Building Computer Literacies in Rural Schools

1 January 2016 to 31 August 2017

Ann Jardine

The project that resulted in the production of this report was funded under a National Priorities Pool (Higher Education Participation and Partnerships Program) grant from the Commonwealth. The recipient of the grant has granted the Commonwealth the right to sub-licence the material in this report. Copyright in the report remains with the original copyright owners.

Higher Education Participation and Partnerships Programme (HEPPP)

2016 National Priorities Pool FINAL REPORT

Building Computer Literacies in Rural Schools

1 January 2016 to 31 August 2017

Name of university	The University of New South Wales
Name of contact officer	Ann Jardine
Position title	Director, AimHigh UNSW
Email address	a.jardine@unsw.edu.au
Telephone number	0434 325 821

In accordance with the Conditions of Grant, you must submit to the Department a Final Report (Clause 6.1 of Part A) and an Acquittal Report (clause 6.4 of Part A).

To meet this obligation, please submit:

- the completed **Final Report** template, in Word and PDF
- the completed and signed **Declaration** form, in PDF
- the completed **Acquittal Report** template, in Excel and PDF.

All documents must be submitted to **equity@education.gov.au** by **31 December 2017**. If you require additional guidance or clarification, please contact us at **equity@education.gov.au**.

Contents

List of Tables **3**
List of Figures **3**
1. PROJECT SUMMARY (Conditions of Grant, clause 2.2 of Part A) **4**
Objectives 4
Project Activities, Milestones and Key Performance Indicators 4
Highlights and Issues 7
2. OTHER PROJECT MATERIAL (Conditions of Grant, clause 2.2 of Part A) **10**
3. ACQUITTAL REPORT (Conditions of Grant, clause 6.4 (a)-(d), clause 6.5 (a)-(b) of Part A) **11**
Appendix: ASPIRE Computer Literacies Report **12**
A. Introduction 12
B. Stakeholders 12
C. Contextual Information 12
D. Implementation 13
E. Engagement 15
F. Evaluation 16
Lessons Learned 20
Forward Planning 22
References 23

List of Tables

Table 1: Project objectives 4
Table 2: Project activities, milestones and KPIs 4
Table 3: Additional materials produced over the course of the project 10
Appendix Table 1: Total number of teachers and students engaged during the project 15
Appendix Table 2: Responses to the question: 'do you like coding?' 18

List of Figures

Figure 1: Teacher levels of computer literacy 16
Figure 2: Likelihood of teaching coding and computational thinking concepts to students 16
Figure 3: How useful was learning Scratch in your teaching context? 19
Figure 4: How useful was the hands on session (Bee-bots, Makey Makey's and Raspberry Pi's) in your teaching context? 20

1. PROJECT SUMMARY (Conditions of Grant, clause 2.2 of Part A)

Objectives

Indicate the extent to which the Project Objectives specified in clause 3 of Part A of the Conditions of Grant were met. Where obligations established in the Conditions of Grant were not met, please identify these and provide an explanation of circumstances and consequences.

Table 1: Project objectives

IDENTIFIED OBJECTIVE	EXTENT TO WHICH THE OBJECTIVE WAS MET
Build computer literacies in teachers through professional development and the identification of, and support for, champions within the school.	**Completed and ongoing.** Demonstrated increase in computer literacies for teachers who participated in the project. Champion teachers established at schools and have been supported through professional development.
Assist in the building of computer literacies within upper primary school students in particular.	**Completed and ongoing.** Demonstrated increase in computer literacies for students who participated in the project. Feedback from teachers shows that the computer literacies of a significant number of students will increase as teachers embed the skills and content they have learned into their lessons.

Project Activities, Milestones and Key Performance Indicators

Below, please specify whether:

- *all project Activities specified in Schedule 1 of the Conditions of Grant were completed*
- *all Project Milestones specified in Schedule 1 of the Conditions of Grant were completed*
- *all Key Performance Indicators specified in Schedule 1 of the Conditions of Grant were met.*

Where obligations established in the Conditions of Grant were not met, identify these and provide an explanation of circumstances and consequences.

Table 2: Project activities, milestones and KPIs

TIME FRAME	PLANNED ACTIVITIES AND MILESTONES	PROJECT ACTIVITIES AND MILESTONES COMPLETED	IDENTIFIED KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOMES
1 Jan 2016 – 29 Feb 2016	1.1 Establishment of Project Team	Project Officer appointed 6th June 2016.	Project Officer is contracted.	**Completed** Appointment of project officer delayed due to withdrawal of initial

