have the literacy to understand it and be part of a discourse around it. Then the next kind of level I think from there is something around being able to create and make, where you do programs, you build communities of practice around – for example, here we do 3D printing and we have a Tech Shed. We're starting to build a community of practice with young people around coding and electronics and so on.*

Central to the idea of a community of practice is a collaboration between people with common interests who form relationships based on trust and mutual respect, which develop over time. Joy said:

> *I guess the heart of all of any of this kind of work is relationships, to get beyond a model of telling people stuff and to develop into – so we see ourselves here as working inside and alongside this community.*

According to Wenger et. al. (2002), a community of practice consists of a group of people who share common interests and concerns in relation to a '*domain*' and through regular interactions, i.e. discussions and collaborative learning '*community*', they develop methods, tools and a body of knowledge '*practice*' (Figure 3, above). Key to the success of The Learning Space is the evolving community of practice and the collaborative partnerships they have built in recent years. It is clear from the evidence seen during the visits that characteristics of an effective community of practice were present. Not only did the staff share a common interest in the transformative potential of new and emerging technologies with The Learning Space users, they had also developed working relationships with them through the creative use of Augmented Reality to work with them to capture aspects of their cultural practice through dance and performance. Joy explained:

> *The technology was of interest to them, because it was highly relevant. We made videos that allowed them to share and explain their cultural practice on a broader scale, which was something they were interested in. It happened to be this augmented reality platform. But for them the invitation to share their skills and come to the table and work with us, with an acknowledgement of their contribution and their skillset, I think was the key to that programme, being able to understand what it was that they had.*

Two other examples of the work of The Learning Space on engaging members of the community in the creative and purposeful use of new and emerging technologies are captured in two case studies, described in pages 58 and 59 of this report, to showcase models of good practice. The text and images in the case studies were produced by The Learning Space and are included in this report with their permission.

8.1   Case Study 1: Connecting Communities of Need and Practice.

The Learning Space Program, '3D Printing Club' has been running weekly since March 2017 and provides participants with an inclusive space where they can access 3D printers to print models and learn about 3D modelling. The core participants have developed a community of makers from diverse backgrounds and interests spanning engineering, medical fields and craft. The role of The Learning Space team has been to provide the technical support necessary to enable community members to take an idea or need and turn that 'sketch' into a working 3D part. Staff prepare a series of 'object lessons' where participants learn how to model a new object every week, based on using a specific modelling concept or toolset. This program feeds a community of experimenters, tinkerers and makers who use the social context of the program to co-develop projects and test new ideas.

Ron began attending 3D Printing Club as he had recently purchased a 3D printer kit, but needed help understanding how he could learn to use the device successfully at home. The 3D Print Club helped Ron understand the relationship between modelling and slicing and successfully run 3D prints using his own printer. Ron's need to 3D print was based on printing prosthetic ears for a foster child. Printing the ears in print club provided a wider social context for possible 3D printing projects that could be produced by the 3D printing community, contributing to a field of open source prosthetics. Ron's connection to other carers and parents of young people with cerebral palsy provided the Print Club with design, modelling and fabrication challenges to real world problems faced by a community of need. This allowed the 3D Print Club to contribute to making prototype parts for wheelchair mounted smartphone holders and other simple accessibility projects.

1st version 3D printed smartphone holder with wheelchair mount

The core participants have developed a community of makers from diverse backgrounds and interests spanning engineering, medical fields and craft

8.1 Case Study 2: Tech Shed and Sydney Heritage Fleet

Tech Shed began in response to the interest in 3D Printing programs that were being run at Concord Library in advance of the opening of The Learning Space. Retirement age library members were interested to learn 3D printing and had worked in trade or workshop backgrounds, which gave them a familiarity with concepts of engineering and drafting. A Department of Family and Community Services grant was obtained to run a 'Tech Shed' as a pilot program to promote well-being and social inclusion for older men. The Learning Space team worked with an external facilitator to develop literacies in platforms including 3D printing, BBC Micro:bit and Arduino as well as providing mentorship and guest lessons for the external provider.

