



## Developing a Makerspace: engaging students at Kangaroo Flat Primary School

***Ben Fiegert has had a busy start to the year developing his Code Club and makerspace at Kangaroo Flat PS, near Bendigo. Ben explains how he got started, what equipment is in the makerspace, how the students have become involved and plans for the future.***

### **But just what are makerspaces?**

*“Maker’ spaces are zones of self-directed learning. Their hands-on character, coupled with the tools and raw materials that support invention, provide the ultimate workshop for the tinkerer and perfect educational space for individuals who learn best by doing.”*  
Source: [www.digipubs.vic.edu.au](http://www.digipubs.vic.edu.au)

***Please explain how things got started with the makerspace and coding room at your school. For example, who instigated it? How long ago was it instigated? Why was it instigated? (e.g. was the decision based on curriculum or student engagement or other needs?)***

The idea of a *Code Club* at Kangaroo Flat started through *Twitter* feeds that I received. Through links with the *Department of Education* and a number of teachers, coding groups kept coming up on my *Twitter* account and I read them for a number of months but didn't pursue any. My role at the time was three days teaching in a classroom and two days coaching mathematics. It was a struggle to get other teachers involved and interested in coding. *Code Club Australia* (<https://codeclubau.org/>) was one of the *Twitter* feeds I kept receiving and as I read more about it, it seemed the program fitted in a way that I could teach coding after school for one hour a week with kids that were interested and not interfere with the other teachers' programs.

This coincided with our school being accepted into the Science, Technology, Engineering and Mathematics (STEM) Specialists program where two staff share a fulltime role as STEM coordinators across the school. In 2016 I started the STEM role as well as teaching two days in a grade 4/5 classroom. This allowed me to teach coding to the students in my class as well as the *Code Club* on a Thursday afternoon. I was also able to release both our grade 3 teachers for an hour and taught all grade 3 students *Scratch* (a visual programming language).

Through the STEM training I got to meet Gary Stager and do a one day professional development session with him. This opened up the possibilities of a makerspace and the opportunities it could offer our students. The makerspace concept fitted with my own ideas about learning and also what I do outside of school. After the interest in *Code Club*, a science night we ran in term 3, 2016 and the engagement of students in our pop up makerspace for science week 2016 I asked our principal, Kim Saddler, if we could have a dedicated makerspace/coding room for 2017. It was approved and the space has been developing throughout term 1.

A lot of the resources we have in the makerspace are found items from around the school. We'd recently had a major audit of our computers and all technology that was being thrown away provided opportunities for students to tinker with and be pulled apart. A number of laptops were still in good condition but didn't hold power so I have set them up with power cords to use for coding. We have spent about \$2400 over the 18 months on *LEGO* base boards for a vertical *LEGO* wall, 9 *mBots*, 4 drones and a *Makey Makey* board. The rest of the resources were already at the school or collected for free.

***Please describe what you've got in your makerspace and coding room in the way of materials, tools, equipment, kits, computer hardware and software and so on. Please also tell us about the physical layout of the facility.***

Our makerspace is set up for students to work in small groups. There are lots of old computers, printers, scanners, keyboards, radios, etc. for kids to pull apart and explore how they work. We have a number of computers for coding; these are mostly laptops that have *Scratch*, *mBlock* and the internet on them. These are all free programs but you need your technology resources manager to set up an image to have them on your computers. *Scratch V1* is on all *eduSTAR* images (*DEECD* Computers) and you can access *Scratch V2* online at [www.scratch.mit.edu](http://www.scratch.mit.edu) which allows students to do a lot more than V1. We have also installed *Scratch Jr* on our *iPads*. I would like to start using *Python* for coding in the near future and this can be downloaded from their website for free.

As I went around the school looking for resources I found a number of USB cameras for videoing and *Stop Motion Pro* animation software as well as two tablets for drawing. This has opened up some great possibilities for students to create their own characters in *Scratch*. *Tickle* is another program we have used on our *iPads* which allows students to program and control the drones we have.

Other resources in the STEM room include square coloured tiles for making pixel pictures, tubes and peg board for making marble runs, a science table with natural items such as bird nests and feathers on it, *Vertical LEGO* wall and *LEGO* kits for constructing, bottles and containers for experimenting, lots of cardboard for construction, soldering irons for making circuit boards or pulling them apart, clip together circuit boards for creating electronic devices and learning about series and parallel circuits. We also store all our Primary Connections Resources in the STEM room to support our science program. These are a starting point for our science units and we add extra resources and ideas into these to engage our students.

