Teaching online
BEHIND THE MASK

7.2

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JOURNAL

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Contents

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Editors

Roland Gesthuizen

Associate Editors

Matthew Harrison
Clark Burt

Publisher

Digital Learning and Teaching Victoria

61 Blyth Street
Brunswick VIC 3056 Australia
Phone: +61 3 9349 3733
Web: www.dltv.vic.edu.au
Email: office@dltv.vic.edu.au
Twitter: @DLTVictoria

Invitation to send contributions to
publications@dltv.vic.edu.au

ABN 20 211 799 378
Registration Number A0060428T

Editorial



Clark Burt, Matt Harrison and Roland Gesthuizen.

Journal Editorial Team

We don't like change but it runs deeper than that. We also fear the new because of the uncertainty it brings. Wise teachers know that when we are pushed out of our comfort zone, that is where the learning transformation begins and the growth really happens.

> "We Must Have Courage. We Can't Ignore The Danger. We Must Conquer It."

The year opened with a scorching wave of bushfires driven by climate change driven bushfires that swept across our state. A lightning strike took out my electronics and computers on one side of my home, a good learning lesson about the effects of an electromagnetic pulse and electrical shock. I had planned a January keynote at LCA2020 in QLD about the CSIRAC computer at Scienceworks Museum in Melbourne. With some Melbourne agility, we surprised everybody by conducting our presentation remotely. Our online approach would become the lingua franca for conferences during 2020 when the COVID-19 global pandemic arrived.

As we emerge from isolation in Victoria, it is a reminder of how our systems must become resilient to sudden surprise events. It starts with an honest reflection about what we are doing well and how we can level up and what really matters. We need to use this opportunity to reimagine our school system of teaching and learning by embracing emerging technologies. These themes and ideas are unpacked with this issue when we peek behind the mask.

It was sad to hear about the death of educationalist Sir Ken Robinson, proponent of the encouragement of creativity among children and The Arts. Take the time to read the eulogy penned by Tim Kitchen. At the DLTV online AGM, Tim Kitchen was himself recognised with a "Making IT Happen" award for his contribution to digitech in Australia spanning two decades. Our DLTV VP Mathew Harrision was recognised online with his PhD research culminating in an online graduation ceremony. We dip our lid to him for this splendid achievement.

Some schools without online platforms quickly adopted the likes of Google Classroom and Seesaw, adapting their teaching rapidly. It was a wonderful opportunity to meet online fellow teachers at the Annual VCE Teacher Day hosted by DLTV with

Mathew Harrision

Nathan and Kev hard at work behind the scenes. I enjoyed hearing how others are implementing the new Applied Computing study design, and hearing about emerging technologies such as Tableau and STEM Technologies. Nicky Carr outlines the work by her RMIT team to promote Computer Science in secondary schools. Take time to read the post by Matthew Harrison that lists many wonderful things happening by DLTV grant awardees such as the Bristle Bots or Raspberry Pi clubs, activities inspired from innovative ideas submitted by our DTLV membership!

Past DLTV state council member, Narissa Leung writes about her teacher insights during the remote schooling experience and Evan Rutherford explores some changes that we need to consider next year. Stephen Trowuse gives us pause to reflect on emerging technologies by examining the legal and ethical issues. Joshua Ho shares a Machine Learning Activity that you can try out in your classroom then Corey White dives deep into the future of AI with his splendid "Centaur Learning" reflection. Along this journey, Yen Siow reminds us in her article how we must not forget the disadvantaged groups in Melbourne when she outlines her important work as an online STEM coach with the Fr Bob Charity. Bill Kerr reminds us that we must also be culturally sensitive with our coding activities with a post from Central Australia.

Celeste writes about her literacy journey and Passy shares the YouTube gallery that he has been working on. Altan Riffat talks about his Create and Perform program at his primary school that dives into a range of emerging technologies. Steven McGlade reached back into his past work as a games programmer and writes about how to engage students to join a Code Club at his school. Jason Coleman outlines how he has

been emerging learners in an online world with Minecraft, with some fascinating underwater sculptures. During isolation, this was something that engaged preservice teachers at Monash University and Venturer youth at my scout group.

