

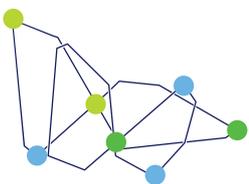


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DLTV JOURNAL

The Journal of Digital Learning
and Teaching Victoria

Volume 6 | Number 1 | 2019



Digital Learning
and Teaching Victoria

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DLTV Journal

The Journal of Digital Learning and Teaching Victoria

Editors

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Pennie White

Associate Editors

Matthew Harrison
Clark Burt

Publisher

Digital Learning and Teaching Victoria

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Editorial

Roland Gesthuizen and Pennie White

Faculty of Education, Monash University



Some themes that might be of particular interest to our readership are STEM, the VCE curriculum, Artificial Intelligence and Coding.

See our new bits and bytes section for Celeste Petinella's thoughts about STEM at Doncaster Primary School and Vera Cook and Stephen Trowse's take on running a joint VCE Computing class.

If you are interesting in Coding the Micro:bit then see the article Yan Mu who explores its use in the Chinese Language classroom or have a go at the coding challenge by Mukesh Soni using the radio functions. There is also the article by Bill Kerr on its capabilities and connections. If you are using Apple products you may like to explore the report by Melissa Yuan from Fintona Girls School on her use of Swift Playground with students. There is also an article about stimulating creativity in Code Club at Glen Waverley Primary School by Samuel Laffy.

Some valuable insights into strategic implementation of the Digital Technologies Curriculum are given by Aisha Kristiansen, Learning and Teaching Leader at Christ the King Primary School. Case studies of Design Thinking and Empathy taught in

the USA is presented by Marcus Mulcahy who had the privilege to undertake research under as a Churchill Scholar in 2017. The Aust Edu Tech Trends Report data is shared by Jason Zagamie.

Delve into Artificial Intelligence with your students using the practical classroom activity on facial recognition developed by Dr Joshua Ho. Dr Ho is working with educators as part of the CSIRO's STEM professionals in schools program. We thank ACER for kind permission to reproduce this article that first appeared in Teacher. Visit www.teachermagazine.com.au for more. Also on the topic of AI is the article 'Why students should create with AI Tools' by Nicole Krueger, reprinted with permission from ISTE.

If you are not already familiar with the Hello Ruby books you can get an overview of the topics covered and ideas for classroom use in the review by Nathan Alison, Professional Learning Coordinator.

We welcome your contributions to the DLTV journal. Please email us and share your ideas for an article for an upcoming issue.



DLTV Editors at Conference

Current Associate Editors Clark Burt and Matthew Harrison, Editors Pennie White and Roland Gesthuizen with David Thiessen, first editor of the first Computers in Education Group of Victoria (CEGV) Journal. DLTV is an evolution of the CEGV.

From the President

Ben Gallagher



The past year has been a busy one for Digital Learning and Teaching Victoria. We have undergone significant changes to personnel throughout the year and in my first year as President I have learnt a lot leading this amazing organisation and we are continuing to establish ourselves as a strong and innovative professional association. 2018 has seen DLTV try to refine and develop our strategic plan further and whilst there is still work to be done in this area we have taken long strides forward.

DLTV has continued to develop networks and partnerships which allow DLTV to advocate on behalf of its members as well as to be a part of the school system. In the past we have used our co-opted members to be able to do this to its maximum effect, but during 2018 we had a number of our co-opted members stand down due to various reasons and the Committee of Management are in discussions on how to leverage our co-opted committee members to best benefit our members.

In terms of Professional Learning, Nathan has organised a number of popular professional development sessions, including the finalisation of the DigiTech Start up initiative that we ran on behalf of the Department of Education. The resources and professional learning will continue to flow through 2019 with an emphasis on getting into the regional centres of Victoria to provide support. We have also entered into a partnership with ACA to provide 10 1-day professional development sessions and progress for these is well underway.

Late in 2018 we said farewell to our Manager Cameron Hocking, who took up a position at a library in Adelaide. This led to a period without a manager, whilst we sorted out the best possible person to replace Cam. I would like to make special note of Nathan and Lola who stepped up significantly in our time without a manager and kept everything running smoothly as well as sitting on the selection panel to help find our new manager, Kevin Daly.

We have continued to provide for the DET Strategic Partnerships Program (SPP) which provides funding to not-for-profit organisations to deliver programs to improve student achievement, engagement, health and wellbeing and/or teacher capacity. This partnership has enabled DLTV to provide quality professional learning to schools in how to implement the Digital Technologies curriculum.

In July, the annual DLTV conference, DigiCon was held at ACU. With over 400 delegates the conference was a huge success and showed the strength of digital learning and teaching in Victoria. Our 2018 award winners, Steve Allen

(Educator of the Year), Marcus Mulcahy (DigiTech Teacher of the Year) and Bec Spink (Leader of the Year), were there to accept their awards and be part of the digital learning community they give so much to and we were excited to be able to present our Maggie Iaquinto Award (VCE Educator of the Year) for the first time to Natalie Heath. Planning for this year's DigiCon is well under way and the committee are thrilled at the excellence shown across the program. The depth of Digital Learning and Teaching in Victoria is certainly a credit to its members and this is shown in the strength of DLTV's community, where teachers are willing to take risks and support each other in learning and teaching. This also has us incredibly excited for our turn to host the ACCE Conference in April 2020, which is also well into the planning stages.

DLTV have continued to maintain strong partnerships with the Brainary, ACA, Department of Education Victoria and our long term major sponsor CentreCom. We have also reached out to other subject associations to develop networks and opportunities for collaborative professional learning. At a national level we are represented by Ben Gallagher who is serving as Secretary and ISTE Representative on the ACCE board and this year our worldwide network with ISTE was supported with President, Ben Gallagher representing DLTV in their planning for their Annual Affiliates Network day as part of the ISTE conference. Our affiliation with ISTE allowed us to present our ISTE MakingIT Happen award for 2018 to John Pearce.

Looking forward for the rest of 2019 we have some major events coming up. By the time this is printed DigiCON 2019 will have been completed with work on ACCE 2020 well under way. Excitingly, in partnership with Microsoft we are running our first Inclusive Education Day in August and have also been lucky enough to receive a grant from Google to supply Inclusive Education PD to regional areas of Victoria. We are working hard to provide for all areas of the DigiTech Curriculum and are looking to increase what we provide for all of our members, including the emerging area of Early Childhood and the long-standing support of our VCE and Higher-Education Teachers.

I would like to thank the hard working Committee who have supported DLTV throughout the year, ensuring a high quality association for all of its members. A role on the DLTV Committee is more than just turning up at meetings and this has certainly been shown by the Committees' enthusiasm and drive to get projects up and running. I would also like to take this time to acknowledge some of our long serving committee members who are not going to continue in their position on the Committee. Mel Cashen, Andrew Williamson and Narissa Leung.

Quickulum

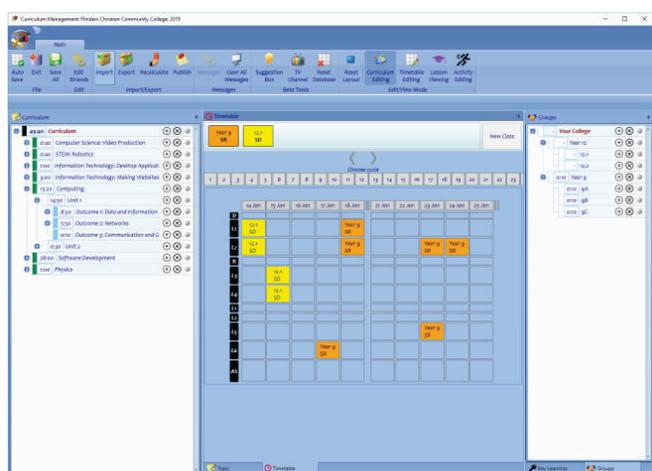
By Stephen Trowse, Clearsoft Pty Ltd

quickulum@clearsoft.com.au

Late in 2016 we (at my school) were all instructed to produce detailed lesson plans for every lesson of the year. Good or bad, right or wrong, effective or otherwise, it had to be done and that's a mammoth task! I tried for weeks to get into the process without success using all kinds of approaches - no good. It needed a new software tool and that, after more than two years of development, is **Quickulum**.

Quickulum made its launch at DigiCon 2019. There wasn't much to see on the DigiCon program about it, and those more curious who Googled it found a reference to a Swedish LMS product. That would have made an interesting topic, but no! Quickulum is a new Curriculum Management Tool (it's the "K" that makes it special!). The name came from a contraction of "Quick Curriculum".

The primary benefit of this software is that it allows you to build your subjects and dazzling topics in a tree-like structure and, with a single click, and print out an entire year's worth of lesson plans in seconds! If something changes just change it and republish. It removes one more bottleneck in the creative art of teaching and makes life *much* easier.



OK, so how?

You enter your topics in a tree structure on the left with each subtopic is given an estimated duration. Entry is quick, and simple keyboard shortcuts allow your thinking to flow. On the right, you



construct a tree of groups (e.g. Year 7 - 7A, 7B, 7C, Year 12 - 12.1, 12.2), and by connecting the subjects and groups, you define your classes. Finally, entering your own timetable then marries all the bits together. You can even account for interruptions such as excursions and holidays in the published lesson plans. This is not a timetabling tool by the way - it is designed solely for the individual teacher.

Anyway, it all just works! Even I found it more helpful than expected, and I wrote the blessed thing!

The best news is that it's free and downloadable in its Beta form. That means that, while it's working and fairly robust, there's no guarantee that you won't find some way to break it, so take that caveat on board won't you? I am hoping to create a community of users who can add their voice to the product, to build and enhance the most useful features, and to craft the user experience into something beautiful. My only request then, is a valid email which is entered upon installation. I can keep you up to date with developments that way too.

Quickulum can be downloaded from

<https://live.clearsoft.com.au/#quickulum> or

<https://bit.ly/quickulum> and lessons and user help will be coming soon. New releases and bug fixes happen on starting the application. It is available only for PC, while work continues to provide it as a cloud service.

If you have any enquiries please email

quickulum@clearsoft.com.au.

I look forward to your interest!

FACE TO FACE



REFLECTING ON DLTV'S PROFESSIONAL LEARNING IN 2018-2019

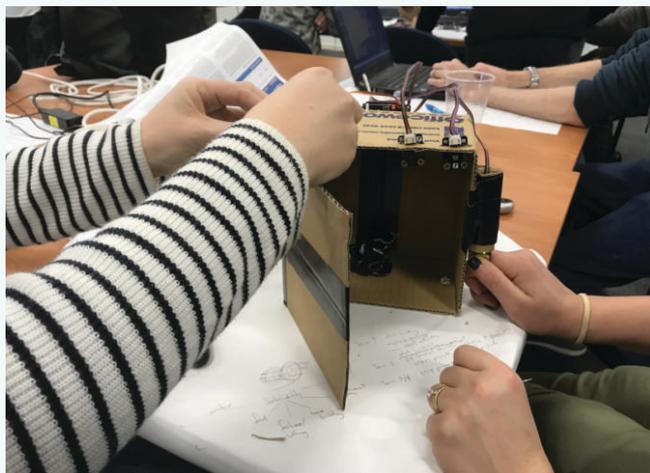
By Nathan Alison, Professional Learning Coordinator

The last twelve months have been a busy time for professional learning with DLTV. It has been a privilege for me to continue the role of Professional Learning Coordinator, after over a decade of classroom teaching in Maths and Digital Technologies.