The Learning Space engineered a safe space for older men to share experiences and learn new skills similar to the Men's Shed model, but with a focus on emerging tech rather than industrial workshop environments. Participants worked on open source OTTO robots that combined manual skills, rapid electronics and 3D printing which were then exhibited during the Robot Ball event as part of Vivid Ideas 2018. This program has evolved to become a branch of Harry's Shed in Concord, where there is an industrial workshop but no IT or digital fabrication facilities. This has enabled the participants to access both 'shed' spaces, with The Learning Space providing ongoing material support for the Tech Shed, such as inductions in 3D printing filament and consumables. As part of Tech Shed, participants work on their own self-led projects. Dave, who also volunteers at the Sydney Heritage Fleet has been attending Tech Shed with the aim of making brass labels for ship parts on a vessel being restored by the fleet volunteers. This combined modelling then printing batches of discs to be used initially for sand casting experiments, and more recently as positives for silicon moulds. Dave has been able to learn 3D printing and modelling and apply these skills to traditional lost wax casting and boat building, contributing to the restoration of the fleet combining his literacy in printing and casting.

Retirement age library members were interested to learn 3D printing and had worked in trade or workshop backgrounds, which gave them a familiarity with concepts of engineering and drafting.

Top: 3D printed positive, wax cast and silicon mould.
Bottom: Sand casting experiment with 3D prints.

9

Key Findings and Recommendations

The findings outlined in chapters 5 and 6 of this report show that PtF has shown many distinctive characteristics of innovation and significant potential for engaging children and young people in harnessing new and emerging technologies to achieve the outcomes they have reasons to value.

The evidence also points to identified areas for improvement, refinement and scalability, should Save the Children decide to extend the work of PtF to other areas of NSW, as originally planned. As explained in the introduction to this report, repeated staff changes in the leadership of PtF during 2018 and 2019, led to interruptions in the project momentum in early 2018 and consequently, in significant delays in data collection. As a result, it has not been possible to carry out observations of PtF classes, and conduct online surveys with children and young people to identify their understandings of fundamental coding concepts and to gauge their competencies in the use of coding applications. For the same reason, it was not possible to conduct online surveys based on the 12-item Child and Youth Resilience Measure (CYRM) at the beginning and end of each series of workshops, to gauge the project's impact on children and young people's wellbeing and to make appropriate referrals, as originally planned. However, the researchers conducted individual interviews and qualitative data analysis with champions, Save the Children staff, Advisory Group members, and other stakeholders to assess the outcomes and impact of PtF on children and young people's access to new and emerging technologies, as well as to gain a deeper understanding of Aboriginal children and young people' use of new and emerging technologies and the impact that these have on their lives. To achieve these aims, the research was guided by the following questions:

- How can progress or success be understood in term of the pedagogy of PtF?

- What are the educational parameters involved with teaching and learning of skills in new and emerging technologies in regional and rural NSW?

- What is known in the field of Indigenous Australian education about projects such as PtF?

- What are the relationships between Indigenous Australian populations and the types of new technologies & skills offered by PtF?

These understandings have helped the researchers in achieving the following outcomes:

- Identification of pedagogies that are conducive to children and young people's purposeful engagement with new and emerging technologies;

- Analysis of social and cultural factors that impact on Aboriginal children and young people's access and engagement with new and emerging technologies;

- Contextually specific, empirically grounded new theoretical insights into the capacity of projects such as PtF in redressing digital inequality in regional and rural areas of NSW.

9.1 Key findings

PtF initially aimed to provide a series of workshops in new and emerging technologies (i.e. coding, Augmented Reality (AR), Virtual Reality (VR), 3D printing and modelling, Wearables and Digital Music) to approximately 900 children and young people in disadvantaged locations in rural and regional areas of NSW. The use of the hub and spokes model to deliver PtF training programs was designed to consist of a network that extended from two large and fully resourced central sites, or Digital Excellence Hubs (DigiEHubs), in Bathurst and Dubbo, to smaller satellite nodes, or spokes, aimed at maximising the reach of the service provided. While it could be claimed that the hub and spokes model is ideally suited for the delivery of training schemes across sparse and expansive geographies, such as regional and rural NSW, and as evidenced by recent research in Education and Health (Elrod and Fortenberry, 2017), the approach used by PtF did not fully achieve its desired outcomes. Data obtained from the two DigiEHubs indicate that a total of 163 children and young people participated in a total of 62 workshops in coding, AR and VR at Macquarie Regional Library. The DigiEHub in Bathurst worked with a much smaller group of children and young people at Headspace site, but offered training and Masterclasses to a total of 182 champions, including members of the Aboriginal Education Consultative Group. The findings of this research are described below:

1. **Staff changes:** The main obstacle to PtF achieving its aim to provide training in the use of new and emerging technologies to 900 children and young people in regional NSW was the disruption caused by two successive changes in the leadership of PtF staff team in 2018 and 2019, respectively. The momentum initiated in early 2018, when a critical mass of interested champions and organisations was mobilised, came to a halt each time the PtF team leader post was unfilled. This is because the hub and spokes model used by PtF relied heavily on effective communication and centralised provision of expertise and continuous support.