TIME FRAME	PLANNED ACTIVITIES AND MILESTONES	PROJECT ACTIVITIES AND MILESTONES COMPLETED	IDENTIFIED KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOMES
				candidate identified and position was readvertised.
	1.2 Identification of primary schools in rural NSW with low SES populations to participate in the project from UNSW's ASPIRE school partners		At least two schools agree to participate in the project.	**Completed and ongoing** Four rural schools with low SES populations agree to participate. 1 primary school and 3 central schools. Further schools are now participating after the project period.
	1.3 Purchase of 40 Raspberry Pi's	Following consultation with participating schools it was decided not to use Raspberry Pi's as the primary method for building computer literacies. Therefore the decision was made to purchase a wider range of resources that were useful and relevant to school context.	40 Raspberry Pi's are purchased.	**Completed** 12 Raspberry Pi's were purchased. Resources were then used to purchase Bee-Bots, Edison Robots and Makey Makeys. These resources were chosen as they were accessible tools for all teachers and students and were more suitable for schools.
6 Jun 2016 – 31 Aug 2016	2.1 Professional development course in computer literacy for teachers	Course designed addressing the following topics: 1.Basic concepts of coding and computational thinking 2.Methods to introduce coding and computational thinking to primary aged students 3.Building teacher confidence in incorporating technology in the classroom 4.Teaching coding and computational thinking across stages 1-3 of the NSW Curriculum 5.How to use Scratch and unpacking programming concepts using visual programming 6.Creating digital stories, music and video games on Scratch 7.Incorporating Scratch into lessons	A course to develop teacher skills in computer literacies is developed, focusing on free educational resources available through the Raspberry Pi Foundation and Codecademy.	**Completed** A course was created focusing on free educational resources using accessible tools such as Scratch.

TIME FRAME	PLANNED ACTIVITIES AND MILESTONES	PROJECT ACTIVITIES AND MILESTONES COMPLETED	IDENTIFIED KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOMES
		8.How Scratch can be linked to external devices to learn robotics 9.Using a Raspberry Pi to teach digital technologies 10. Hands-on coding and robotics in the classroom (using Bee-Bots, Makey Makeys, Edison Robots		
	2.2 Endorsement of professional development course in computer literacy for teachers		Board of Studies, Teaching and Educational Standards endorsement is sought for the professional development course in computer literacy for teachers.	**Completed** Course is endorsed by the Board of Teaching and Education Standards (now NSW Education Standards Authority). Teachers receive fourfour hours professional learning addressing teacher standards 2.6.2, 3.4.2, 6.3.2 upon course completion.
	2.3 Identification of champion teachers in participating schools for continuing facilitation of computer literacy development of teachers and students		At least one teacher at each participating school agrees to take on this role.	**Completed** One teacher from each school formally agrees to participate in the role. These teachers remain strong advocates for the project.
6 Jun 2016 – 31 Oct 2016	3.1 Development of enrichment activities in computer literacy for upper primary students at participating schools		Development of upper primary age-appropriate materials completed and materials approved.	**Completed** Materials for students in Years 5 and 6 developed and used in both teacher training and with students in schools.
	3.2 Engagement with the local school community to assist with development of activities and materials	Meetings with champion teachers in each school. Meeting with local library in Gilgandra where coding activities take place.	Development of upper primary age-appropriate materials approved by school community.	**Completed** Upper primary materials for students in Years 5 and 6 approved by the school and local community. Resources trialled in both school and local community.
1 Oct 2016 – 31 May 2017	4.1 Delivery of professional development course for		Professional development course in computer literacy	**Completed and ongoing** Professional development course delivered at four schools, training 42

TIME FRAME	PLANNED ACTIVITIES AND MILESTONES	PROJECT ACTIVITIES AND MILESTONES COMPLETED	IDENTIFIED KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOMES
	teachers at the participating schools		delivered at a minimum of two schools.	teachers in total. Training course to be delivered in a further two schools in term 4, 2017.
	4.2 Delivery of enrichment activities for primary students at the participating schools	**Robotics Day** A day of computer literacy activities focused around coding and computational thinking.	Enrichment activities for upper primary students delivered at a minimum of two schools.	**Completed** Year 5 and 6 students in four schools attended five hours of enrichment activities. A total of 85 students and 10 teachers participated over four days.
	4.3 Evaluation of professional development and enrichment activities		Evaluation of professional development course and enrichment activities completed.	**Completed** See attached evaluation report.
	4.4 Resources from project activities are made available through the ASPIRE website		Resources from project activities are provided as open source material on the ASPIRE website.	**Completed and ongoing** www.aspire.unsw.edu.au Further resources and development to be added in second half of 2017. A new revision of the ASPIRE website will mean that the resources created have a more prominent section.
	Final Report is submitted to the Department			**Completed**

Highlights and Issues

Provide a summary of highlights and achievements arising from your project (maximum half page).

The responses from teachers who participated in the course were some of the highlights and achievements. The course switched many teachers on to using computer literacies to engage their students and helped them to understand its importance to students' future careers.

> *"I found the Coding Course to be the most interesting and relevant PD Course that I have done. The direct connection between professional development and resources/content that can be directly used in the classroom was as real as it gets for me as a teacher."* — Champion Teacher

> *"It was really good. The delivery was hands on which made all the difference, plus the amount in each session was just enough without overloading with*

information. I would completely recommend this for any teacher as Tom delivered the content in a way to make it applicable to all KLA. I am hoping there will be more in the new year to extend my learning and skills." — Teacher

The number of teachers who participated in the project was an achievement and will result in building computer literacies in students from Kindergarten onwards. At Gilgandra Public School, it was made mandatory for teachers to participate in the training, resulting in increased computer literacies for all the teaching staff. The project has afforded teachers in rural schools an opportunity for professional learning they would not otherwise have had. This has been reflected in the number of teachers giving up time after school to attend the sessions and the enthusiasm that they took to participating in something which was unfamiliar. It is too early to comment on the long-term benefits as many teachers who participated in the program have not had sufficient time to incorporate the content from the training into their lessons. However the proposed changes to the NSW Science and Technology Curriculum will leave the teachers who have participated very well placed to meet the new syllabus. Initiatives such as the lunchtime code club established at Dunedoo Central School are a legacy of the project which are of great benefit to students.