Following from the DigiTech Startups Initiative in early 2018, no less than 30 separate face-to-face events have been run in the last twelve months, covering:

- F-10 Digital Technologies curriculum,
- VCE Computing (now VCE Applied Computing),
- coding in visual blocks, Python and JavaScript,
- physical tech with electronics and robotics,
- interactive fiction,
- virtual and augmented reality,
- tools for digital literacy and creativity,
- choosing tech for a more inclusive classroom,
- students working towards Foundation (Levels A-D), and for diverse learners.

DLTV was also represented with a workshop at the biennial ACCE2018 conference in Sydney and at the DATTA Aus 2018 National Conference.



A team of teachers at one of our Physical Tech days designed, built and coded a prototype "smart locker" to reduce crowding in their hallway.



Writer and Director of Speculate, Joel Martin, delivers a keynote talk at our Interactive Fiction day in October 2019.

Trends

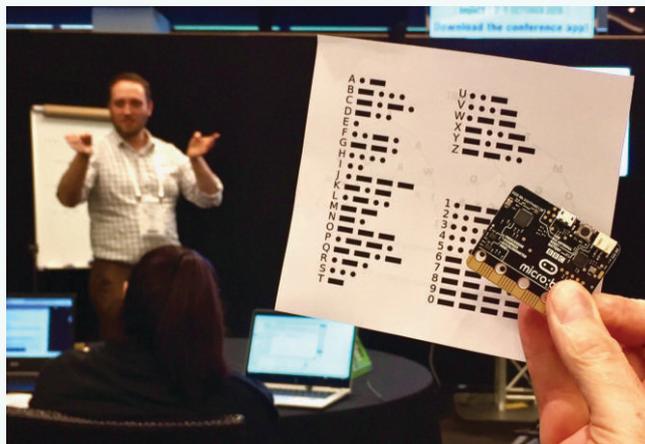
As the Professional Learning sessions were developed, these are some of the themes and principles used:

1. **Hands-on.** Participants have appreciated a practical focus within almost every event this year. Whether coding, building or otherwise creating, there has been no shortage of opportunities to get your hands dirty and try things for yourself.
2. **Collaborative.** We have deliberately sought to encourage participants to share their own practice, to contribute ideas and strategies, and to work together on skills.
3. **Relevant.** With the F-10 Digital Technologies curriculum still new in many Victorian schools, sessions have been designed to demystify the content, explain resources and practice relevant skills.

What's coming in 2019-2020?

Current plans for 2019 include:

- Digital Technologies **curriculum skills and concepts**,
- cooperative workshops linking to **other learning areas** in the curriculum,
- skill-focused events from beginner to advanced, including **Python and JavaScript coding** and the popular **micro:bit**,
- the return of an annual **VCE Applied Computing Day** in Term Four, with other standalone events during the year,
- digital literacy and creativity.

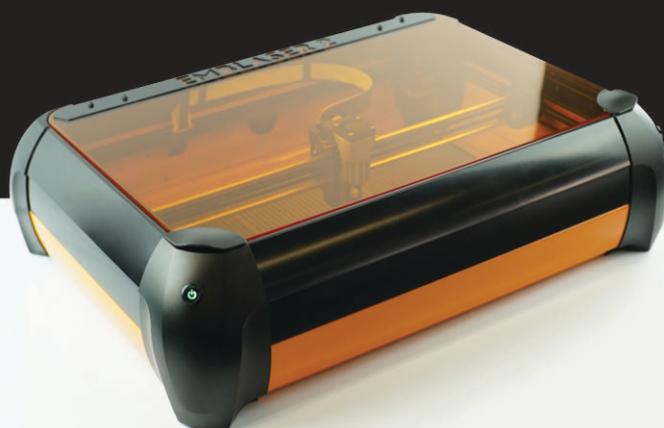


At the ACCE2018 conference, presenting on a Morse Code Network lesson resource developed for the Digital Technologies Hub, which uses the BBC micro:bit.

Perhaps you have your own thoughts or ideas for Professional Learning next year. Please feel free to contact me at nathan@dltv.vic.edu.au

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BITS AND BYTES

Correspondence, conversation starters and short thoughts from our community.
If you have something to contribute please email the editors at publications@dltv.vic.edu.au

SENSING STEM

By Celeste Pettinella, STEM Leader at Doncaster Primary School

STEM is more than gadgets or coding activities. It's an interdisciplinary approach to learning that can develop 21st century skills, connect students with design thinking and build links with the real world. Often as an educator who is passionate about STEM other educators will ask the question 'How can STEM look at our school?'

The answer does not fit into such a neat and tidy box like perhaps other curriculum areas. STEM really is not a linear process in terms of teaching it and what it can look like at schools. Here are some ideas that have enhanced the profile of STEM in our school and you may like to consider:

Our **STEM Treasure Chest** is a school-home based initiative P-6 that I created for students to be actively involved in STEM

projects outside of school. Students complete many hands-on learning tasks from baking to building and then they share their work with their peers.

Our **STEM After School Club** operates for the students P-6. A range of hands on activities are carried out to facilitate students STEM skills. Some activities include: making slime, creating a marble run, building structures using Lego and coding.

The **STEM Leader Training** of some Year Six students has contributed to improving our student voice. Their roles include: supporting staff with ICT equipment, helping keep STEM stock in control and making videos related to STEM.

Education is about sharing ideas with the hope and aim that we inspire our students to achieve great things. I have been fortunate to make a great connection with Roland Gesthuizen, an outstanding STEM Education Lecturer from Monash University who has taught me heaps. I have also been able to build my knowledge through STEM demonstrations and a professional dialogue with you all. Catch you online.



It is time
to sense
STEM!



RUNNING A JOINT VCE COMPUTING CLASS

By Vera Cook vcCook@mscw.vic.edu.au & Stephen Trowse trouse.stephen@gmail.com

Faced with declining enrollments, a school may sometimes ask a VCE teacher to consider a combined class that merged year 11 and 12 students, combining Unit 1 and Unit 2 students in the same room. Whilst there are some differences between the VCE Applied Computing Units, there are some similarities and synergies that can be exploited. Here is a list compiled from some of the discussions on Edulists.

Similarities between the two courses:

- Structure - SAC, SAT, SAC
- Problem Solving Methodology
- SAC 2: Comparison
- Gantt charts and project management
- Data collection albeit very different types of data

Differences

Informatics has a lot of rigour around referencing (Harvard etc.). This rigour could be impressed on SD classes but with reference to websites where code samples were found

Synergies

INF SAC 1 covers database, SD SAC 1 cover code portfolio. Could the INF group supply the database to the SD group for integration since data access is an important part of coding, and can be partitioned off? This establishes a need for collaboration, interface definition and the rigour of design. This could also extend to the SAT and allow the Gantt chart to be established with concurrent resources.



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micro:bit

Tinkering for teaching Chinese

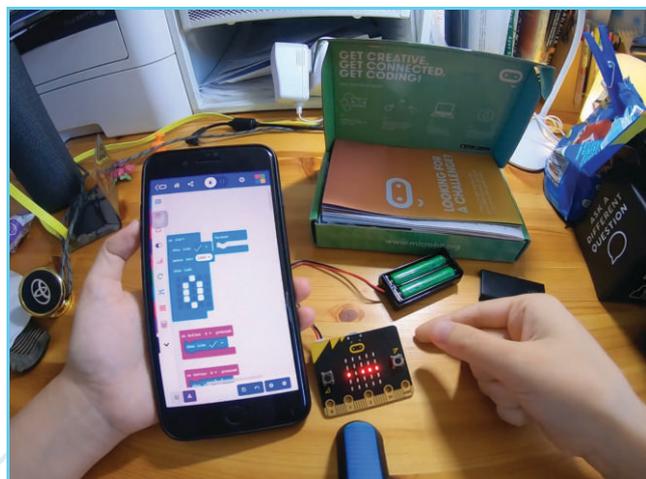
By Yan MU, Preservice Teacher at Monash University
email: helenamuyan@gmail.com

I spent four nights on self-study after I got the micro:bit. There are several factors that scaffolded my self-learning, including curiosity, prior knowledge, ideas, as well as detailed tutorials.

Stimulating my curiosity

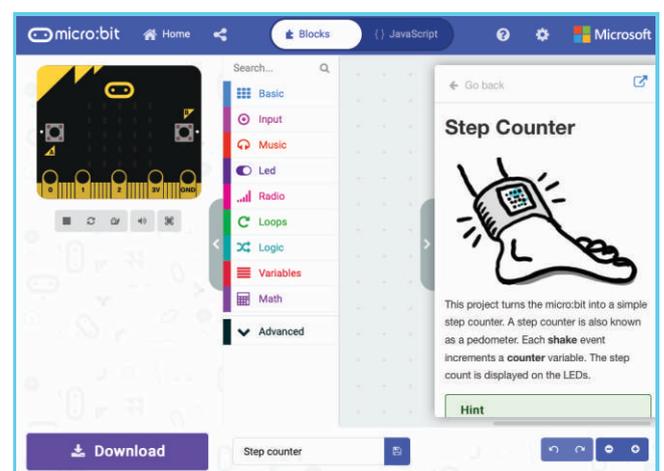
Without knowing what Micro:bits are and what they can do, it might be difficult to raise students' learning enthusiasm. My University mentor Roland Gesthuizen encouraged preservice teachers in his EDF5030 Science Education class to engage with some STEM Education challenges. After handing out his Micro:bit units to experiment with, he invited a fellow preservice teacher to share her learning outcome and findings.

The facial expression of this student and Roland's encouragement made a deep impression on me. Although the concept of a micro:bits was still vague for me, I can recall their smiles and excitement when they gave an explanation of what can be programmed by these tiny computers. The micro:bits seemed to be very interesting and this learning environment created by them made me feel curious about what I could do with them. I soon had my own Micro:bit to play with.



Building upon my prior knowledge

In high school, I was lucky to learn some Visual Basic programming language. Since then for my bachelor's degree, I major in Interpretation and Translation. My university studies and coding had nothing in common, until I was introduced to this STEM Education challenge. When Roland said that micro:bits had educational value and that even kids could write their own code by following the tutorials, this boosted my confidence of relearning how to code again.



After self-studying, I found out there are two ways of writing programming code with the MakeCode software using blocks or the Javascript language. I knew nothing about either. After exploring the MakeCode interface, I noticed that the logic of these coding languages was unexpectedly similar to the computer programming language that I learned in high school. It was a surprise how quickly I could learn writing code and successfully learn another new computer programming language!

Ideas for what to code

Before getting the idea of using the micro:bit as a teaching tool, I spent a long time to think about out what I wanted to do with

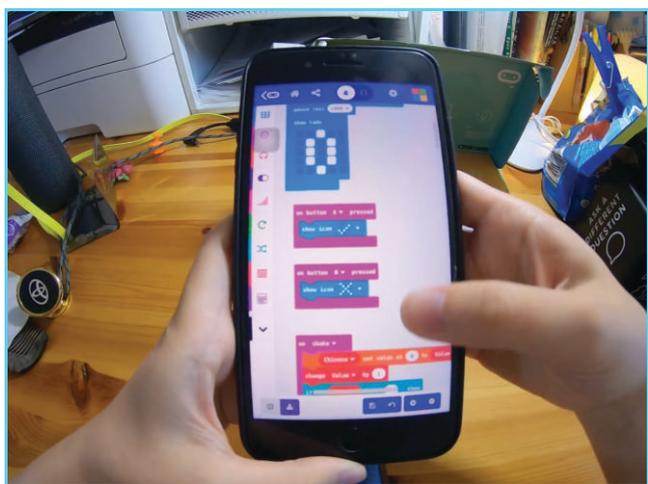
it. At the beginning, I felt so confused about what kinds of code I wanted to write and what problem I could solve. I searched tutorials and checked other people's ideas.

The inspiration for my idea was from my personal experience and the tutorials.