2. **Tackling digital inequality:** One of the key goals of PtF was to tackle digital inequality in socio-economically disadvantaged locations in regional NSW by encouraging children and young people to 'use new and emerging technologies to resolve social issues that they have identified in their communities' (Dellow, 2017). However, PtF did not have the mechanisms for capturing and monitoring crucial data to be able to assess its progress towards achieving its objectives in relation to the number of spokes, champions, children and young people who specifically benefited from the PtF workshops.

3. **Capturing and monitoring data:** PtF had planned to capture data relating to the take-up its coding, AR and VR training programs by the champions, children and young people through a central portal located at the Bathurst DigiEHub. However, due to technical difficulties, PtF was not able to ascertain its progress in relation to its key objectives. A more systematic approach could have been used to collect data in relation to participant information, that would have been very useful to ascertain the extent of its progress towards achieving its aims.

4. **Selection and recruitment of champions:** This research found that champions whose job roles included an element of a digital education specialist, such as librarians for example, were more effective in engaging children and young people in PtF workshops. Despite the enthusiasm of some of the champions whose involvement with new and emerging technologies was incidental; it was found that particular champions in spoke sites located at significant distances from the DigiEHubs, lacked the technical know-how and in the absence of ongoing support, felt powerless and unable to provide training in the use of high-tech resources, such as AR and VR.

5. **Access to high-tech resources at spoke sites:** The distance between the hub and spokes made it difficult for champions and children in remote areas of NSW to have access to some of the expensive PtF equipment such as the 3D printers, as these were solely located in Bathurst and Dubbo DigiEHubs. This has meant that some of the champions could only offer workshops in coding, as they did not have access to resources to engage children and young people in more exciting AR and VR activities.

6. **Engagement with communities:**
Meaningful engagement with children, young people in their communities, rests on enduring and reciprocal relationships built over time. What makes community engagement meaningful is its flexibility and willingness to address issues that are important to the community. The collaborative multi-agency approach adopted by champions at the Macquarie Library DigiEHub in Dubbo is correlated with an increase in the number of children and young people who took part in the workshops they organised between 2018 and 2019. The champions established collaborative partnerships with local community groups to celebrate high profile events ranging from the Youth Council to Dads' literacy Days and NAIDOC Day.

7. **Characteristics of engaging pedagogies:**
The masterclasses of AR and VR delivered online to students, teachers and champions, one of which was observed by the researchers during a visit to Bathurst DigiEHub, used high-tech apps, but the delivery was sometimes fast paced and too rushed, resulting in some participants feeling left behind. A more engaging, and therefore more effective pedagogic approach, that was more 'easy going', could encourage children and young people to work together towards a communal goal, for example, and therefore participate in an exciting, collective approach to acquiring high-tech skills.

8. **Promoting the use of new technologies through detached and outreach work with Aboriginal communities:** It is clear that the set-up and maintenance of the relations between the proponents of PtF and the Aboriginal communities which they are serving, is crucial in the ways in which PtF is to function in the context of rural NSW. It is when one encounters a knowledgeable and passionate educator such as Mike that the pieces of the puzzle fit together, and the way forward in terms of learning the high-tech skills, and doing something with them with the community, becomes apparent. Librarian enthusiasts such as those in Dubbo, also show how Aboriginal communities may be engaged and given meaningful tech-skills through informal learning networks which are flexible, and able to be relocated to the places where the Aboriginal communities feel most comfortable.

9. **Working with schools to support Aboriginal learners:**
Support in schools for Aboriginal learners, and the coding clubs of libraries, serve as important markers for the development of high-tech skills amongst Aboriginal youth in rural and remote areas in Australia. With better high-tech infrastructure, improved internet access, and investment in the requisite hardware to make the PtF skills come alive (for example, investment in 3D printers), the Aboriginal communities in Australia will respond positively to initiatives such as PtF in the future.