I hope that over this summer you find time to spend some precious time reconnecting with family and friends. As I count down to my January 2020 PhD Confirmation Milestone, I'm now engaged with some serious academic writing where I will explore my research about how we "Teach to Transform".

> "There will be days when we lose faith. Days when our allies turn against us ... but the day will never come that we forsake this planet and its people." – *Optimus Prime*

Thank you to my DLTV Editorial team Clarky, and Matt who helped chisel away at this issue with many evenings of editing and proofreading. We did it!

Roland Gesthuizen

PS: How did I acquire my nickname, *"Optimus Prime"?* Back in Jan 2019 in a South Australian desert, I volunteered to lead a team of preservice teachers and youth leaders at the Australian Scout Jamboree. We called ourselves The Transformers and worked tirelessly for two weeks in the dust and hot winds to run a VEX Robotics activity for over 8000 scouts, an event we will repeat in 2022. Sometimes you can see us at our best, when things are at their worst.

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From the President

Ben Gallagher

As we come to the end of one of the strangest years that we can remember, it is fitting to look back and reflect on the successes, opportunities and persisting challenges of Victorian educators over the past six months. So much has already been written about the monumental collective response by teachers to Covid-19, and it is difficult to find descriptive words and terms that have not become cliches of 2020. Every teacher that we talk to is exhausted, but most are proud of how their school community came together and found solutions to complex problems that emerged during remote teaching. It is important to celebrate the creativity and commitment of those implementing these solutions to ensure that every student has a quality education.

Within this issue you will find a variety of ideas and topics for a post Covid-19 world. While we as an organisation have a special interest in technology, the focus of these expert practitioners always remained on impact on student academic learning and social inclusion. This focus from our community has also been seen in the diverse range of member-led webinars that DLTV have been running over the past six months. We have a highly talented group of educators with interests ranging from early childhood through to higher education. What unites us is our common commitment to ensure that every student, regardless of age, has a high quality learning experience.

While it has been difficult at times, particularly for students with complex needs, we need to learn from each other and 'keep the good' that has emerged through your hard work and collaborative approaches to teaching and learning. For most students face to face teaching will remain the primary mode of schooling, but we have learnt some fascinating lessons about how online teaching can complement what we have traditionally done well. Indeed, some of our members have reported that students who are reluctant participants in traditional classrooms have really excelled when engaging with teachers and students in online environments.

From this we can see that through the exhaustion, the frustration, and the fears, there have been wins and successes this year. One could consider 2020 to be one of the most significant transformations to formal education since its inception. The use of technology to support more learning for more students has been demonstrated this year and what it means to 'teach' and to collaborate has been redefined.

As we move into 2021, we hope that the connections with other educators you have established and the skills you have developed will transform our system of education into something that allows every student to thrive. At the end of the day we know that what really matters is that our students are safe, happy and learning and we are confident that we are better equipped to meet these challenges now than ever before.

DLTV is delighted to put you in the draw for one of three great prizes

Major Prize supplied by Acer

Virtual Reality Headset

2nd Prize

FREE Two-Year Membership with DLTV

for one school & one individual.

3rd Prize

A 90 Minute STEM Education Workshop

with the Brainary's STEM Expert, Sam Kingsley.