Inspired by “the step counter” in the tutorial, I decided to design and write code on my micro:bit to help students learn about Chinese numbers as a teaching tool for when I am working as a teacher of Chinese in Australia. Students who want to learn Mandarin usually start by learning Chinese numbers.

Detailed tutorials and easy to learn

The tutorials in the micro:bit app are detailed and simple to follow. They are a very easy way for beginners to understand the logic between lines of code and invite learners to copy and rewrite the code themselves. You can even learn how to write the code and program the micro:bit using just your smartphone!



After fully understanding the function of each programming block in MakeCode, I wrote my own code again and worked towards my goal of writing my very first program by trial and error. After time spent making adjustments and testing, I was

excited to finally finish my micro:bit Chinese teaching tool that can be used for teaching counting in Chinese using the micro:bit LED array and the built-in accelerometer.

Check out these links and demonstration videos of my first Micro:bit programs then share some feedback. What will be your challenge?

[Micro:bit Tinkering for Teaching Chinese \(2019\)](#)
[Youtube 2:39 min duration](#)

<https://youtu.be/rDvms84vWts>

[Micro:bit Tinkering for Selfie Remote \(2019\)](#)

<https://youtu.be/TaXPtdqkPnI>

[Micro:bit Tinkering for Teaching Chinese coding \(2019\)](#)

https://makecode.microbit.org/_MP0TYCcArE0C

[Microbit home page](#)

<https://microbit.org>

[Microsoft MakeCode home page](#)

<https://www.microsoft.com/makecode>

micro:bit radio function

A challenge to build a Multi-channel Temperature Monitor

By Mukesh Soni, STEM Technology Evangelist - Paktronics soni@paktronics.com.au

This project challenge uses the built-in radio function to create and code a working 3-channel temperature monitor. I'm sure you will have fun developing this by just following just my hints below. If you are stuck or need help, do not hesitate to contact me

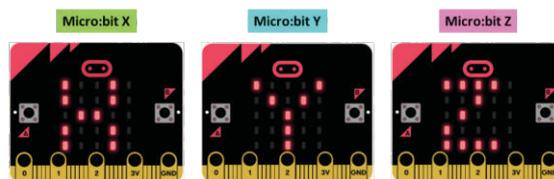
Introducing the Micro:bit Radio

The micro:bit is a credit-card size programmable electronic board developed by BBC and Microsoft. Apart from LED matrix, pushbuttons and bunch of on-board sensors the micro:bit also boasts wireless radio communication with other micro:bits.

The radio link between micro:bits make it useful in interesting applications like a multi-channel temperature monitor with wireless link between the two nodes.



wirelessly. We can program a micro:bit to read the temperature value from its sensor and transmit the reading to another Micro:bit wirelessly. Thus, we can build a temperature sensor system with distributed sensor nodes connected wirelessly over a common radio link. Temperature value from a node can be read from any of the nodes created using a micro:bit.



Condition	Micro:bit X	Micro:bit Y	Micro:bit Z
Default	Temperature X (local)	Temperature Y (local)	Temperature Z (local)
Button A press	Temperature Y	Temperature X	Temperature X
Button B press	Temperature Z	Temperature Z	Temperature Y

Figure 1: Arrangement of the Micro:bits for building a 3-channel temperature monitoring system

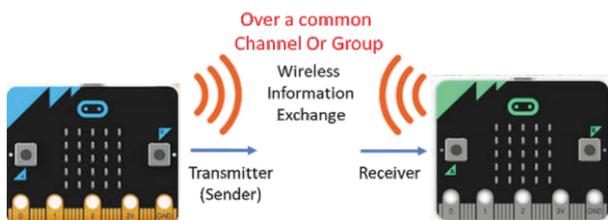


Figure 1: Overview of the Micro:bit radio communication

About this project

The processor chip of the micro:bit contains a 2.4GHz radio module that allows it to interact with other micro:bits

Coding the Three Micro:bits

To create the multi-channel temperature monitoring system, we can use the popular 'block-based' graphical programming available online at (<https://makecode.microbit.org/#>). Functional block for temperature reading is available under "INPUT" library; whereas, the blocks for establishing radio communication and transmitting/receiving data (i.e., the temperature reading) is available under "RADIO" library.

Algorithm

- Each micro:bit has its own program. The program establishes a common radio group for the three Micro:bits

(say group number 1) and a unique device name (or temperature sensing node name – e.g., “x”, “y” and “z” for the three channels).

- The micro:bits continuously read the temperature from its on-board sensor (i.e., the “LOCAL” temperature) and transmit it to the radio group with the device name. For example, the Micro:bit X node would transmit name and value pair as – “x”, “temperature_value_x”. The temperature read locally will be shown on, by default, local LED matrix.
- A micro:bit node will also store the temperature value transmitted by other two nodes. For example, micro:bit node X will store local temperature as temperature_X, and temperature values received from other two micro:bit as temperature_Y and temperature_Z.
- Button A and B press events can be used to display the temperature values received from other two nodes respectively.

About the Author

Mukesh Soni

STEM Technology Evangelist



Mukesh Soni looks after the courseware development and training of educators at Pakronics. He is a PhD researcher (thesis submitted) at Melbourne University and has been associated with technology education in universities and schools for the past 9 years.

Mukesh brings in over 15 years of industry experience in technology, research and development from his earlier association with multi-national companies like General Electric (GE), Bosch, Wipro Technologies and Tektronix.

He can be reached at : soni@pakronics.com.au

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Micro:bit Connections

By Bill Kerr billkerr@gmail.com, writing from Alice Springs

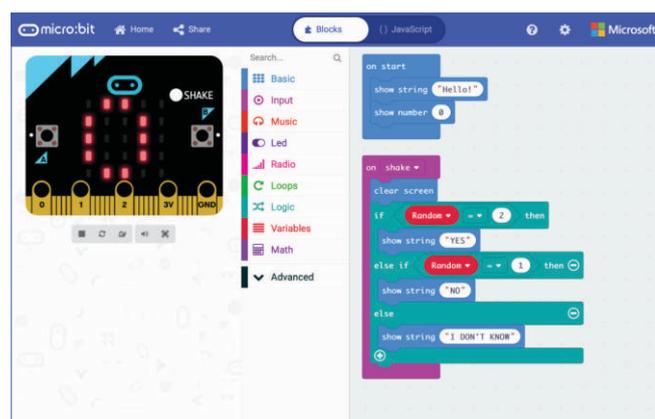
Micro:bit is a credit-card sized programmable computer designed for education. It is also a new species of microcontroller in that it has buttons, sensors and display built right into the board.

How and where does the micro:bit fit into the bewildering array of new technologies and companies ushered in by the maker movement? To list just some of the technologies: Makey Makey, Arduino, Little Bits, Ozobot, Chibi Chip, Circuit Playground Express, LilyPad, Bee-Bot, Dash and Dot, Sphero, Edison, Drones – add or choose your favourite.

With such a wide choice what is needed is some meaningful evaluation. CSER Digital Technologies has made a beginning to this task, although more needs to be done.

For me, the immediate attraction of the micro:bit was its' low cost combined with its' block coding and wicked online simulator at

<https://makecode.microbit.org/#editor>



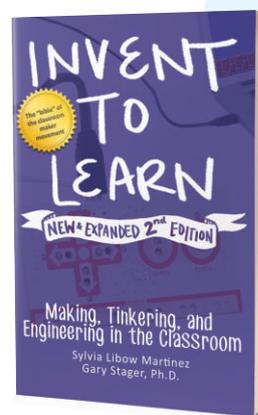
This has led to a personal learning curve about its' capabilities and its' connections.

By its' capabilities I mean what this technology offers for educators and what it leaves out and so requires further, thoughtful expenditure.

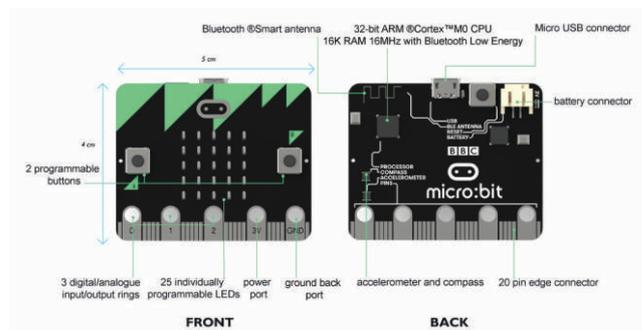
By its' connections I mean what forces are pushing and promoting the micro:bit (very relevant to its current and future success) and how does it integrate into the broader movement

of what we tend to think of, either with one eyed hyped enthusiasm, "STEM conquers the world", or ironically, "unstoppable technological progress".

I'll adopt the Martinez / Stager overview that two out of three "game changers" are wrapped up in the micro:bit, namely coding and physical computing (By physical computing I mean tangible devices which take computing beyond the confines of the screen).



With blocks, coding has become easier and accessible to the 99%. This began with Scratch and now everyone has jumped on board. Arduino has been around for a while but a huge issue which always put me off was that it required coding in C, which presents a big barrier to inclusion for all. Now, Makecode, developed by Microsoft, makes Micro:bit coding far simpler with blocks (and JavaScript and MicroPython are also available).



The micro:bit does require a bigger computer to code it. But once coded and untethered we step outside of the computer lab into the world of mobile and wearable computers.

By way of illustration, some of the interesting things you can do with the micro:bit include:

- make a game of rock, paper, scissors and strap it to your wrist to play
- use the on board accelerometer to make a simplified version of Pacman (H-ero), the character moves by tilting the microbit
- use the radio to send messages between microbits

Scratch3.0, which was released in January 2019, includes a microbit extension which enables two way interactivity between Scratch and the micro:bit. For example, you can write code about whether students prefer cats or dogs by pressing

the A or B button on the microbit. This can be adapted to voting on anything. Pass the laptop around the room and as the votes appear on the screen a cat or dog icon is stamped as well. This requires Scratch Link and bluetooth 4.

Initially, the micro:bit requires tethering through the USB cable, then you write your Makecode, test it on the simulator, flash it over to the micro:bit and then untether, connect your battery and take it outside, if you want.

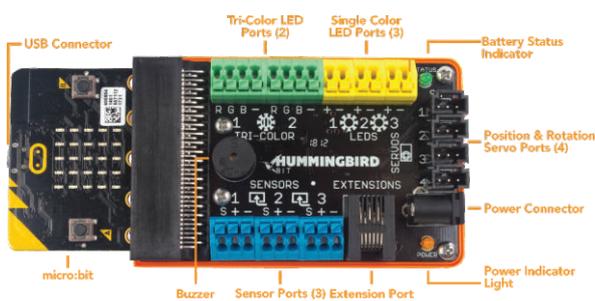
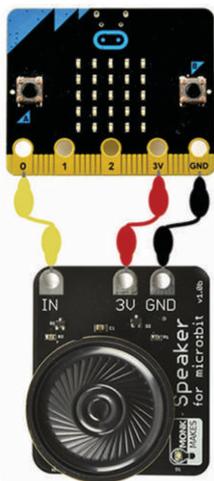
With the further development, however, of Microblocks, another programming language similar to Scratch and MakeCode, you can have live coding before the untethering. MicroBlocks runs right inside the microcontroller board so as you write your code you see the effects immediately on the microbit.

The micro:bit is inexpensive hardware so inevitably it does have some limitations. Since kids love sound one important limitation is no onboard speaker. But it does have 25 edge connector pins and four ring connectors which enables speakers, motors, light and more sensors to be connected.

Of course, this leads to more expense and decisions have to be made about the best way to go. I bought both the Kitronik

Inventor's Kit and the Monk Makes Electronics Starter Kit for microbit. They were both good but I'd put in a special mention for the Monk Makes speaker.