Did the project lead to implementable outcomes? What changes will result at your institution/nationally? How is research being translated into practice? Are there activities resulting from this project that will be continued?

The project has led to many other ASPIRE partner schools expressing an interest in participating in the course and it will now be offered to schools beyond the project funding period through core UNSW ASPIRE funds.

Did you undertake an evaluation of your project?

Yes [X] No [ ]

Please summarise the findings and attach the evaluation report.

Overall, the UNSW ASPIRE *Building Computer Literacies in rural schools* pilot appears to have been a very effective trial that has been welcomed by principals, teachers and students. The participating teachers and students show increased computer literacies, and concepts and tools to build computer literacies are now much more likely to be introduced into the classrooms in participating schools. Throughout the project, 42 teachers have engaged in activities designed to increase their knowledge and understanding of digital technologies. The project worked directly with 85 students from Years 5 and 6 and it is estimated by teachers who have participated that the increased computer literacy of teachers has resulted in an estimated 485 students being taught new concepts, building their knowledge of coding and computational thinking from Kindergarten through to Year 8.

Where applicable, indicate number of the following resulting from this project:

Student contacts	85
Journal (or other publication) submissions	N/A
Conference Presentations	N/A
Websites developed	1 www.aspire.unsw.edu.au
Educational or marketing campaigns	N/A
Community organisations engaged	2
Schools engaged	4
Parental/family contacts	N/A

Optional - If you included transformational/behavioural change KPIs in your EOI, please summarise outcomes here:

See attached evaluation report.

Describe any issues that occurred during the year and any mitigation strategies you implemented.

High staff turnover, particularly in small rural schools, is commonplace and this provided one of the setbacks in the project and led to a slight revision in the model. In the first schools to participate in the project, much of the focus was on working with individual champion teachers to great success. However at the end of 2016, the champion teacher at Mendooran Central School left and much of the momentum in working with this school was lost. In the second iteration there was a broader focus on building as many champion teachers as possible within the schools. This approach proved to be very successful with teachers from all stages introducing computer literacies to their students. The course was broadened to include more examples from Kindergarten through to Year 8 and in some cases led to teachers reaching students in Years 9 and 10.

The use of Raspberry Pi's as the main tool to build computer literacies in rural schools was found to be inappropriate. In schools with well-resourced IT support staff, teachers would feel more comfortable in using the devices. Otherwise, when updates are required or WIFI networks change, the devices could become redundant. One champion teacher is now in the process of using Raspberry Pi's after spending extra time with the UNSW ASPIRE Project Officer and a significant portion of his own time in understanding the device. This is not something which is possible for the average classroom teacher. This was mitigated by focusing on a more diverse range of tools and applications to support the building of computer literacies such as Scratch, Makey-Makeys, Edison Robots, Bee-Bots and Sphero's.

2. OTHER PROJECT MATERIAL (Conditions of Grant, clause 2.2 of Part A)

List the titles of any published reports, pamphlets or other documentation produced in the course of the Project and attach them to this Final Report.

Table 3: Additional materials produced over the course of the project

TYPE	AUTHOR	DATE OF PUBLICATION	PUBLICATION DETAILS
E.g. Journal article; conference paper; website; pamphlet, etc.			Name of journal; conference title and date; website URL, etc.

3. ACQUITTAL REPORT (Conditions of Grant, clause 6.4 (a)-(d), clause 6.5 (a)-(b) of Part A)

Have you fully expended the Grant Funds provided under the Conditions of Grant?

Yes ☒ No ☐

If the answer is No, please specify:

- *the amount of funds remaining: $*
- *the reason for this underspend:*

Ensure that the completed Acquittal Report template is signed by an appropriate university officer and attached to this Final Report.

**IMPORTANT NOTICE - Unspent 2016 National Priorities Pool Grant Funds*

- *Grant recipients must fully expend these 2016 National Priorities Pool funds in the project period for which the grant is made and report on this expenditure to the Commonwealth, including the amount of any unspent funds.*
- *If a provider fails to spend the full amount granted it in respect of a year, the unspent funds may be recovered by the Commonwealth.*

Appendix: ASPIRE Computer Literacies Report

A. Introduction

The UNSW ASPIRE *Building computer literacies in rural schools* pilot project ran in schools from term 4, 2016 until the end of term 2, 2017 working with teachers and students from selected ASPIRE partner schools. All activities and resources that were implemented throughout this project were to achieve the following objectives:

1. Build computer literacies in teachers through professional development and the identification of, and support for, champions within the school
2. Assist in the building of computer literacies within upper primary school students in particular.

B. Stakeholders

The main stakeholders engaged in the project were principals and teachers from the schools listed below, with a focus on identifying champion teachers in the upper primary years. Activities were also run with upper primary students from Years 5 and 6 in all participating schools. The project also included engagement with local community organisations. UNSW faculties, industry experts (e.g. Codeclub, Codecamp) and external education providers (e.g. Coder Academy) were also consulted during this project.