10. **Champions as change agents:** Enthusiasm and relational change agents such as Mike and the Dubbo librarians will help to make a difference in the lives of Aboriginal youth. Evidence from the fieldwork for this project found that Aboriginal youth are susceptible to high-tech habits such as online gaming and using devices such as PlayStations. A scheme such as PtF, if well managed, and if it gets the groundwork right, and attracts successful change agents to guide and help the youth sustain their interest in positively building their high-tech-skills, might be a way forward to at least partially address these contemporary malaises in outback Australia, and provide pathways into jobs that do not currently exist.

9.2 Recommendations

The following recommendations are put forward to Save the Children, should the development of a similar initiative to Programming the future be considered in the future.

1. **To operationalise the digital theory of change in a meaningful way, PtF should work with smaller youth organisations to help them develop long-term goals for addressing local concerns.** The aim of the digital theory of change is to encourage young people to use new and emerging technologies to resolve social issues that they have identified in their communities (Dellow, 2017). This is a laudable goal, particularly when working with children and young people in socio-economically disadvantaged locations, but it requires working closely with children and young people in their communities, as equal partners, and over a significant period of time.

2. **Consider adopting a peripatetic Mobile Youth provision** to support a hub and spokes model for delivering training in new and emerging technologies in regional areas of NSW. Deploying 3D printers as a high-tech skill development area, for example, could act as a focal point of interest to engage young people in a process that could lead to tangible results (printed objects). A peripatetic mode of provision through the Mobile Youth Van could make such equipment accessible to a larger number of champions, children and young people in NSW. This could also enable the champions to build relationships with young people and their communities over time.

3. **Developing collaborative communities of practice:** The evidence from Macquarie Regional Library in Dubbo, and case studies from the Learning Space in Canada Bay, have demonstrated that developing collaborative communities of practice is pre-requisite to success in engaging children, young people and their communities in the productive and purposeful use of new and emerging technologies. Building collaborative communities of practice rests on promoting reciprocal relationships as well as flexibility and willingness to address issues that are important to the community.

4. **More effective mechanisms for capturing and monitoring data required:** A more systematic approach to the collection of data should be used in initiatives such as PtF to provide the means for detailed analyses of the reach and impact of the provision as well as the potential for ongoing formative improvements and refinements where needed.

5. **PtF should engage in more multi-agency collaborations with local community organisations:** Evidence from the Learning Space and Macquarie Regional Library have demonstrated the benefits of engaging in multi-agency and partnership work with organisations to celebrate high profile events.

6. **Better selection and recruitment of champions:** A more strategic selection and recruitment of champions is key to the success and continuity of training workshops in new and emerging technologies. PtF should recruit champions whose current roles involve an element of a digital education specialist.

7. **Champions should use more engaging dialogic pedagogies:** PtF champions should use a more engaging pedagogic approach, based in dialogue and experimentation, to encourage children and young people to work together towards achieving common goals using new and emerging technologies.

8. **Promoting the use of new technologies through detached and outreach work with Aboriginal communities:** establishing and maintaining relations between PtF and the Aboriginal communities through detached and outreach work is crucial to developing engaging Aboriginal children and young people, their communities, in equity focused interventions that utilise new and emerging technologies to address social issues.

9. **Liaise with Aboriginal Education and Communities Directorate to engage in work with Aboriginal learners in schools:** PtF should liaise more with the Aboriginal Education and Communities Directorate to support Aboriginal learners in the use of new and emerging technologies in schools.

10. **Champions as change agents:** PtF should seek to attract successful change agents to guide and help the youth sustain their interest in positively building their high-tech-skills. This will be a way forward to at least partially address these contemporary malaises in regional and rural Australia, and provide pathways into jobs that do not currently exist.

10
References

ACARA (Australian Curriculum, Assessment and Reporting Authority). (2018). Aboriginal and Torres Strait Islander Histories and Cultures. Online resource located at: https://www.australiancurriculum.edu.au/f-10-curriculum/cross-curriculum-priorities/aboriginal-and-torres-strait-islander-histories-and-cultures/

Auld, G. (2002). The role of the computer in learning Ndj Bbana. *Language Learning & Technology, 6* (2), 41–58.

Barraket, T.J., Wilson, C.K., Cook, K., Louie, Y.M., Holcombe-James, I., Ewing, S., & MacDonald, T. (2018). *Measuring Australia's Digital Divide: The Australian Digital Inclusion Index 2018*. Melbourne: RMIT University.