For more ambitious projects with a STEAM philosophy (A for Art) Martinez and Stager recommend the Hummingbird Bit developed by Tom Lauwers of BirdBrain technologies. This is more expensive, especially with our current exchange rate (\$350AU for the Premium Kit), but I've been most impressed by my initial trials.



I think there has to be a pragmatic yet deep educational programme underwriting the technology. For me, this is provided by the **Creative Computing Curriculum Guide** developed by the *Creative Computing Lab at the Harvard Graduate School of Education*.

So rich has this new era become that it threatens us with metaphorical overload. The original metaphor from Seymour



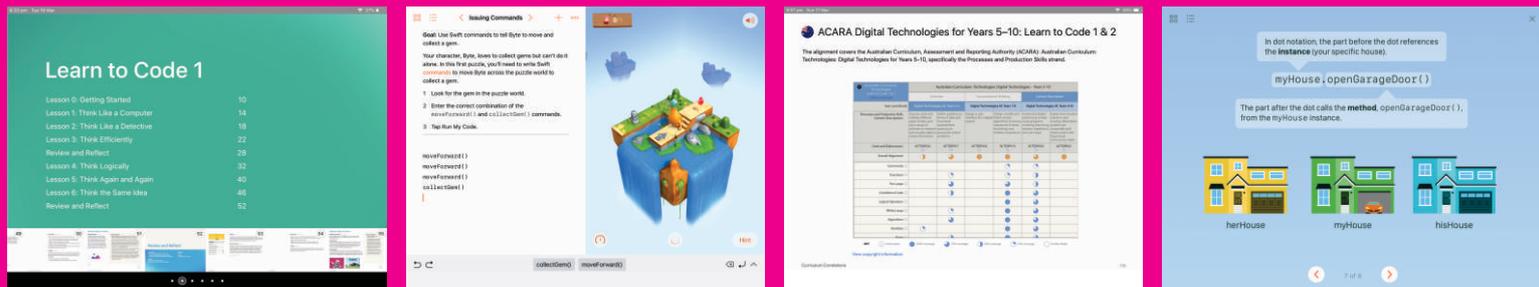
Papert was low floor, high ceiling (easy start, no limits). Then Mitch Resnik included wide walls (diversity in projects). Then with the remix features on the Scratch site, Yasmin Kafai and Quinn Burke added on open windows (for collaboration). Then with the micro:bit microcontroller we can move outside the house, wear it and play.

References and further reading:

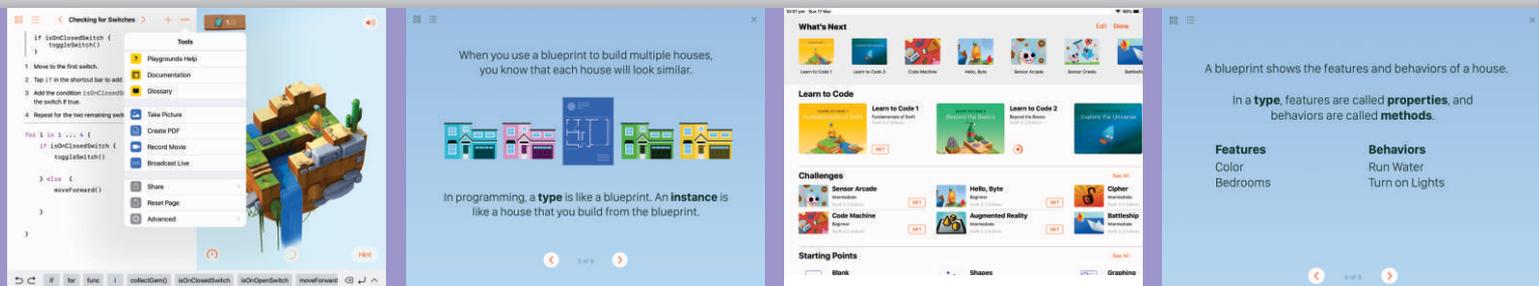
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- Microbit home page <https://microbit.org/>
- MicroBlocks home page <http://microblocks.fun/>
- Monk Makes Kit https://www.monkmakes.com/mb_kit/
- Scratch3.0 <https://scratch.mit.edu/>

Kindly adapted from his blog post at

<http://billkerr2.blogspot.com/2019/06/making-sense-of-microbit.html>



Swift Playgrounds



Melissa Yuan – Year 9 at Fintona Girls School

Swift Playgrounds is Apple's learn to code offering that is comparable to code.org or Microsoft Make Code in that it offers a highly structured programming curriculum with clear learning outcomes, structured tasks and hands-on coding exercises.

At the 2018 DLTV DigiCon, Swift was positioned as bring a “line coding” alternative to block-based offerings such as Scratch or Blockly. However, although the code looks more like text, students create their programs by clicking on the text, like a block. Students can select and drag these blocks around within the editing interface.

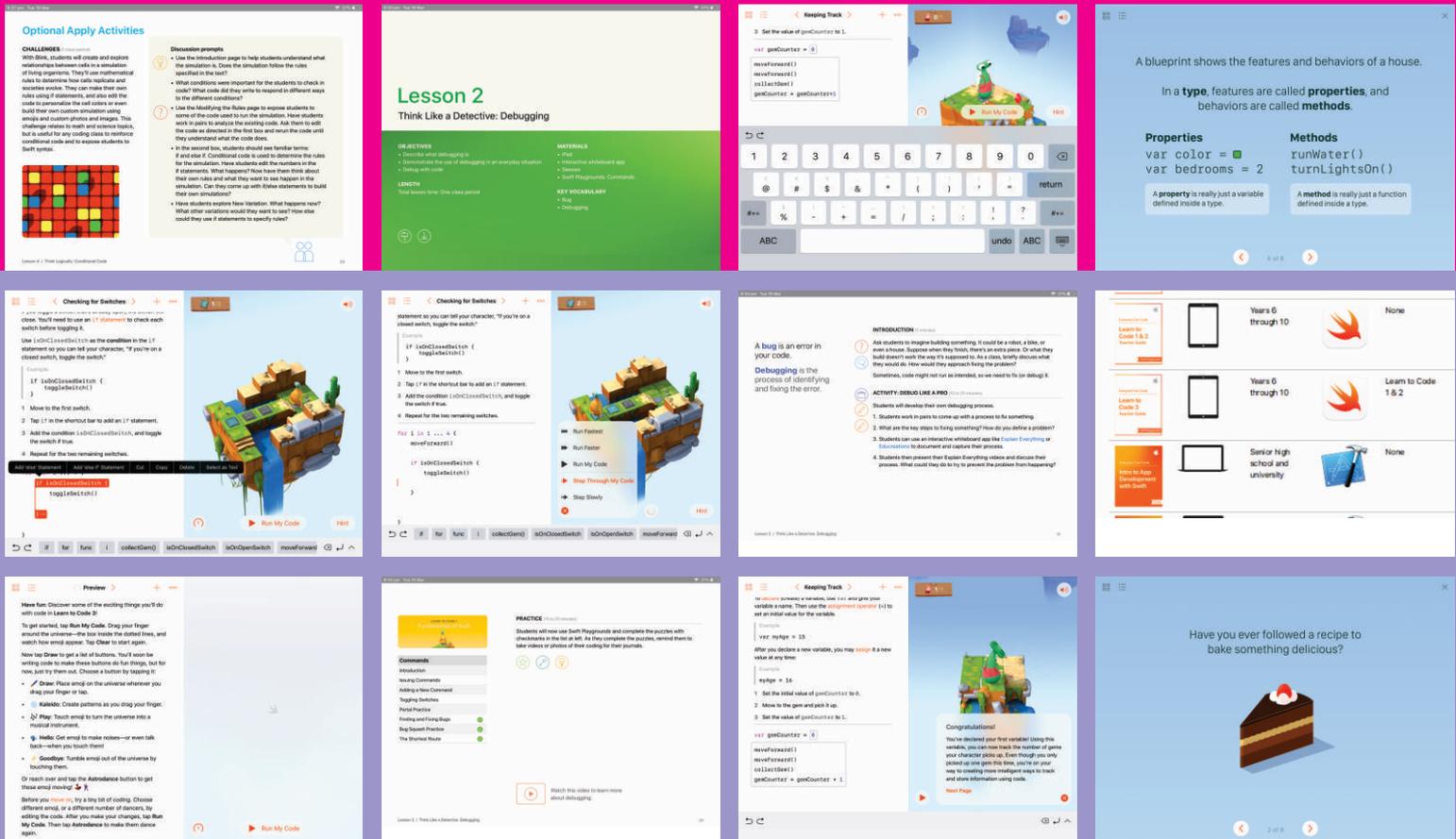
Year 9 students in a coding elective, who had prior experience coding via the code.org “Accelerated Intro to CS” in years 7 and 8, were able to complete Learn to Code 1 and almost all of Learn to Code 2 on iPads in first term. The elective runs for seven (7) periods per fortnight cycle of 60 periods.

To get started, download the Swift Playground app, then add the various “Learn to Code guides”, plus “Challenges” and “Starting Points”. The “Learn to Code” guides are self-contained lessons and development environments whereas the

“Challenges” are extension puzzles on the core curriculum. “Starting Points” are self-contained development environments with specific code blocks and snippets to hack.

Each Learn to Code lesson starts with an animated explanation of the concept then a series of lessons. The concept explanations are short, with no words wasted and in Apple's typical visual design style. The IDE include drag-and-drop code blocks, options to control how fast to Run the code with a Step option, plus Hints. Students can toggle between the code blocks and the keyboard and clicking certain blocks (such as “if”) gives additional menus (such as “Add 'else if' Statement”). There are a range of tools to enable to students to save and share their work and the ability to Reset the page. The code runs in a 3D navigable environment which is brightly coloured and has cute sound effects.

The Teacher's guide (available only via iBooks) contains lesson objectives and “unplugged” activities to try, but not solutions. Lessons come with Keynote presentations and supporting videos, which run on the iPad and Apple TV would be required for class display. The curriculum is mapped against a number of national curricula, including Australia's.



We ran this using individual iPads with generic logins (shared devices) but if you have individual iPad logins then there are more options for storing and saving progress and code.

Swift is positioned as a years' 6-10 offering which leads into senior High School "Intro to App Development with Swift" which (currently) requires a Mac running Mac OS Sierra or El Capitan and Xcode 8.

Apple's offering is an excellent learn to code environment for middle and high school. The more Apple infrastructure you have available, the easier it would be to run. The ability to export and submit work for assessment is so far un-tested but would rely on students to use the Tools to take a picture, PDF, record a movie or broadcast live.

Students made the following comments:

- I really like it
- They do chest bumps with the wall
- It's easy to understand
- The music is cool

- The instructions are very clear and its very organised
- It really helps me understand the different terms of coding and how they work
- It has clear explanations for new terms and definitions
- Sometimes the way things work aren't explained
- The characters are cute
- Some levels are hard
- The 3D playground is very helpful
- When you finish a really hard level, it makes you feel really accomplished
- So much better than code.org

References:

<https://www.apple.com/au/swift/playgrounds/>

STIMULATING CREATIVITY: 'CODE CLUB' at Glen Waverley Primary School



By Samuel Laffy

Digital Technologies & Multimedia Teacher
laffy.samuel.s@edumail.vic.gov.au
Glen Waverley Primary School

“And so I jumped in, I jumped into this world of technology, to see how I could use it to enable magic as opposed to kill it . . .”

Young artist **Shilo Shiv Suleman**, TEDTalk

https://www.ted.com/talks/shilo_shiv_suleman_using_tech_to_enable_dreaming

This line, delivered in a captivating 2012 TED Talk by Shilo Shiv Suleman (illustrator, storyteller and iPad book creator) encapsulates the desire no doubt shared by many in the quest to create purposeful teaching and learning opportunities in the realm of the 'digital space'.