Schools

- Coolah Central School
- Dunedoo Central School
- Gilgandra Public School
- Mendooran Central School

Community organisations

- Gilgandra Library
- Gilgandra Youth Services

C. Contextual Information

The schools identified to be part of the pilot program were UNSW ASPIRE regional partner schools in which strong relationships existed. All the schools are situated in central west NSW and have total enrolment numbers of less than 250 pupils. They identified as disadvantaged and classify as outer regional as defined by the Australian Bureau of Statistics Remoteness Classification. In consultation with the principal of each school, champion teachers were identified based on three main criteria: that they worked with students who were in stage 3, were willing to commit to attend the professional learning, and would trial activities with their students.

In order to undertake this project it was important to determine what ‘computer literacies’ encompassed. After researching both the NSW and Australian Curriculum and gathering information from academics, current and former teachers, it was established that a measure of ‘computer literacies’ for this project would integrate stage 3 of the *Australian Curriculum: Digital Technologies* with focus on coding and computational thinking. By doing this,

computer literacy skills could be embedded across the curriculum making the course relevant for a wider audience. The Digital Careers organisation says that students need experience and skills in computational thinking and computer programming (coding) to be successful in their future careers (NESA, 2017).

Definitions of coding and computational thinking taken from the NESA Coding across the Curriculum guide are as follows:

Coding

Coding refers to computer programming, where a 'high level' programming language is used to instruct a computer device to perform certain functions. High level languages are similar to spoken languages but have special commands that are understood by an interpreter (coder) to enable a computer's central processor to understand them.

Computational thinking

Computational thinking comes predominantly from the work of Jeannette Wing in recent years but stems from the early work of Seymour Papert, who himself was a student of Jean Piaget. Jeannette Wing defines computational thinking as 'the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent' (JM Wing, 2014). Computational thinking concepts and approaches have been used in UK primary schools within ICT lessons for a number of years.

Raspberry Pi's

A Raspberry Pi is a credit card-sized computer that can be used in school based projects. It can be used for many of the things that a desktop PC does like spreadsheets, word processing, browsing the internet and playing games. Whilst these devices have many benefits, they also require a high level of technical knowledge to maintain, troubleshoot and perform updates. After discussions with the teachers and principals at pilot schools, it was decided not to make Raspberry Pi's the primary focus throughout the computer literacy professional development (as stated in the project KPI's) as the devices would not be sustainable after the trial period without resources being allocated to their maintenance. The Raspberry Pi's were used during a portion of the course, and for teachers who expressed a further interest in using them, additional training was provided. Much of the training focused around using free tools that could be implemented in the classroom such as Scratch. Other devices also used in the training included Makey-Makeys, Bee-bots, Sphero's and Edison Robots.

D. Implementation

For every school that participated in the project, meetings were held with the principals and champion teachers to establish the ideal way to implement the project within their school's context. It was decided in every school that the course would be available to all interested teachers from Years K-8. In Gilgandra Primary School, it was made compulsory for all teachers to attend the professional learning sessions. The project was implemented in each school as follows:

Preparation

Once a school agreed to take part in the project, interviews were conducted with the champion teachers and a survey was sent out to all teachers to assess the current levels of computer literacy, confidence in using technology and technology support available. Following this consultation at the first two pilot schools, it was decided to design professional learning activities that used a variety of hardware and software that would best suit all teachers. This meant that the training and activities would not rely on the use of Raspberry Pi devices and would therefore be sustainable in the schools after the project period.

Course

A professional learning course was designed and accredited for teacher professional learning by BOSTES (now NESA) meeting standards 2.6.2, 3.4.2, 6.3.2. The content was guided by consultation with teachers, the *Australian Curriculum: Digital Technologies* and the NSW curriculum. The course was designed to cover a broad content base and engage teachers with little or no confidence in using technology. Scratch (a free to use block based coding language) was a core focus of the course as it enabled teachers to learn coding and computational thinking principles on a software that is highly accessible and sustainable for future use.

The course is four hours in total split to cover the following topics:

1. Basic concepts of coding and computational thinking
2. Methods to introduce coding and computational thinking to primary aged students
3. Building teacher confidence in incorporating technology in the classroom
4. Teaching coding and computational thinking across stages 1-3 of the NSW Curriculum
5. How to use Scratch and unpacking programming concepts using visual programming
6. Creating digital stories, music and video games on Scratch
7. Incorporating Scratch into your lessons
8. How Scratch can be linked to external devices to learn robotics
9. Using a Raspberry Pi to teach digital technologies
10. Hands-on coding and robotics in the classroom (using Bee-Bots, Makey Makeys, Edison Robots and Sphero's)

Student activities

Teachers were introduced to a variety of lesson plans and activities throughout the course and champion teachers were provided regular assistance via phone, email and in person. A resource sharing website was created via padlet and made available to all participating teachers providing resources and activities that follow on from the professional learning. In consultation with champion teachers and principals, the equipment that would best suit the needs of the school was loaned out for use in the classroom. Over the course of the pilot this included Bee-bots, Edison Robots, Makey Makeys, Sphero's and Raspberry Pi's. The opportunity for follow-up was offered to each school, and all participating schools accepted this offer. Subsequently, face to face consultations were conducted with champion teachers to provide further guidance on how best to build the computer literacies of their students.