There are lots of resource lists online and I use them to look at what tools and resources I may need for a new station/activity. I have started to collect resources and ideas on paper circuits and squishy circuits so that students can explore these ideas in term 3.

The room has a number of tables and chairs in it so it can be configured any way that's needed. Often furniture is set up in a U shape and students are free to work where they need to and move around to share ideas and get resources.

***How does the use of the makerspace and coding room 'fit' into your school program? Is it used to promote Science, Technology, Engineering and Mathematics (STEM) areas of the curriculum? What year levels make use of the facility? Also, can you please tell us how is the space utilised, for example, do classes come into the room on a rotation basis, or is it used by individual students at lunchtime or after school etc?***

The makerspace and coding room is used by students at recess time to tinker and make things. This is often a workstation activity setup by the teacher running it. It is also used by each class for coding. We are working on all students and teachers having access to learning about coding. Each fortnight all classes come to the makerspace room to participate in a coding session and then teachers work with their students between sessions. I then talk with the teacher and we focus on an area the students or the teacher wants to learn/improve in our next session. This is working well and the teachers across the school are finding out how engaged our students are in coding and that they know a lot more than what we think.

A real positive out of the coding sessions is the collaboration between students. In most cases students start a session on their own computer but very quickly they are in small groups around one computer trying to solve an issue in their code or showing off what they have created. This then encourages someone else to improve on an idea and before you know it the bell rings and students don't want to go out to play.

*Code Club* runs in the makerspace on Thursday nights for an hour after school. We have up to 20 students, aged 9–11, come and code together. We work on making games using *Scratch* and again students collaborate together to create games. Most games get modified to match students' interests and creative ideas are put together to make some awesome games. Our *Code Club* students have also used a collaboration website to share their games with other schools and have played against them online.

***Please describe the sorts of activities students do in the makerspace and coding room.***

When classes come to the makerspace coding room I try to have a number of challenges set up for them to work with. They often have a different focus and are open ended so students can take their ideas as far as possible. Coding classes have a skill development aspect so students and teachers are learning how to make a program do something and then students use their skills to pimp up their program.

When the space is open for any students to come in they are allowed to select what they want to do. Students often come with an idea they want to pursue and so they show great interest and persistence with activities of their choice. This insight into their interest can help teachers develop programs that engage students who sometimes are not always able to focus in a traditional classroom setting.

Talking with teachers after team teaching I often hear how well a particular student worked for that session and that it was great to see them engaged and doing the right thing. The opportunity for students to shine in an environment they have some control over often creates a positive influence on student behaviour.

***Have other teachers from your school, or other schools been involved in your makerspace and coding room or utilised the facility? For example, have you run 'tours' to show your facility, or conducted professional development?***

All our staff come to the makerspace at least once a fortnight to participate in the coding sessions. A number of staff have come to *Code Club* after school to help and learn about coding with the students. The interest in our new *mBots* has got all students and some teachers wanting to access these resources.

I have run Professional Development in this room with Ian from *Code Club Australia* running a full day PD on *Scratch*. I have also conducted coding PD for local teachers. People from Bendigo and other places have travelled up to two hours to attend these PDs showing there's interest and need for support in this area. A lot of the resources I use and my own learning are from the 'University of Google'. There are so many resources available online and the knowledge the students already have is also a great place to start.

Another resource a number of our teachers have used is *CS Unplugged* ([csunplugged.org](http://csunplugged.org) Computer Science Unplugged) which gives you lots of activities to do without using technology (computers). Our grade 3 students loved creating and solving binary code problems and working out the most efficient way to guess my number which had students discussing their solutions with great passion.

**Are there any plans for the future for the makerspace and coding room and the program such as updating the equipment, expansion or extension of the program?**

We are very interested in getting some community groups involved with our makerspace. Opportunities exist to work with our local secondary school, located directly across the road from us. We have started a grade 6 transition day held once a term based on technology and makerspace ideas. We have also made a connection with RMIT to work with their Arts and Communications Department to develop an app to tell our story using historical sites around Bendigo. This will allow students to use GPS concepts and create their stories in many different ways.

We want to continue to develop the programming skills of our students and hopefully have them come up with real world/local problems they can address through creative coding.

**Do you have any advice you'd like to share, for teachers or other educators who are thinking about setting up a makerspace and coding room at their school?**

Have a go! The enthusiasm of the students is catchy and teachers will want to know what students are talking about and why they want to work in the makerspace/coding room. There are many resources online to help with what you need for a makerspace/coding room. Select the things you are comfortable doing and start there. I love electronics so this was an easy space for me to start in. Create small sets of resources and have open ended tasks for students to solve using these resources, but when a student asks for something to improve their design and they can justify why they need it, go to every effort to support them; it is amazing what students can design and build.