That desire to enable young people to harness technology around them to pose questions, find solutions, influence the world around them, and to create previously unthought-of inventions.

It's a dream – more often than not – shared by the very young people we seek to empower. You only need to ask them!

“Our generation is very advanced; technology is part of our lives. I don't see a situation where coding and other digital skills wouldn't be important. It teaches us how to use our resources wisely, and in a creative way, and it also teaches us how to break down complex problems into smaller parts” – Amy, Year 6.

The quote above – written by a 12-year old girl reflecting on the importance of digital learning opportunities – highlights the need for quality teaching and learning of digital skills. To expose students to the process of Analysis-Design-Development-Evaluation built into the DigiTech curriculum.

Through my role as Digital Technologies & Multimedia Teacher at Glen Waverley Primary School in 2018/19, I had the

opportunity to design new learning experiences for students to sample the process of invention, building their capabilities and confidence in applying digital skills.

Dubbed 'Code Club', the small-group innovation program allows interested students to build their knowledge and skillset across a variety of platforms. Tackling introductory coding courses such as 'Code Combat' and 'Intro to Python' via Codecademy, they were exposed to the basic syntax of 'written' coding. Following this, they applied their knowledge of 'Blockly' based coding to create basic games with Scratch, before 'hacking' various sensors and cameras on their iPads through use of the app 'The Everything Machine'. Many had minimal experience with such platforms, and were largely 'thrown into the deep end' – with a focus on learning by experimenting.

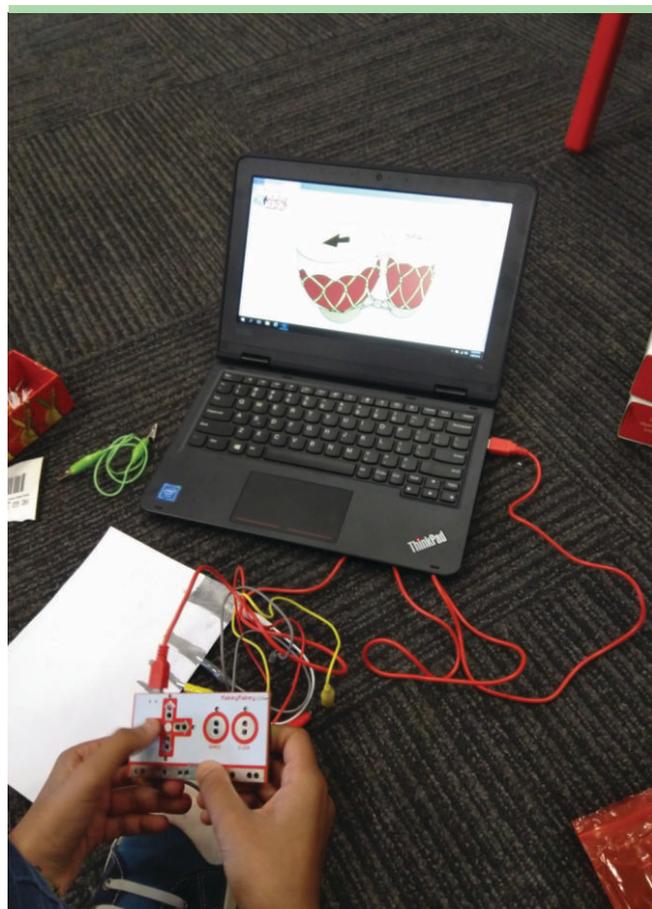
The most engaging learning however, occurred following the discovery of a set of five 'Makey-Makeys' collecting dust in the back of a cupboard in my teaching space. A Makey-Makey is a small circuit board that connects to a computer via USB (and often used in conjunction with Scratch). They are used to transform conductive materials – anything from grey-lead pencil, Play Doh, aluminium foil, and even fruits and vegetables – as an input device to invent playable machines.

Acting as a joystick, a keyboard key, or a sensor, the circuit

allows students the chance to comprehend how the physical push of a button can cause a digital reaction in a device or creation. Following targeted instruction in the use of Scratch to create simple algorithms that resulted in the playing of sounds and the movement of characters when a particular keyboard key is pressed, students were set a range of challenges to 'create':

1) Bongo Drums:

Accessing a pre-built set of bongos from 'Makey-Makey Labz', students experimented with the idea that their fingers can be used to complete a circuit, and help them 'play' an instrument – at the same time learning how to connect each element of the Makey-Makey in conjunction with alligator clips.

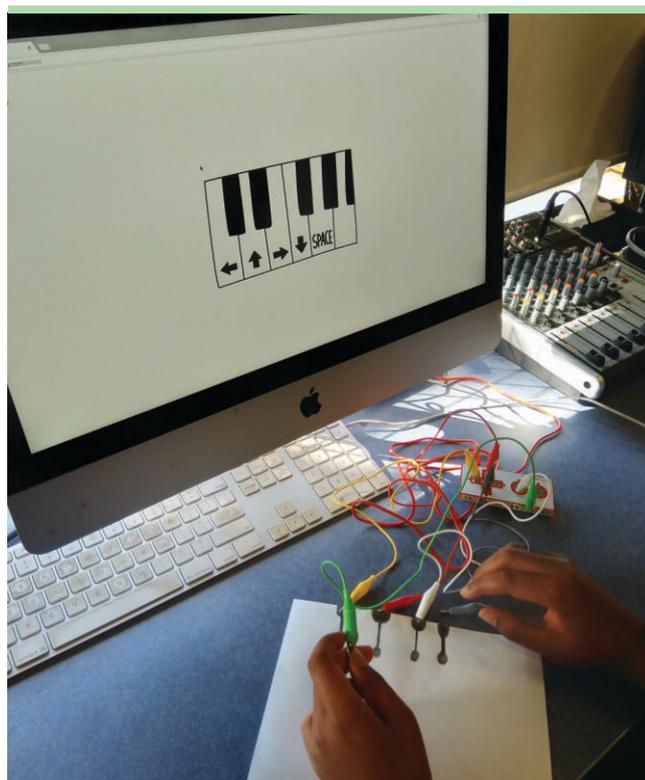


Building Understanding

"I learnt about the different materials we could use to conduct electricity, and how we could complete a circuit. We could use these skills for making games and consoles – linking to things like VR." – Vanessa, Year 6.

2) Pencil Keyboard:

Tasked with sketching five 'keys' for a grey-lead keyboard on A4 paper, students took advantage of the electrical conductivity of the graphite in the pencil to create a playable musical instrument – with an unplanned extension element discovered in the challenge of selecting and linking programmable sounds that could actually be used to play a simple tune.

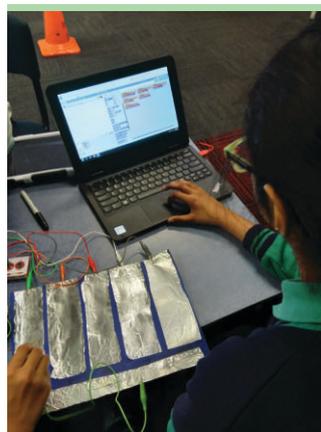


Makey-Makey Keyboard in Action

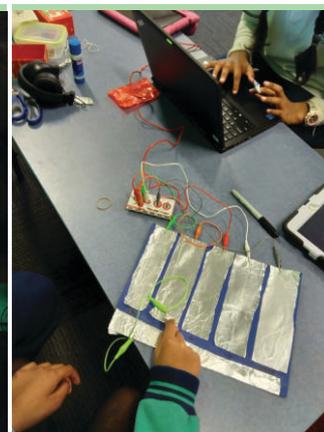
"I enjoyed making the grey-lead piano. It was really cool, especially the way it worked! I especially enjoyed creating basic programs [to extend my learning] and then trying them out" – Thathya, Year 5.

3) Synth Pad:

Taking advantage of the electrical properties of aluminium foil, students created a makeshift 'Synth Pad', using square and rectangles of foil glued down to A3 paper to create their music-making device. Each 'pad' was connected to the Makey-Makey, and programmed to play a sound when students completed the circuit and 'played' the Synth Pad.



Programming Sounds for the Synth Pad

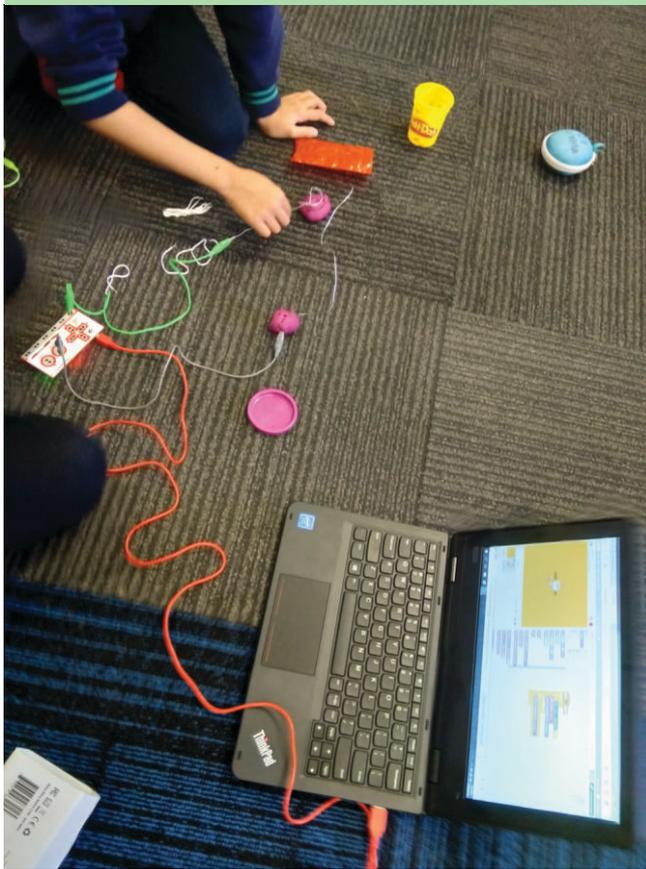


Making Music!

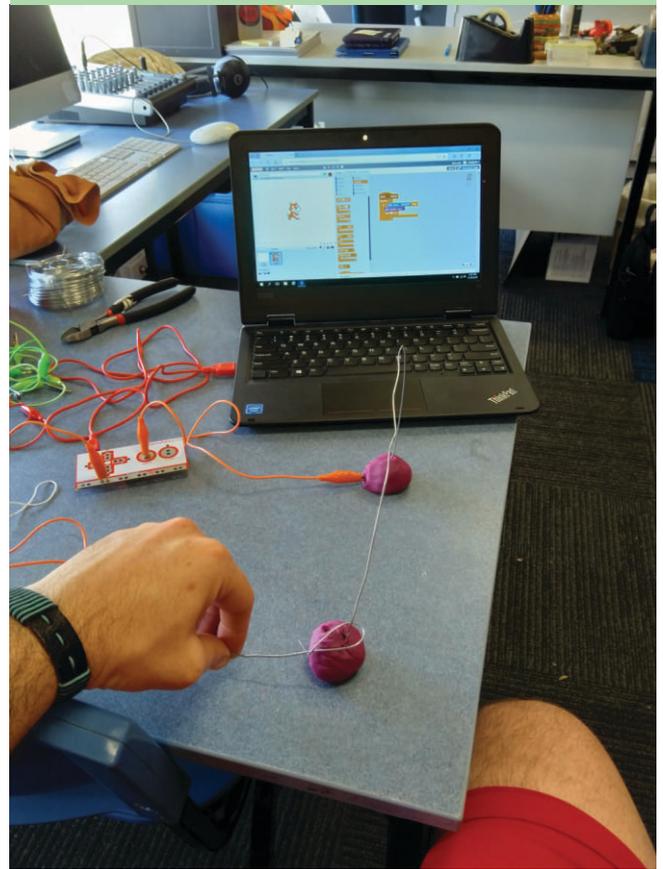
"I learnt how to program the Makey-Makey and use it with Scratch. I enjoyed being able to control digital tasks in a different way" – Vihaan, Year 6.