A ‘Robotics Day’ was held for each school which was run by the UNSW ASPIRE Project Officer, designed to build student computer literacy through a series of activities culminating in programming an Edison Robot. All students in Years 5 and 6 were invited to participate in the events which were held in Dubbo. Champion teachers (and other attending teachers) observed the activities and were provided with equipment and activities to work further with the students back at school.

E. Engagement

Total numbers of teachers and students engaged during the project are below:

Appendix Table 1: Total number of teachers and students engaged during the project

SCHOOL	FIRST ENGAGEMENT	PARTICIPATING TEACHERS	STUDENTS
Dunedoo Central School	June 2016	6	23
Mendooran Central School	June 2016	8	14
Coolah Central School	Feb 2017	9	20
Gilgandra Public School	Feb 2017	19	28
Total number of teachers engaged			**42**
Total teacher engagements			**165**
Total students engaged through direct (ASPIRE led) contact			**85**
Total students engaged through indirect (teacher led) contact (estimated by champion teachers based on observations and discussions with teachers across their schools)			**485**

F. Evaluation

1. **Build computer literacies in teachers through professional development and the identification of, and support for, champions within the school**

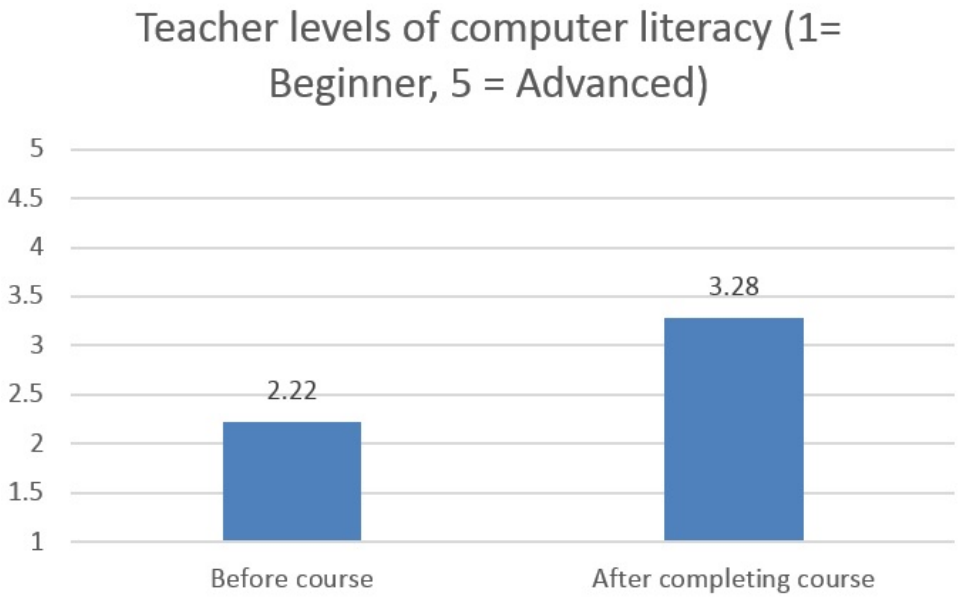

Figure 1: Teacher levels of computer literacy

In evaluating the project, data was gathered from 26 respondents who had completed the course. When asked to rate their own levels of computer literacy before and after completing the course, teachers showed an average growth of 20% in their self-identified level of computer literacies. This alone shows that the professional development has assisted in building the computer literacies of teachers in rural schools.

> *"I enjoyed the workshops. I have learnt quite a lot considering I am not very computer literate. I especially enjoyed the third session."* — Teacher feedback on completing course

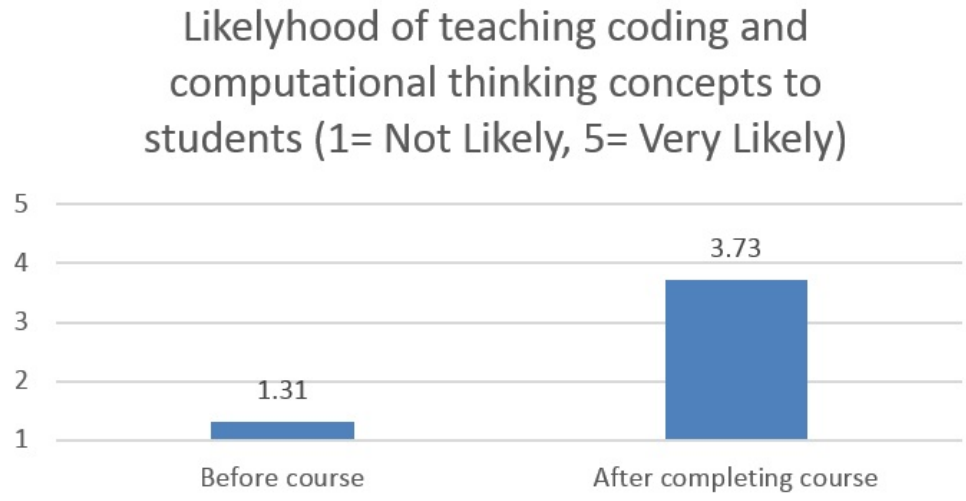

Figure 2: Likelihood of teaching coding and computational thinking concepts to students

Feedback from participating teachers shows a significant increase in the likelihood of teachers' future teaching of coding and computational thinking to their students. This data is also supported by the fact that 96% of teachers indicated that participating in the course helped them to identify areas where digital technologies can be incorporated into their teaching curriculum. An increased confidence in teachers in teaching coding and computational thinking and a deeper understanding of the curriculum links demonstrate an increase in computer literacies amongst participating teachers.