Bell, G. (2009). GETTING CONNECTED, STAYING CONNECTED: EXPLORING SOUTH AUSTRALIA'S DIGITAL FUTURES. Adelaide: Department of Premier and Cabinet.

Black, P., & William, D. (2005). Lessons from around the world: How policies, politics and cultures constrain and afford assessment practices. *Curriculum Journal, 16*(2), 249–261.

Broadbent, R., & Papadopoulos, T. (2013). Bridging the digital divide – an Australian story. *Behaviour & Information Technology, 32*(1), 4–13.

Buchtmann, L. (2000) Digital songlines: The use of modern communication technology by an aboriginal community in remote Australia. *Prometheus, 18*(1), 59–74.

Burnip, L. (2006). ICT mediated study and teachers: Do they have access to the infrastructure? *Australasian Journal of Educational Technology, 22*(3), 355–374.

Carty, J. (2011). Creating country: abstraction, economics and the social life of style in Balgo Art. Thesis (PhD). Canberra: Australian National University

Chaudhary, B. (2018). The role of ICT in promoting constructivism. *International Journal of Technical Research & Science, 3*(I), 1–4.

Cole, D.R. (2011). *Educational life-forms: Deleuzian teaching and learning practice*. Rotterdam: Sense Publishers.

Cole, D.R. (2013). Affective literacies: Deleuze, discipline and power. In I. Semetsky & D. Masny (Eds.), *Deleuze and Education* (pp. 94–112). Edinburgh: Edinburgh University Press.

Cole, D.R., & Pullen, D. (Eds.). (2010). *Multiliteracies in motion: Current theory and practice*. London & New York: Routledge.

Cole, D.R., & Pullen, D.L. (2010b). Multiliteracies and the agency involved with computer operations in education. In D.R. Cole & D.L. Pullen (Eds.), *Multiliteracies in Motion: Current Theory and Practice* (pp. 105–124). London & New York: Routledge.

Cole, D.R., & Pullen, D.L. (Eds.). (2010a). *Multiliteracies in motion: Current theory and practice*. London & New York: Routledge

Czerniejewski, R. (1989). Literacy production in bilingual schools in central Australia. *Unicorn, 15*(4), 216–220.

Darvall, K. (1986). Computers and aboriginal literacy. *The Aboriginal Child at School*, 14 (4), 3–8.

Dellow, J. (2017) *A digital theory of change*. DragonHall, London, UK.

Dench, P. (1991). Some computer strategies for achieving literacy in Australian languages: The Yintarri project. *The Aboriginal Child at School, 19*(2), 3–15.

Douglas, J., Kilpatrick, S., Katersky Barnes, R., Alderson, R., & Flittner, N. (2018). Embedding tertiary education in rural communities: building 'warm connections'. *Studies in Continuing Education*. DOI: 10.1080/0158037X.2018.1548435.

Duckor, B., & Holmberg, C. (2017). *Mastering formative assessment moves: 7 leverage practices to advance student learning.* Alexandria, VA.: ASCD.

Dyson, L. E. (2004). Cultural Issues in the Adoption of Information and Communication Technologies by Indigenous Australians. In F. Sudweeks, & Ess. C. (Eds.), *Proceedings of the Fourth International Conference on Cultural Attitudes towards Technology and Communication (CATaC)* (pp. 58–71). Karlstad, Sweden, 27 June–1 July 2004, Murdoch University, Murdoch W.A. Available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.198.7661&rep=rep1&type=pdf

Foundation for Young Australians (2015). *The New Basics: Big data reveals the skills young people need for the New Work Order.* FYA's New Work Order

Freeman, J., Park, S., Middleton, C., & Allen, M. (2016). The importance of broadband for socio-economic development: A perspective from rural Australia. *Australasian Journal of Information Systems*, 20, 1–18.

Gibson, C. (1998). "We sing our home, We dance our land": Indigenous self-determination and contemporary geopolitics in Australian popular music. *Environment and Planning D: Society and Space*, 16, 163–184

Gilster, P. (1997). *Digital literacy*. Oxford: John Wiley & Sons, Inc.

Halsey, J. (2018). Independent Review into Regional Rural and Remote Education—Final Report. Canberra: Commonwealth of Australia (Department of Education and Training).