4) Wire Skill Tester:

Extending their skills, students had to construct a 'wire skill tester' using Play Doh, fencing wire, and Scratch, with the circuit completing – and thus, ending the game – whenever the 'wand' touched the wire. Programming multiple screens including the creation of 'Scoring Systems', 'Timers', 'Game Over' screens, and other game-based features, students bent wire to form a challenging test of steady hands.



Trialling the Skill Tester



Putting the Teacher to the Test!

“Makey-Makey was fun because we could mix up the controls of a game or we could make our own custom controllers. I can use these skills to create things!” – Zach, Year 6.

To add depth to each session, students were quizzed on their thought processes, explaining how they used each device, where they believed they could transfer these skills, and deepening the link between the concrete, usable 'devices' and digital programs.

Overall, the experience of facilitating 'Code Club' enabled me – as an educator – to think 'outside the box' to lead students' development of digital skills. Both in terms of mixing explicit instruction with the chance to 'explore and experiment', and in selecting digital resources that engaged and intrigued students.

“I enjoyed coding games on Scratch and uploading them. Also, learning new coding languages like Python, HTML, and JavaScript. I can imagine some games that can be amazing, using my critical creativity.” – Bhaavi, Year 6.

“I enjoyed Scratch, because I can create anything I want.” – Anqi, Year 6.

“I enjoyed Code Club because I could use my imagination.” – Zak, Year 5.

“I understand that there are two parts to technology, the software and the hardware. The software you code, and the hardware is the stuff you build.” – Daniel, Year 6.

“I was able to explore a variety of different coding websites and scripts, and learn to make games and apps. There are so many possibilities you have when coding, and endless things you can program.” – Jasmine, (former) Year 6.

“I liked making my first game, and it being successful. I am confident when brainstorming” – Thevindu, Year 5.

“I enjoyed the creative thinking and learning. I improved at problem-solving, and learning Python was really fun” – Shawn, Year 6.

“I made a game that used a variety of buttons, screens, and images to create a short 'Choose Your Own Adventure' game” – Tashiya, (former) Year 6.



STRATEGIES FOR IMPLEMENTING THE DIGITECH CURRICULUM

BY AISHA KRISTIANSEN, LEARNING & TEACHING LEADER AT CHRIST THE KING PRIMARY SCHOOL



Aisha is the Learning & Teaching Leader at Christ the King Primary School. She is passionate about cutting-edge approaches to education. Aisha holds key roles on the CEM STEM Advisory Board, DLTV Committee, Geelong Innovation Collective, Melbourne STEM Teaching Collective. Her school has been the focus of many case studies in contemporary teaching practices.

There's a storm coming, albeit it, a digital one! A race between the haves and have-nots of technology - the ultimate social divide. The rapid advancement in

technology has seen a large number of teachers fighting to keep their heads above water. App development, robots, virtual reality, makerspace movements and artificial intelligence

are destabilising our teaching landscape (arguably) for the better. But how do teachers keep on top of these latest trends? The answer is quite simple - jump in and don't be afraid to fail! As the famous American basketball player and coach John Wooden says, 'failure is not fatal, but the failure to change can be'. Whilst emerging technologies can be daunting, having a growth mindset, engaging industry experts and working collaboratively across the teaching sector will assist with overcoming these challenges.

As the Learning and Teaching Leader in a school with cutting-edge approaches to technology, one of the big questions I am constantly being asked is where to begin! With so much on offer, how can schools strategically implement a strong, manageable DigiTech curriculum.

HERE ARE MY TOP 5 TIPS TO GET STARTED:

▶ TIP 1 – MAKE A SCHOOL COMMITMENT TO DIGITECH

Schools need to make a decision whether the Digital Technologies curriculum will be taught as a specialist subject, embedded into daily teaching practice, or both. This is of particular importance, so as to provide evidence of student achievement and allocate reporting responsibilities.

CONSIDER - Does your school have a Forward Planning Day each term, where teachers are released to create rich assessment tasks and assessment rubrics involving the Digital Technologies curriculum?

▶ TIP 2 – FIND YOUR EARLY ADOPTERS

There will be a range of differing abilities amongst your staff. Finding the staff members who are really passionate about this area is the secret to success! Including these staff members in Leadership Meetings or asking them to lead learning can really take the profile of DigiTech to the next level.

CONSIDER - Is there a digital "expert" in each area of the school? Can the school appoint Digital Technologies coaches to build teacher capacity?

▶ TIP 3 – AUDIT YOUR CURRENT PRACTICE

Audit the Digital Technologies curriculum against current practice in the school. Understanding the curriculum is the key to using it effectively. *Digital Systems, Data & Information* and *Creating Digital Solutions* have seen a sharp move away from the narrowness of previous curriculum documentation.

CONSIDER - What areas of the curriculum is the school already covering? How can the yearly Scope and Sequence ensure that all three content areas are being addressed?

▶ TIP 4 – DESIGN RICH ASSESSMENT TASKS

Knowing the curriculum is vital to designing rich assessment tasks. Creating a cross-disciplinary task linked to an assessment rubric will become a roadmap for learning and teaching. Explicit links to the Digital Technologies curriculum will allow for the collection of work samples, teacher moderation and the allocation of progression points that are supported by evidence. It all starts with the quality and richness of the task!

CONSIDER - How does the school currently collect evidence for student feedback, progress and reporting? What is still missing?

▶ TIP 5 – SHARE PRACTICE

Share, share, share - both within your school and beyond! Get your staff involved in the Twitter and LinkedIn Professional Learning Networks. They are a great source of inspiration!

CONSIDER - What opportunities are there for staff to share their practice at a school and system level?



Finally, if we are going to rise to the next major challenge in education, we need to let go of being the expert. Accept that your students know more than you (they do!) and enjoy the ride. Co-learning with your students is a way to build deep, trusting relationships with them and will be the best professional development you will ever have! Together, we can not only ride out this storm, but we can conquer it!

Aisha is the Learning & Teaching Leader at Christ the King Primary School. She is passionate about cutting-edge approaches to education. Aisha holds key roles on the CEM STEM Advisory Board, DLTV Committee, Geelong Innovation Collective, Melbourne STEM Teaching Collective. Her school has been the focus of many case studies in contemporary teaching practices.

Design Thinking and Empathy in teaching Digital Technologies

A reflection by Marcus Mulcahy



Marcus Mulcahy is a Learning Specialist (Community Engagement/Learning Technologies) at Carrum Primary School and Coordinator of the Northern Peninsula Digital Technology Teachers' Network, representing local public Primary and Secondary schools in an area 35 kilometres south east of Melbourne, Victoria. He undertook a Churchill Fellowship to find out how teachers can better equip students for the next wave of digital innovation and prepare them for the transition to more advanced digital learning at university and in the workforce. Marcus visited a diverse range of F-12 public, independent and charter schools in the United States. These schools have already encountered many of the challenges facing schools in the digital age and this series of articles includes ideas that could be adapted for the Australian context. This article focuses on the deep connections between design thinking and empathy and is an extract from Mulcahy, M. (2018) 2018 Study of Innovative Digital Technology and Makerspaces in USA Schools and Communities [Report], The Winston Churchill Memorial Trust of Australia, pp. 11-13.

The Nueva School is an independent F-12 school with a junior campus in Hillsborough and a high school in neighbouring San Mateo. The school is located between San Francisco and Silicon Valley in the Bay Area of Northern California. Design thinking is a major force at this school. I spoke with Diane Rosenberg, Head of School, about how the Nueva School has implemented a successful model for design thinking across all year levels. Diane explained that students at her school engage with design thinking principles on a daily basis and across the curriculum, both in the dedicated Innovation Lab (I-Lab) and in their classrooms. The Nueva model for design thinking is available from the school website and it explicitly references empathy as an integral component. According to Kim Saxe, Director of the I-Lab:

“Design Thinking is a collection of techniques and mind sets that enable people to identify underlying needs through empathy, to harness and develop their ability to generate ideas, and to actively seek feedback. ...Design Thinking helps people jump into ambiguous challenges with energy and excitement.”

According to Maker Faire presenter Tim O'Reilly of O'Reilly Media, student motivation will come from “working on stuff that matters.” He gave a list of complex problems the world needs to fix including: dealing with climate change, rebuilding infrastructure, feeding the world, ending disease, resettling refugees and sharing wealth. The application of design thinking means that students must first carefully consider the question that needs to be answered or the problem that needs to be solved. A crucial

aspect of this stage is listening to the people who are impacted by the problem and trying to develop a deep understanding of their underlying thoughts and feelings in order to develop insights. This leads to focusing on a small part of a larger problem, setting boundaries that will allow for success.

Schools can harness student motivation by allowing them to identify and work on authentic problems that arise within their own socio-cultural sphere. This begins in prep and junior primary with students designing something for themselves and the next step can be to design something for someone else. Carl Shan, middle and upper school I-Lab teacher at Nueva School explained that students from years 4 to 12 undertake a year-long personal independent project of their own devising in order to explore in depth a subject of interest to them. This is a free choice project focussing on something they are curious about. The students spend 40-60 hours of class time over the course of the school year working on their projects and they are encouraged to reach out to mentors within and outside of the school for assistance.

At the end of the year the school holds an expo where students showcase their finished projects to the school community and public. In middle school this project is called "Recital" and in the senior school "Quest". Students taking part are doing so as a graduation requirement and are coincidentally building skills such as time management or creative self-expression. Examples of projects include: a Year 9 student writing a fantasy novel, other students learning a new foreign language, learning to cook and learning a computer programming language. In one of the more ambitious projects one student, who was very able and also adept with the tools, built a functioning jetpack.

While in the I-Lab I watched a student using a laser cutter to create a braille business card. The design process can be applied to any problem and does not place limits on where a solution can be found or how a need can be met. It begins with listening to the proposed user and researching related models and issues. Students synthesise the many ideas they encounter and begin to design and then construct a model or prototype. They actively seek feedback from the end user and experts, and adjust the model or prototype accordingly. After many iterations a preliminary solution is achieved and after implementation, a cycle of obtaining feedback and redesigning for improvements begins.

In many classes at Nueva, students are encouraged to get out and listen to people talking about the problems they are facing and then to work with them to design a solution. In this way Nueva school students have assisted a pet shelter and designed a sleeping bag for homeless women. One student was working on a go-kart and was at first resistant to listening to feedback but he soon learned the value of it, not because teachers said it would be useful, but because he found out for himself that feedback was a great source of ideas on how to improve his go-kart.

Another example of an authentic problem can be found in the seemingly overwhelming range of need in the community of



people with a disability. At Scarsdale High School in New York, I saw how one student working on their senior school project, first identified a manageable part of a problem by focussing on the specific needs of a 15 month old child with microcephaly. The student himself described the process as designing for somebody and with somebody. He worked with experts in the field, the child and the child's parents to build a chair out of cardboard that was customised to provide for the particular physical support needs of that child. A film of this project, "Yehuda's Chair", can be found on YouTube.