> *"I found the Coding Course to be the most interesting and relevant PD Course that I have done. The direct connection between professional development and resources/content that can be directly used in the classroom was as real as it gets for me as a teacher."* — Champion Teacher

The identification and support of champion teachers within the schools has assisted in more teachers being confident in their own computer literacies. An example of this is at Dunedoo Central School where the champion teacher had little confidence and experience in using digital technologies, and now runs a lunchtime code club for interested students. After completing the course at Mendooran Central School, the champion teacher and school principal requested further computer literacy training for all teachers. A two hour computer literacy session was run during the school development day at the beginning of 2017 for all staff members. This highlights the worth of the project by dedicating this time during a valuable day for teachers within their calendar.

> *"It was really good. The delivery was hands-on which made all the difference, plus the amount in each session was just enough without overloading with information. I would completely recommend this for any teacher as Tom delivered the content in a way to make it applicable to all KLA. I am hoping there will be more in the new year to extend my learning and skills."* — Participating Teacher

> *"The teachers involved in these coding workshops are keen as mustard to begin utilising the skills the ASPIRE training has provided. Coding is teaching our students systematic thinking which is great for those of us teaching maths and science. It's also teaching perseverance and resilience (because some of that coding stuff is tricky). It has given our teachers valuable insight into which students are able to think systematically and those that need a little extra help in this regard."* — Participating Teacher

Other qualitative feedback from teachers after completing the course:

- "All the sessions were great especially the final one where we got to play with stuff."
- "Great intro - have been to Code Club training before and felt lost straight away - this made sense and I feel more confident."
- "Really helpful and in language that all teachers can understand."

2. Assist in the building of computer literacies within upper primary school students in particular

Working directly with 85 students from Years 5 and 6 from the pilot schools, computer literacies were enhanced as students learned concepts such as algorithms, sequence, iteration and debugging. Throughout the activities, students demonstrated their increased

knowledge, culminating in programming an Edison robot through a maze that they had designed. Throughout all these activities students demonstrated a high level of interest and engagement. Based on the responses of 74 students who completed the survey, 68% of students indicated that they thought coding "was great!". The data in the table below demonstrates a strong interest in coding and this engagement indicates that students understood and followed the activities. Qualitative feedback from the students and teachers who attended the activities also demonstrates the success of the activities.

Appendix Table 2: Responses to the question: 'do you like coding?'

DO YOU LIKE CODING?	RESPONSES
Not at all	2.70%
It's ok	6.76%
I like it	22.97%
It's great!	67.57%

> *"This workshop provided an opportunity to experience coding that they would not get anywhere else. It was fantastic for a small rural school to have access to this technology and it provided great professional development for our staff who attended."* — Teacher feedback from Robotics Day

> *"The event was fantastic. Well sequenced and paced activities."* — Teacher feedback from Robotics Day

> *"It was a great day and I hope to do it another time."* — Student feedback from Robotics Day

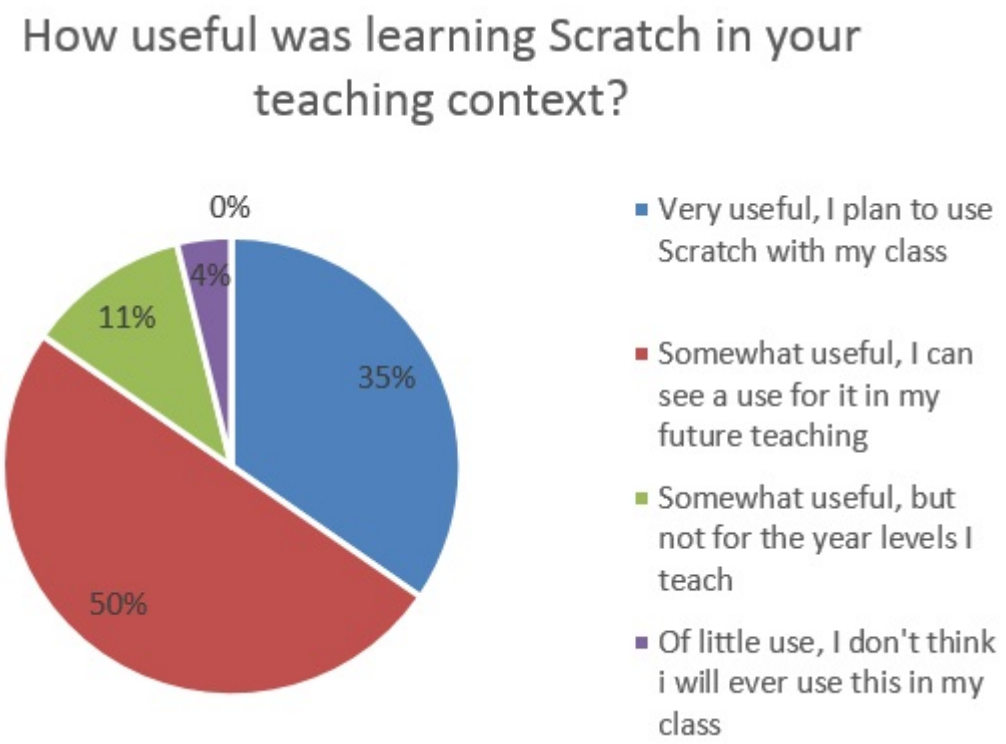

Figure 3: How useful was learning Scratch in your teaching context?