ALL you need to do is sign up or renew your membership by 31st of December 2020.* Schools and individual who have already signed for 2021 will be put in the draw. To see DLTV other member offers visit our website **https://dltv.vic.edu.au/**

***DON'T FORGET YOU CAN SIGN UP NOW AND PAY IN 2021**

acer

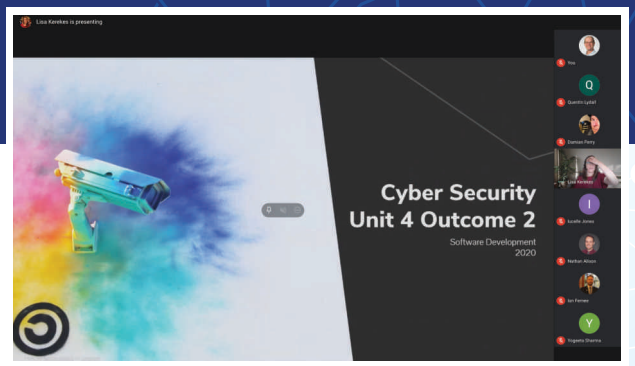
the Brainary®

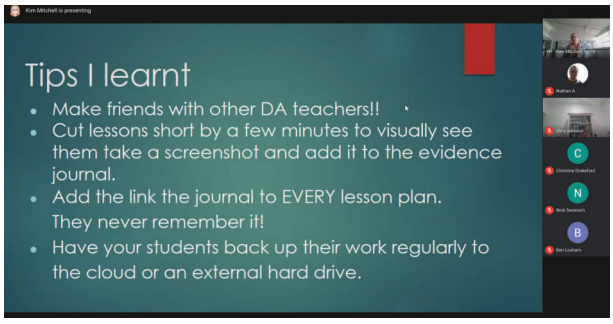
Digital Learning and Teaching Victoria

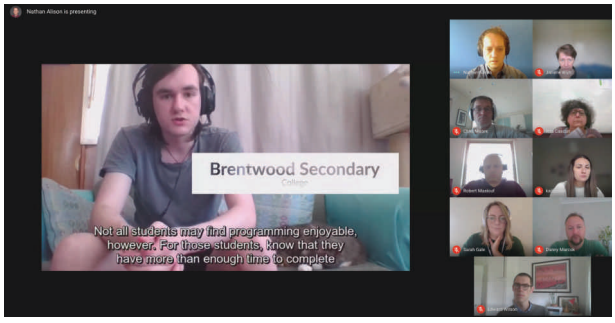
BITS AND BYTES

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

DLTV VCE APPLIED COMPUTING TEACHER CONFERENCE 2020







By Nathan Alison

This year's event took place online on 6th November.

Organised and run with the active involvement of our re-formed VCE subcommittee, the day was a great success with useful material for both new and experienced teachers of VCE Applied Computing, Data Analytics and Software Development. The flexible, online format proved a positive for many participants, as well as for many teacher presenters!

This year's event also featured a number of topical sessions ranging from data visualisation tools like Tableau, to the Wolfram suite, Agile from an industry perspective, modern network security and a presentation from Monash Tech School on innovative projects that connect to the new outcome in Applied Computing Unit 2.

Recordings of these topical sessions are available at bit.ly/DLTVsenior2020

Many thanks to DLTV staff and the VCE subcommittee for the many hours put in.

NATURAL POWER AND BLITZORTUNG

BY ROLAND GESTHUIZEN

During a storm in January 2019, a sudden flash and noise shook the house at the same time when a large bolt of lightning strike hit the ground nearby. The next day I noticed it had hit some old farming equipment a few metres away from our home, burning a patch of ground and some sticks.

To my dismay, I also discovered later that our family television, spare monitor, router and hard drive was no longer working. The lightning bolt had generated a powerful Pulse of Elecromagnetic Radiation that had damaged all of the the electronics on that side of the building. Surprisingly, my old iMac computer survived but I suspect that has much to do with the wrap-around metallic aluminium case.

https://www.edn.com/electronics-blogs/brians-brain/4435969/Lightning-strike-becomes-EMP-weapon-

Whilst we have a decent surge protector and good power protection system but I have since discovered that this won't protect your equipment from an EM Pulse, even if is turned off!