This student was able to rely on the very well-resourced Design Lab at Scarsdale High School. The Lab Director, Lisa Yokana, showed me some of the equipment he used for the project including access to computer aided design programs with 3D modelling capability, 3D printers, sewing machines and laser cutters. Lisa explained how, prior to working on this prototype, the student had undertaken an internship at the Adaptive Design Association, New York (ADA). This gave him valuable knowledge and skills and meant that staff of ADA made themselves available to offer expert advice and encouragement as he put his project plans into action. ADA does amazing work supporting children with special needs mainly through the inventive use of cardboard carpentry. Using durable building materials, including triple-wall corrugated cardboard, wood, fabric, plastics and electronics, the ADA creates solutions to meet the needs of individual children. The internships offered by the ADA enable occupational therapists, interested community members, teachers and senior school students to acquire the skills needed to undertake this valuable work. The design thinking process requires that schools engage with the broader community both in identifying authentic problems and in designing and resourcing effective solutions. The Scarsdale example shows how community-school co-operation can stimulate great ideas and assist with expertise, training and resourcing for mutual practical benefit.

Aust Edu Tech Report

The full report can be downloaded for reading here:

<https://jason.zagami.info/theora-research/educational-technologies/australian-trends>

By Jason Zagami

Welcome to the Australian Educational Technologies Trends (AETT) project. Over 100 leading Australian and international educators and experts concerned with Australian education, drawn from schools (primary and secondary), school leadership, industry, government, and academia, were invited to be part of the report because of their ability to contribute in a meaningful way to our collective understanding of how Educational Technologies and the computing curriculum is currently being implemented in Australian schools, and the changes that may occur in the near future (5 years). The collective wisdom generated by the [Delphi Method](#) and [Conjoint Analysis](#) research processes provided detailed insight into what is occurring in Australian schools and the directions possible to improving Australian education.

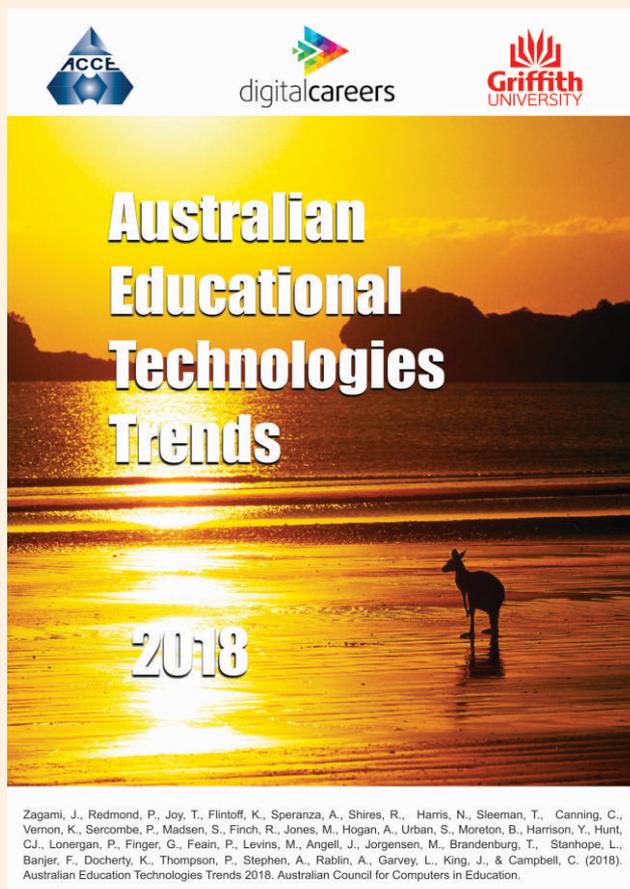
The end result of this process was a report that shows how Educational Technologies are being used in Australian schools, how the Digital Technologies and Senior Computer Science curriculum are being implemented, and how these may change in the near future (5 years). Teachers, school leaders, governments, industry and researchers can use this report to assist in making decisions on the focus, support and funding of Educational Technologies and the computing curriculum in Australian schools.

The research process was supported by the [Australian Council for Computers in Education \(ACCE\)](#) with funding from the [Digital Careers \(CSIRO\)](#) and [Griffith University](#).

The intent is for this to become an annual process that builds a longitudinal understanding of changes in Educational Technologies and the Digital Technologies / CS curriculum.

The first stage identified participants and gained a consensus on the alternatives to be included in this years study, in four areas:

- 1 Which technologies related to the teaching Digital Technologies (F-10) and Senior CS Curriculum should we include?
- 2 Which Educational Technologies related to the diffusion of ICT General capabilities (students), instructional (teachers), and organisational (school) Technologies should we include?
- 3 Which challenges related to Educational Technologies should be included? and



- 4 Which trends related to Educational Technologies should be included?

Participants considered a wide range of possibilities and contributed additional alternatives for consideration based on their collective experiences with educational technologies and the curriculum.

This first stage was completed by the 6th of April, 2018 and took less than half an hour for each participant to complete.

The second stage gained a consensus on the relative importance of each technology, challenge and trend. It was completed via an extensive set of surveys taking 1-3 hours to complete.

The second stage was available from the 13th of April, 2018 and was completed by the 27th of April, 2018.

The third stage examined the consensus from stage 2 through online discussion where participants argued for or against elements in the presented consensus. This again involve an hour or two contributing to a shared document discussion over a two week period. The third stage was available by the 11th of May 2018 and completed by the 25th of May 2018.

The fourth stage briefly repeated the second stage survey to reflect any changes in views and took less than an hour but generated 15619 conjoint pair votes. The fourth stage was available by the 1st of June 2018, and was completed by the 15th June 2018.

The fifth stage involved preparing the report from analysis of surveys, discussions, and conjoint pair votes, and was completed by the 2nd of October 2018.

The sixth and final stage was to launch the report at the [ACCE2018](#) Conference on the 3rd of October 2018 and publication in the Australian Educational Computing (AEC) journal summer edition (subject to peer review). Participants contributing fully to the first five stages were acknowledged as contributing authors to the report with randomised ordering after the lead researcher and research assistants. Those attending ACCE2018 were acknowledged at the launch.

Decision making over the increasing range of Educational Technologies available to support K12 education is complex, expensive and embarrassing mistakes are common. This research aims to use an expert consensus model to clarify the criteria for the selection of Educational Technologies, and provide an annual expert consensus view on what Educational Technologies are available, their rising or falling popularity, their value for money, and their impact on learning and teaching.

The research utilises the Delphi method, and presents findings in a format similar to the now discontinued Horizon Reports that popularised this field internationally from 2004 to 2017.

With the introduction of the Digital Technologies subject into the Australian curriculum, and a continuing focus on the integration of ICT throughout the curriculum, there is a need to provide considered advice on the use, purchase, and deployment of various Educational Technologies, as well as highlighting new areas of content and pedagogical approaches.

The focus is not only on prediction, but the identification of current practice and trends over time. This can enable projection of trends, but has limited predictive capability to identify unexpected new educational technologies, though it may identify opportunity gaps where these are likely to emerge.

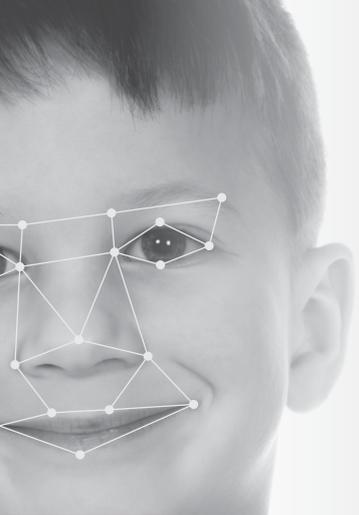
This process builds on the trial conducted at the Leadership Forum of the Australian Council for Computers in Education conference in October 2016 and the New Media Consortium Horizon Report series.

Past contributing authors, AETT Reports, and de-identified data collected from each Australian Educational Technologies Trends project have been made publicly available on this Australian Educational Technologies Trends (AETT) website.

Ethics approval for this research has been through Griffith University (GU Ref No: 2018/282) in compliance with the [Australian Code for the Responsible Conduct of Research](#) (Australian Code) and the [National Statement on Ethical Conduct in Human Research](#). In participating, participants acknowledge and agree to the conditions detailed in the projects [Informed Consent](#).



Dr Jason Zagami is a Senior Lecturer in Information and Communications Technology (ICT) within the School of Education and Professional Studies. Jason conducts research in cognition, professional learning and expertise, and all aspects of educational technologies. Jason has many years of experience in K-12 computer education including experience as a former classroom teacher.



AI classroom activity: Facial recognition

By Dr Joshua Ho

Artificial intelligence (AI) is everywhere in our daily lives – search engines, social media, intelligent personal assistants such as Siri – and today's schoolchildren are a generation who will grow up with these AI technologies.

I have a one year old daughter; it is distinctly possible that she does not need to learn how to drive when she grows up because self-driving vehicles will be the norm.

As a computer scientist who works in a medical research institute, I witness firsthand how AI is transforming the way we screen our three-billion-character genome to discover disease-causing mutations, and detect cardiovascular risks by analysing data from wearable fitness trackers.

Like it or not, AI will be an integral part of our children's future. The term AI may sound scary, possibly due to association with killer robots in science fiction. Another misconception is that AI is so complicated that there is no way schoolchildren can understand the concept.

Setting aside the philosophical issues surrounding what is intelligence, most real-life AI algorithms are actually doing something much simpler – to mimic some aspects of human-like behaviours, such as identifying objects inside an image, learning, natural language comprehension, and social interactions. All these behaviours can be encoded into computer algorithms.

Through the CSIRO [STEM Professionals in Schools](#) program, I have been [working with ICT teacher Matthew Scadding](#) from the Ravenswood School for Girls in Sydney's North Shore to introduce the fundamental concepts of AI into their Year 6 robotic classes. In this two-part series, I will summarise the activities we used to introduce two important AI tasks to our students – facial recognition and learning.

'Unplugged' facial recognition task

The facial recognition task was an unplugged activity in which students act out the algorithm physically in a game, without the use of a computer or robot. The task is as follows: given a person's photo, name the person inside the photo. This is the type of facial recognition technology behind automatic photo tagging in Facebook. To make this activity more engaging for

our Year 6 girls, we called this activity 'Who is this princess?' – a game to identify the name of a Disney princess inside a picture. (*Before creating your own game, check the [Smartcopying website](#) for copyright issues and use of images.*)

Preparation: In our game, the teacher prepared seven colour-printed papers, each with one side printed with the image of one of six different Disney princesses – five images of five different princesses and two different images of one princess.

On the other side of the page, print a list of questions regarding some physical characteristics of the princess, such as dress colour, hair colour, skin colour, hair length and so on. Disney princesses were selected because they are generally well-known to our students, and the characters tend to have distinct visual features. You can choose any other collection of characters to suit your class, or create your own.

Classroom discussion: Before the activity, the teacher can explain to the class that facial recognition is not as easy as it seems. A computer can match two photos pixel-by-pixel to check if there is an exact match. However, in real life the same person may look differently in each photo due to different posture, clothing, and facial expression. Humans can readily recognise faces. We can do so because our brain extracts and matches key features of the person inside the photos. For example, Snow White has short dark hair and always wears a dress, while Ariel has long red hair and has a fishtail. The goal of this activity is to illustrate the key AI concept of *feature extraction* – conversion of data in the original format (for example, an image) into a series of quantitative or qualitative features that can be used to distinguish different objects in the original data. A computer cannot 'see' a photo like a human, but it is good at comparing a list of features. By converting the original image into a series of features, a computer can behave like humans in terms of recognising the person inside each photo.

Activity: This activity consists of two parts – feature extraction and database search. In the feature extraction step, we selected six students and gave each person a randomly chosen princess and instructed them not to show it to anyone else. Please make sure each person has a different character. The students were then asked to answer the questions about the princess in their

hand (see Figure 1 for an example). The teacher then selected one other student from the rest of the class to give them a new 'unnamed' image of one of the princesses that was selected by the initial six students. Similarly, this student had to fill in the questions about their princess, but she could show the image to the class. At this point, the physical image of the princesses can be described by a series of textual descriptors of the characteristics of their appearance. This completes the feature extraction step.