In order to assess the building of computer literacies in the students for whom the project did not have direct contact, the likelihood of teachers introducing content learned from the course was measured. By introducing students to coding and computational thinking their computer literacies are very likely to increase. The likelihood of using Scratch, a block based programming tool, in future lessons was measured. Out of 26 teachers who responded to the survey, 85% plan to use Scratch with their students, or can see a use for it in their future teaching. By using Scratch, students will get the opportunities to learn about algorithms and the fundamentals of coding which would demonstrate high level computer literacies. They are exposed to a visual block based coding language which provides strong fundamentals to learn text based coding languages in the future. Only 4% of teachers found learning about Scratch of little use and would not be transferring the concepts learned into their teaching.

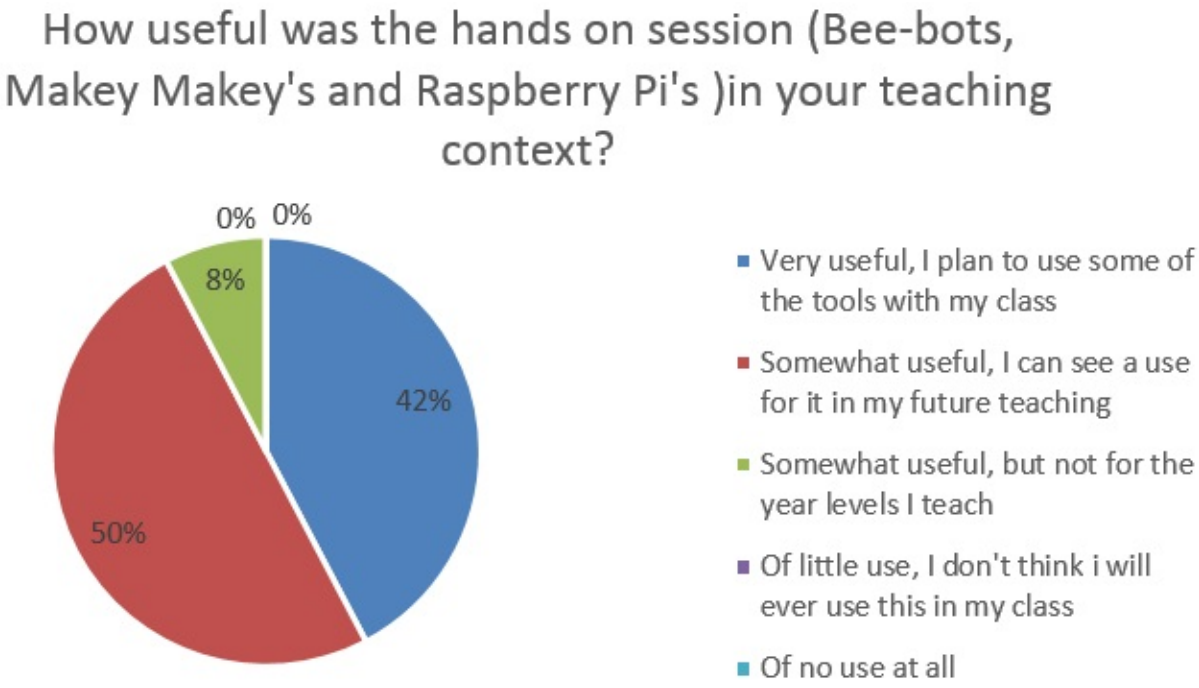

Figure 4: How useful was the hands on session (Bee-bots, Makey Makey's and Raspberry Pi's) in your teaching context?

Hands-on tools that were used in the course enabled teachers to explore introducing different technologies into the classroom to allow students to gain a better understanding of digital technologies and computational thinking. In assessing the likelihood of teachers incorporating these tools, 92% of teachers plan to introduce these tools and the concepts to their students. This demonstrates a likely increase in the building of computer literacies in upper primary aged students within participating schools.

> *"This was a fabulous opportunity for our school as our staff and students had never had access to anything like it before. More follow-up would be greatly beneficial to reinforce the learning and help expand teaching practice in this area. Student engagement when using the technologies showcased was outstanding."* — Participating teacher

> *"It made something I thought was very complex to be something accessible not only to myself but also for my class."* — Participating teacher

> *"Well constructed. Great ideas and wonderful insight into some terrific programs for kids to use. Our boys in particular will enjoy this."* — Participating teacher

> *"I can already imagine the engagement of my students, and the possibilities! Excited!"* — Participating teacher

Lessons Learned

Champion Teachers

High staff turnover, particularly in small rural schools, is commonplace and this provided one of the setbacks in the project and led to a slight revision in the model. In the first schools to participate in the project, much of the focus was on working with individual

champion teachers to great success. However, at the end of 2016, the champion teacher at Mendooran Central School left the school and much of the momentum in working with this school was lost. In the second iteration there was a broader focus on building as many champion teachers as possible within the schools. This approach proved to be very successful with teachers from all stages introducing computer literacies to their students. The course was broadened to include more examples from Kindergarten through to Year 8 and in some cases led to teachers reaching students in Years 9 and 10.