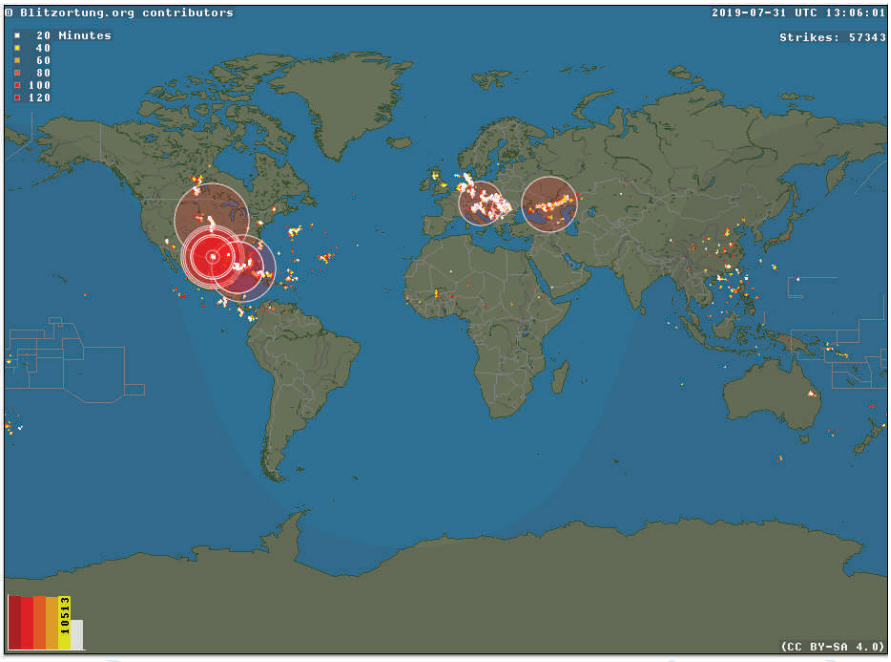
I have read that a nuclear weapon can be used to do something similar, destroying electronics equipment nearby. I am so glad that I was able to recover much of my work from backup files and only today, finally replaced our family television.

I have since discovered Blitzortung, a very cool website and app for tracking storms. Their mobile app even shares an alert on your smart phone for each lightning strike in the area. This is run by a citizens science project that connects detectors around the world. The science behind how they do this is fascinating and uses some cool maths and triangulation to work out each strike.

I will let you look that up yourself and share with your students. It is also mesmerising to just see different storms flash across your screen as they creep around the globe. Love to hear what you think of this cool tool.

http://en.blitzortung.org/live_lightning_maps.php

Best of wishes, Roland



Looking at Literacy Through the Digital Lens

By Celeste Pettinella

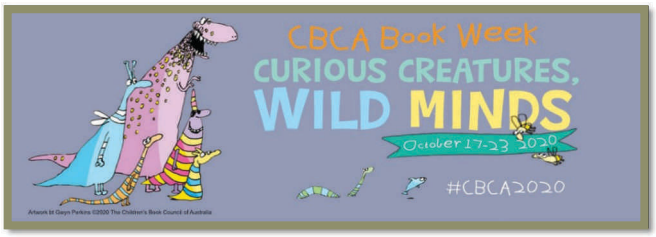
During COVID-19 times, three items raise my educational attention. The first being guided reading conducted online during remote learning, secondly celebrating Book Week online and thirdly using YouTube as an educational writing and discussion tool.

To begin let's look at guided reading…What is Guided Reading? It "is an instructional practice or approach where teachers support a small group of students to read a text independently" (State Government of Victoria, 2019, p. 1).

During remote learning in Term 3, I conducted Guided Reading online via Webex platform using EPIC as the tool to access books online. I was able to share my screen where students were able to read the book with me online in small groups. It was very similar to guided reading in a classroom situation, but the major difference was students would take turns on their screen to read. When it was their turn to read, they would unmute their microphone. Feedback indicated that students favourite online task in my class was guided reading. The groups changed and students' groups would commence at 10am on the groups selected day. The use of technology made guided reading take place and the range of books from EPIC really was EPIC. The books online were useful as there was a huge range and the books used matched the students Fountas and Pinnell levels which is the tool Doncaster Primary School is using.