The next step is the database search step. The teacher asked the six students to stand in front of the class but try not to show the image of their princess. The student holding the unnamed princess walked in front of each of the six classmates and counted how many of the physical characteristics matched between her unnamed princess and their classmate's princess, based on the list of physical characteristics alone, without looking at their images directly. The number of matched characteristics is called a similarity score. After all six princesses have been compared, the student needs to identify the princess

with the highest similarity score. At this point, the teacher can ask all six students to show their princesses to the class. If all goes to plan, the unnamed princess should match the princess with the highest similarity score.

Key concept: This game seeks to demonstrate the key concept of feature extraction – conversion of one type of data (image) into another format that facilitates comparison. The two selected images may not have a perfect match in every single characteristic, but it should be the most similar among a big database of photos. Accuracy of this type of facial recognition depends on the quality and size of the background photo database. This is why 'big data' is such an important component of modern AI.

In what ways is your school engaging students in STEM subjects?

Dr Joshua Ho is working with educators as part of the CSIRO's STEM professionals in schools program. Think about a STEM-related topic you're teaching next term. How could you develop links to tap into external expertise?

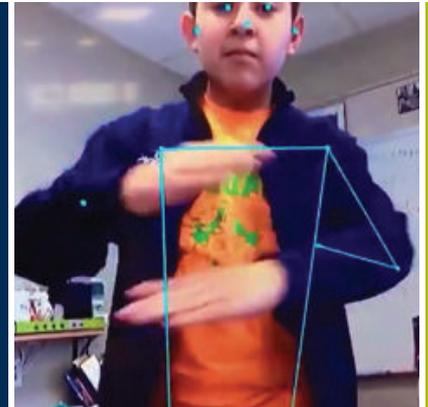
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Why students should create with AI tools



Nicole Krueger is a freelance writer and journalist with a passion for finding out what makes learners tick.

That student with the heart of the world was born, My data burns the same stars in a window. No human would ever mistake these lines for award-winning verse. If they're a bit fanciful and lack coherence, that's because they were composed by a computer algorithm trained on more than 20 million words of 19th century poetry.

Feed a word to the [Poem Portraits website](#), and Google's artificial intelligence will spit out a short poem in response. The seed word in this case was "student." The resulting word salad makes it clear that as powerful as AI is, it still can't create like a human. What it can do, however, is expand the human capacity to create.

Ever since Pixar Animation Studios used artificial intelligence to animate lifelike hair in the film *Brave*, designers, composers and creators of all sorts have been increasingly leveraging machine learning and other AI technologies to take their creations in new directions.

Video game developers can build games that [automatically generate endless new levels](#) for users to play. Artists can [create striking paintings](#) without ever picking up a brush. Filmmakers can [compose royalty-free music](#) for their videos without a lick of musical training.

Just as AI promises to change the relationship between humans and their work, it's also on the verge of transforming how we express ourselves. For creative professionals across a variety of industries, creating in collaboration with AI will become the standard of the future.

Not only will today's students [need to become adept at using AI tools](#), but to become truly empowered creators they'll need a deeper understanding of how AI works — and their changing relationship to it as designers and artists.

Middle school students at Edward W. Bok Academy in Lake Wales, Florida, are experimenting with a variety of AI-powered creative tools as a way to learn about how artificial intelligence works while also exploring their interest in the arts. They're [conducting virtual symphonies](#), composing music and drawing pictures to see if [AI can recognize the images](#).

"They're learning how artificial intelligence can pinpoint different motion-activated posing on cameras, so you see a lot of the CGI in movies is artificial intelligencebased," says STEM teacher David Lockett. "To do that in the classroom and have access to that, that's something new."

As his students discover what AI can help them do — like create entire musical compositions incorporating multiple instruments — they grow increasingly curious about what else the technology might be capable of. This curiosity will be a key job skill in a future with AI, where everyone won't necessarily need to become a coder but will need to become adept at imagining new ways AI can optimize their work.

Lockett sees the creative process as integral to learning about AI. "When you're approaching AI with students, you want to first show [how it's used in everyday society](#), how it's used in their smartphones, how it's used in different programming. Then give them tangible ideas they can create," he says. "We started with art and music because our students love to listen to music, they love the drawing aspect, the STEAM part."

Tools for creating with AI

Here are some tools educators can use to help students explore the creative potential of AI:

Google AI Experiments. Ground AI concepts in [tangible experiments](#) that let students interact with the technology and test its creative limits. Users can create beats from everyday sounds, draw in collaboration with AI and more.

Pixar in a Box. A partnership between Pixar and Khan Academy, this [online course](#) gives students a behind-the-scenes look at how filmmakers use STEM subjects in animation. While it doesn't focus exclusively on AI, it does highlight some of the ways artificial intelligence supports animation. The interactive lessons allow students to try out various concepts, such as creating their own virtual models of different phenomena.

Magenta. This [research project](#) allows students to explore the role machine learning plays in the creative process while getting their feet wet with TensorFlow, an open source platform for developing and training machine learning models.

Music composition tools. AI music generators, from [Amper](#) to [Jukedeck](#), use deep learning networks to analyze musical source material and compose new melodies.

Questions to explore

As students experiment with AI creative tools, the following discussion questions can help prompt them to think more deeply about artificial intelligence:

- How does AI compare to other creative tools, such as a paint brush or digital camera? How is it similar, and what makes it different?
- Are these systems truly creative, or do they simply mimic the creative ability of humans? Where does imitation end and creativity begin?
- When a human creates in collaboration with AI, who owns the result?
- What barriers to creating do students face that AI might be able to remove?
- As machines get better at creating, what role will humans have in the creative process?

Experts predict AI will ultimately impact nearly every job in every industry — and creative professions are no exception. Creating with AI tools helps students prepare for this future while opening their minds to the creative potential of artificial intelligence.



BOOK REVIEW



Review by
Nathan Alison
Professional Learning
Coordinator, DLTV

The Hello Ruby trilogy: Adventures in Coding, Journey Inside the Computer & Expedition to the Internet

Author: Linda Liukas

SUMMARY

Combines computational thinking, computer and network theory with colourful characters. The results are more than just whimsy, but fascinating ways to approach several topics in the Victorian Digital Technologies curriculum.

Something extraordinary happened on the evening of Friday, 8th December 2017. After flying into Melbourne only hours before, a children's book author took a group of exhausted teachers and education experts and ran a 3-hour session on coding and computer theory. It was inspiring, touching and engaging.

Those teachers were captivated for three hours, and they left on a wave of energy and excitement. Who could achieve such a feat? Who else but Finnish author Linda Liukas.

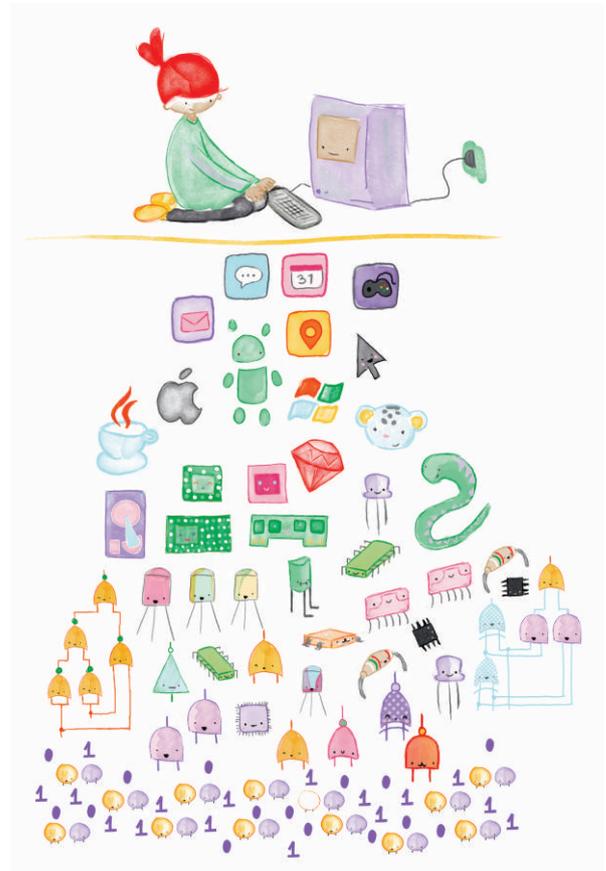
Journeys into computational thinking

"Play is at the core of learning. Coding is like crayons or LEGO blocks - a way to express yourself."

- Hello Ruby: Adventures in Coding, p. 3

Liukas' first major title, *Hello Ruby: Adventures in Coding*, tackles computational thinking via a whimsical journey by Ruby, a young girl who solves problems with imagination, persistence and breaking things down into parts (that's "decomposition" for all the curriculum nerds!).

The book is designed for kids and parents to read and do together. Each page contains Liukas' distinctive crisp, colourful illustrations as Ruby deals with characters such as pedantic, eccentric penguins, a pet python and a snow leopard who desires beauty and minimalism. Some of these might be familiar to grown-ups with experience in IT.



While the story occupies the first half of the book, the second is full of activities related to each chapter. Help Ruby sort out a fabric pattern, make a map of the journey, or communicate in a secret language. We see the familiar vivid colours and eye-catching characters - only the exercise headings give away the real agenda: "Sequence", "Pattern Recognition", "Booleans", "Data Structures".

In the second title, *Hello Ruby: Journey Inside the Computer*, Ruby jumps into a USB port and finds the lowest "layer" of electricity and bits. From there, she moves up through logic gates to the hardware components, and finally to the computer's software.

Activities involve creating a paper laptop, the Input-Process-Output model, and designing your own Operating System.

Finally, *Hello Ruby: Expedition to the Internet* follows Ruby and friends as they try to represent the excitement and scale of the Internet by building a snow city.

This third volume includes activities touching on cybersafety, website design, network protocols and packet switching.

Use in the classroom

Both *Hello Ruby* books take on concepts that are directly connected to the Victorian Digital Technologies curriculum. *Adventures in Coding* ties into the “Data and Information” and “Creating Digital Solutions” strands, while *Journey Inside the Computer and Expedition to the Internet* mainly fall within “Digital Systems”.

Students in Primary Years would likely benefit the most, but Secondary students may benefit from taking the “parent” perspective to the content.

Classroom teachers may find the included activities useful as unplugged tasks or worksheets, and further resources can be found at the official website helloruby.com.

Head and heart

Digital Technologies can seem like the learning area least likely to connect with a child's emotive drives but, as Liukas points out, computers and algorithms are more subtly intertwined with our lives than ever before.

The metaphorical imagery in all three books sometimes verges on the overly abstract, and kids and grown-ups alike are clearly expected to spend some time on each page. Perhaps this is in recognition of the dizzying levels of complexity we find in tiny microchips and world-spanning networks.

Though sometimes excited and overwhelmed, Ruby is never presented as a passenger in this world of bits, logic gates and algorithms. She engages situations with her head and heart. Perhaps the best thing the Hello Ruby titles can do is to encourage teachers and parents in pushing kids from being consumers to being creators and critics of technology.

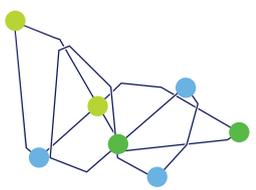
“But Ruby is a very practical girl, and she knows that often, big problems are just lots of little problems stuck together.”

- Hello Ruby: Adventures in Coding, p. 14

Visit dltv.vic.edu.au/videos-presentations for a recording of Linda Liukas' keynote presentation at Digicon 18.



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