> *"A great introduction. I look forward to introducing some coding to my Year 6 and 9/10 Maths classes."*

Raspberry Pi's

The use of Raspberry Pi's is dependent on teachers' level of confidence in using computers and a moderate understanding of text based programming. Raspberry Pi's were set up by the UNSW ASPIRE Project Officer for teachers to use in the training, and it was explained that maintenance functions and navigating WIFI firewalls required a level of technical knowledge. In schools with well-resourced IT support staff, teachers would feel more comfortable in using the devices. Otherwise, when updates are required or WIFI networks change, the devices could become redundant. One champion teacher is now in the process of using Raspberry Pi's after spending extra time with the UNSW ASPIRE Project Officer and a significant portion of his own time in understanding the device. This is not something which is possible for the average classroom teacher.

Scalability

After working with the first two pilot schools, the possibility of making the teacher training more scalable was discussed. One option of providing a one-off face to face session with supplementary online support was proposed. Upon discussions with teachers who had taken part, it was decided that the format of the course (fortnightly face to face workshops, run after school) was one of its strengths as it gave participants the chance to absorb the content without getting overloaded and disengaged. As many of the activities were very hands on, it would also not convert to an online approach without losing some of the impact of having teachers guided through the technology in person.

> *"PD sessions were great. I really liked only having them every second week as we have been so busy this term! Well presented and great hands-on activities."*

> *"The PL was extremely well presented and its frequency was well planned."*

Overall, the UNSW ASPIRE *Building Computer Literacies in rural schools* pilot appears to have been a very effective trial that has been welcomed by principals, teachers and students. The project has afforded teachers in rural schools an opportunity for professional learning they would not otherwise have had. This has been reflected in the number of teachers giving up time after school to attend the sessions and the enthusiasm that they took to participating in something which was unfamiliar. It is too early to comment on the long-term benefits as many teachers who participated in the program have not had sufficient time to incorporate the content from the training into their lessons. However the proposed changes to the NSW Science and Technology Curriculum will leave the teachers who have participated very well placed to meet the new syllabus. Initiatives such as the

lunchtime code club established at Dunedoo Central School are a legacy of the project which are of great benefit to students.

> *"On behalf of the school I would like to thank you for the technical equipment and professional learning given that will enable our teachers and students to explore further the world of Coding." - Principal, Gilgandra Public School*

Forward Planning

Learnings from the pilot project have enabled ASPIRE to develop a more coherent strategy moving forward. While we were aware that there was a need for teachers to build their computer literacies, the enthusiasm for the professional learning was initially underestimated. The take-up rate from schools and the additional requests from teachers as the project progressed has reinforced our belief in the need for this project within our regional partner schools. This work will now be continued past the project period on an ongoing basis.

> *"This has been valuable training to undertake. It has allowed teachers to explore the technology and progress at a rate they feel comfortable with. It has been great to see some teachers enthusiastically teach coding concepts to their classes. It has also been heartening to see other teachers explore coding for the first time. Long may this project continue in rural schools." - Champion Teacher, Gilgandra Public School*

Expansion to more schools

Following on from the pilot program, ASPIRE will run the computer literacies program with Condobolin Public School and Lake Cargelligo Central School in term 4, 2017. The response to the pilot has been very positive and many other partner schools have expressed an interest in taking part. We are currently exploring options to extend the reach of the program to as many partner schools as possible as part of the core regional ASPIRE offerings.

Stage 4 and 5 professional development and resources

The success of the stage 3 resources has also led to ASPIRE staff creating resources aimed at the teaching of students from stage 4 in our rural partner schools. Current UNSW students have also been employed on a casual basis to assist in developing relevant content for students in our rural partner schools from Years 7-10. This content will also be made available through the ASPIRE website. Further teacher professional learning modules in stages 4 and 5 are to be piloted in two schools in term 4, 2017 with a view to reach more schools in 2018.

ASPIRE STEM Offerings

The success of the program has been a major factor in the UNSW ASPIRE program enhancing its STEM offerings to both regional and metropolitan partner schools. Through both formal and informal discussions with principals and teachers at our partner schools it is apparent that many schools and teachers need support in providing STEM activities for their students. As a direct result of the computer literacies program, the UNSW ASPIRE program ran a STEM event (ASPIRE Aerospace) held at UNSW for 23 Year 9 pupils from regional partner schools. Much of the event was focused on building students' coding and

computational thinking skills, linked in with areas of the science curriculum. Moving forward, there is another STEM on-campus event planned in 2017 as well as in- school workshops to support students in Years 7 and 8.

Links with Community

Moving forward, community based ASPIRE Project Officers will receive computer literacies training to enable them to implement some of the activities both within and outside of schools. This has already been trialled in Gilgandra, where 31 students from Years 3-8 attended a community based school holiday coding program. The event was a great success and will be implemented in other regional towns in the future.

References

JM Wing. (2014, January 10). *Computational thinking benefits society.* Retrieved from Social issues in computing: http://socialissues.cs.toronto.edu/2014/01/computational-thinking/

NESA. (2017, March 6). *Coding across the curriculum*. Retrieved from Digital Technologies: http://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/technology/coding-across-the-curriculum#fn2