EPIC books area great online tool to use for Guided Reading.

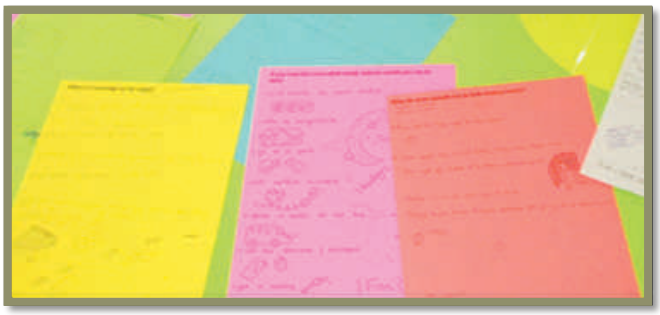
Our school selected to celebrate Book Week in Term 3 online. The school had a dress up day where students and the teachers dressed as book characters. To celebrate Book Week with the Seniors cohort of students I created a virtual bookshelf where students could click a book from Book Week where it would be read to them via YouTube. As well, teachers recorded themselves reading their favourite books and then these were also placed on the virtual bookshelf.



This years Book Week theme was Curious Creatures, Wild Minds.

YouTube…wow! Seriously, if one needs a recipe you just have to YouTube it, if you want a DIY project you can rely on YouTube…, but what is rare and rather remarkable is finding YouTube clips that discuss real deep issues. It came to my attention that Andrew Johnson who I have the privilege to work with in the Senior Team created these phenomenal multimodal texts. I think it is rather clever as these clips enable him to combine two major passions of his…the photography and the writing component. Through the viewing of these video clips it can provide opportunities for students in the age bracket of ten and above to discuss issues associated with the video clips. When I asked Andrew, why did he write such deep issues? His response was very simple and real…he said it was to make primary school students discuss issues that society tends to not discuss and prepare them for the future. I have shown my Year 5 class these video clips to model good writing techniques and to provide class discussion about a range of topics that connect to Wellbeing primarily. This term (Term 4) students in 5P…my class viewed the clip 'When You're Lonely' https://www.youtube.com/watch?v=GoheqKfDwgo a rather fitting topic during COVID as so many people have felt isolated. Students completed the discussion questions which are located on the bottom of link above. Students enjoyed completing the task. Students worked in groups to complete the task. This writing task provided students to think deeply about a range of issues, to collaborate, to make connections with themselves, texts and the world.

An image from the clip.



Students work that shows some of their responses to the discussion questions from the clip 'When You're Lonely'. The students work was created into a booklet.

Andrew Johnson the writer to those YouTube clips. If you wish to subscribe or like the clips…please feel free to do so and share these clips with other educators ***by following him at Andrew Johnson Eden Photos.***

I highly recommend educators teaching students in Year 5 and above to check out the clips from Andrew Johnson. As well, I would love for anyone to connect with me and share how you conducted Guided Reading during remote learning. If you wish to connect please send an email to **celeste.learning23@gmail.com** Let's share the passion and love for Literacy through Digital Technology.

Passy's World of ICT

YouTube Channel and Website

Great to see so many wonderful digitech resources being generated by teachers in Melbourne and freely shared online. Passy's World of ICT is an Online Learning Platform which teaches anyone how to use IT Applications and How to do Computer Programming.

The Beginner Lessons are slow and detailed, so that learners get all of the steps along the way. From there they can progress to our Project Based Online Learning Courses, and our Classroom Lessons with their Downloads are especially ideal for use by Teachers and Instructors.

You can access Passy's World using the Website: **http://passyworldofict.com/** and the accompanying YouTube Tutorial Channel at: **https://www.youtube.com/user/passyworldofict**

Passy wears a white hat, and is a working secondary school Computing Teacher in Melbourne with 15 years of Commercial IT Industry experience, and over 10 years school teaching experience.