## Resources

Below are links to some on the websites I use.

### Invent to learn

<https://inventtolearn.com/>

- *Making, Tinkering, and Engineering in the Classroom*, by Sylvia Libow Martinez & Gary Stager
- Using technology to make, repair, or customise the things we need brings engineering, design, and computer science to the masses. Fortunately for educators, this maker movement overlaps with the natural inclinations of children and the power of learning by doing

### QuickStart Computing

<http://primary.quickstartcomputing.org/index.html>

A resource to help teachers in computational thinking, programming, computer networks, communication and collaboration, productivity and creativity, safe and responsible use of ICT.

### Makerspaces

<https://www.makerspaces.com/makerspace-resources-ebook/>

- 250+ Makerspace ideas
- Includes link to an ebook including information about:
  - 3D Modeling Software
  - 3D Printable Models
  - 3D Printing Materials/Filament
  - 3D Printing News
  - 3D Printers
  - Makerspace Project Sites
  - Maker Education
  - STEM/STEAM Education

- Maker Educators
- Maker Equipment & Tools – CNC Routers/Laser Cutters
- Makerspace Materials
- Makerspace Material Suppliers
- Coding & Computer Science
- Maker Business
- Expos, Events & Conferences – Maker/EdTech
- Research & Articles – Maker Movement/EdTech

### Scratch

<https://scratch.mit.edu/>

- Create stories, games, and animations
- Share with others around the world
- A creative learning community with 22,120,731 projects shared

### Makerspaces Australia

<http://makerspacesaustralia.weebly.com/>

### Digipubs

[http://www.digipubs.vic.edu.au/pubs/maker/create\\_a\\_maker\\_space\\_at\\_your\\_school](http://www.digipubs.vic.edu.au/pubs/maker/create_a_maker_space_at_your_school)

How to create a 'Maker' space at your school

### Code Club Australia

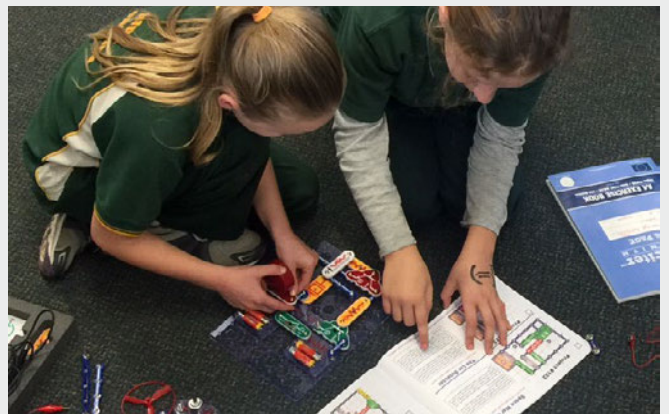
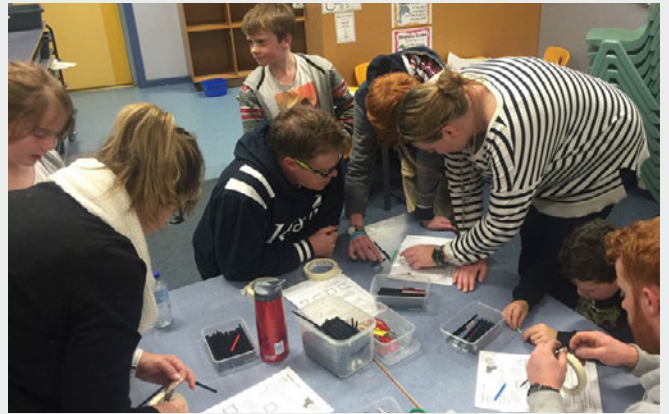
<https://codeclubau.org>

*Code Club Australia's* mission is to give every child in Australia the skills, confidence and opportunity to shape their world. *Code Club Australia* is a network of coding clubs for Aussie kids aged 9–11 #GETKIDSCODING

### Computer Science Unplugged or CS Unplugged [csunplugged.org](http://csunplugged.org)

*CS Unplugged* is a collection of free learning activities that introduce students to computational thinking through concepts such as binary numbers, algorithms and data compression, separated from the distractions of technical details of having to use computers.





Above and left: Kangaroo Flat Primary School students engage in a range of hands-on activities in the STEM Makerspace.

Acknowledgement: Ben Fiegert, Leading Teacher – Numeracy and STEM Specialist, Kangaroo Flat Primary School.