Helsper, E. J. (2016). *Slipping through the net: Are disadvantaged young people being left further behind in the digital era?* London: Prince's Trust.

Hughes, P., & More, A, J. (1997). Aboriginal ways of learning and learning styles. Paper presented at the Annual Conference of the Australian Association for Research in Education, Brisbane, December 4, 1997. [verified 14 Nov 2009] http://www.aare.edu.au/97pap/hughp518.htm

Jones, T., & Birdsall-Jones, C. (2014). Meeting places: drivers of change in Australian Aboriginal cultural institutions. *International Journal of Cultural Policy, 20*(3), 296–317.

Kirkwood, S., & Miller, A. (2014). The impact of new technologies on musical learning of Indigenous Australian children. *Australasian Journal of Early Childhood, 39*(1), 94–101.

Krakouer, J., Wise, S., & Connolly, M. (2018). "We live and breathe through culture": Conceptualising cultural connection for Indigenous Australian children in cut-of-home care. *Australian Social Work, 71*(3), 265-276.

Liebenberg, L., Ungar, M., and LeBlanc, J. C. (2013). The CYRM-12: A brief measure of resilience. *Canadian Journal of Public Health, 104*(2), 131–135.

Masny, D., & Cole, D.R. (Eds.). (2009). *Multiple Literacies Theory (MLT): A Deleuzian perspective*. Rotterdam: Sense Publishers.

McTaggart, R. (1991). Western institutional impediments to Australian Aboriginal education. *J. Curriculum Studies, 23*(4), 297–325.

Notley, T., & Dezuanni, M. (2018). Advancing children's news media literacy: learning from the practices and experiences of young Australians. *Media, Culture & Society*, 1–19: doi/10.1177/0163443718813470

O'Donoghue, R. R. (1992). Why the Aboriginal child succeeds at the computer. *The Aboriginal Child at School, 20*(4), 48–52.

Orlando, J. & Moustakim, M. (2016). *Evaluation of the Mobile Youth Van Claymore Project in NSW: Project Report*, Research Report

Pope, J. & Mutch, R. (November, 2015) How Young People are Faring Report Card 2015 Final, Foundation for Young Australians, Melbourne. http://www.fya.org.au/wp-content/uploads/2015/11/How-young-people-are-faring-report-card-2015-FINAL.pdf Accessed 24th July, 2018.

Purdie, N., & Buckley, S. (2010). School attendance and retention of Indigenous Australian students. Canberra: Australian Government (Closing the gap clearinghouse).

Purdie, N., & Wilkinson, J. (2008). Leadership in Indigenous education: Scoping paper prepared for the ACER standing committee on Indigenous education. Canberra: Australian Council for Educational Research Report. Melbourne: FYA.

Rooksby, E., Weckert, J., & Lucas, R. (2002). The rural digital divide. *Rural Society, 12*(3), 197–210.

Rose, D. (2014). Practitioner's response: It's one 'smart' solution: Using new and emerging technologies to support the mental health and wellbeing of young men. *Developing Practice: The Child, Youth and Family Work Journal, 40*, 20–21.

Shaw, G. (2005). *Voices from the bush: context and learning in rural and remote settings. Tertiary teaching: dealing with diversity.* Darwin: CDU Press.

Stronger Smarter Institute (SSI). (2017). Implementing the Stronger Smarter Approach. Stronger Smarter Institute Position Paper. Online report found at: https://strongersmarter.com.au/wp-content/uploads/2019/08/Stronger-Smarter-Approach-2017_final-2.pdf

Trinidad, S. (2007). Closing the digital divide: Education telecommunications systems in Western Australia. *Australian Educational Computing, 22*(2), 32–36.

Twyford, K., Crump, S., & Anderson, A. (2009). Satellite lessons: Vocational education and training for isolated communities. *Rural Society, 19*(2), 127–135.

Vichie, K. (2017). Higher education and digital media in regional Australia: The current situation for youth. *Australian and International Journal of Rural Education, 27*(1), 29–42.

Wenger, E., McDermott, R., & Snyder, W.M. (2002). *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Cambridge, Massachusetts: Harvard University Press.

Wilde, W.D., & Swatman, P.A. (1997). Toward virtual communities in rural Australia. *International Journal of Electronic Commerce, 2*(1), 43–60.

Williams, M.R. (1997). *A History of Computing Technology* (2nd Edition). Los Alamitos, CA.: IEEE Computer Society Press.