Online STEM Coach

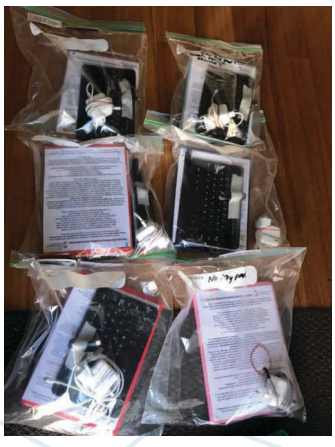
BY YEN SIOW

DIGITAL POVERTY PROGRAM MANAGER FOR THE FATHER BOB MAGUIRE FOUNDATION

When schools and community centres closed during the Covid-19 pandemic period, Social Enterprises and Charity groups had to re-think how they could reach and maintain support lines for their most vulnerable residents, the children. Under the Digital Poverty Project launched by the Father Bob Maguire Foundation, school holiday STEM activity packs were delivered to over 200 children living in Melbourne's public housing areas. The STEM packs included materials to test Newton's laws, explore aerodynamics, create Rube Goldberg machines and investigate outer space. Contactless delivery methods were put in place for families to pick up their packs to ensure safety was a priority. These activities were well received by the children with positive reports and photos sent to provide feedback on how they were doing.

As home-based learning became the norm for all children in Melbourne, digital support services were ramped up to meet the growing needs amongst disadvantaged groups. Families who were already facing immense challenges struggled to engage with schools and teachers. Several families had poor internet connection, few or no learning devices and insufficient data plans to host online classroom meetings. Parents themselves were not technologically inclined to set up their home environments to make it conducive for learning and the learning divide intensified for these children. It was reported that some children were using their parent's smart phone to read up on homework requirements and connect with their teachers and classmates. Other family members opted to hotspot from their parent's phones using it as a mobile Wi-Fi modem for their laptops.

Factoring in all of these growing concerns, the Digital Poverty Project was able to work with schools and community centres to identify the needs of the families to provide mobile Wi-Fi modems, USB modems, laptops, iPads and data cards. Zoom STEM sessions were provided for students from schools and low socio-economic areas including an Indigenous secondary school. The topics of choice were Ocean Sustainability, Landfills - our waste problem, the Biology of our Eyes, Heart, Brain and Entomophagy – the consumption of insects. Providing online STEM sessions on zoom has given students the opportunity to continue with their learning. We utilised breakout rooms with our volunteers as guides who were able to help steer conversations around the learning topics to maximise more interaction.



The pandemic may have put a pause on outside group activities however the online world of learning grew with interest and excitement as we were connecting in new ways not explored before.

Teacher Insights Into The Remote Schooling Experience

by Narissa Leung., @OzLitTeacher

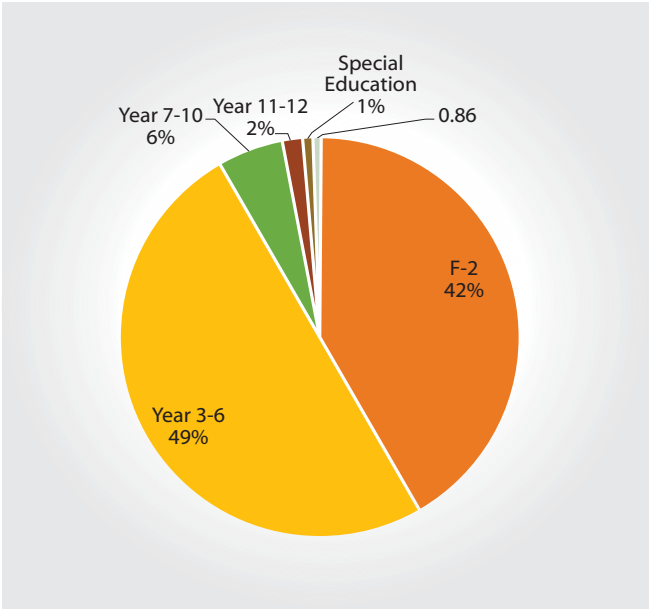
Remember that time when the whole of education changed overnight…

After weeks of remote schooling, teachers and students are returning to schools. So, what reflections do teachers have on this 'unprecedented' time of 'pivoting' the way they teach and learn?

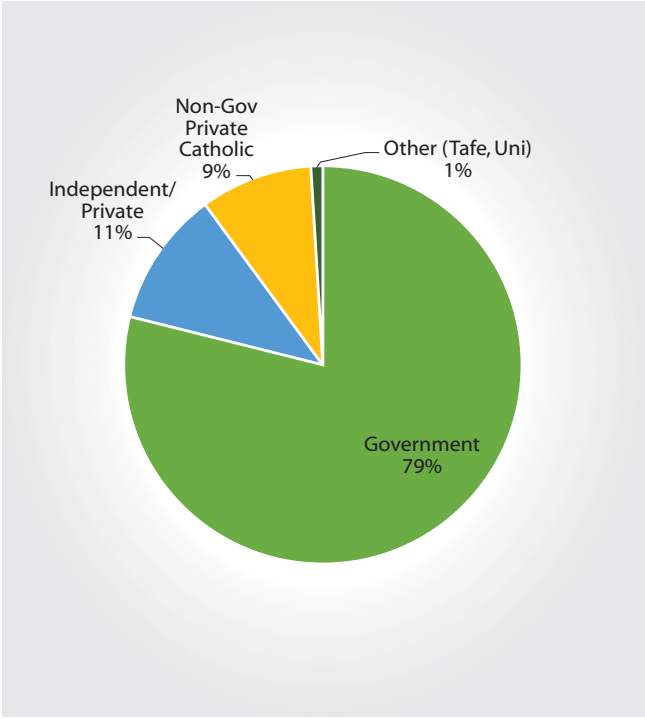
I asked teachers to look back and share their remote teaching experiences. 150 teachers responded to the survey. Here is some key information about them:

67.5% from Victoria, 24.5% from QLD, 6% from NSW, 1.3% WA, 0.7% SA (no respondents from ACT or TAS)

- F-2 teachers =41.7%
- Year 3-6 teachers = 49.5%
- Year 7-10 teachers = 5.6%
- Year 11-12 teachers= 1.73%
- Special Education = 0.86%
- Tertiary= 0.43%



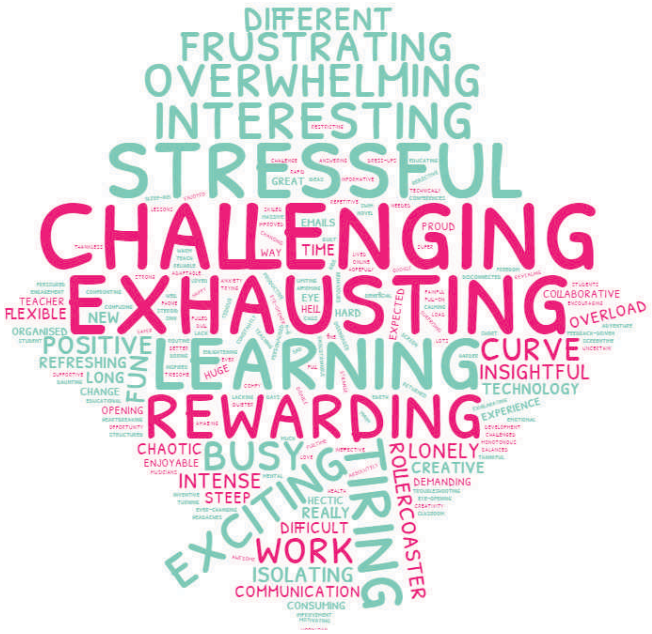
- 79% Government
- 11% Independent Private
- 9% Non- Government Private Catholic
- 1% other (TAFE, Uni)



Q1.

In Three Words, Describe Your Remote Schooling Experience:

Just a reminder on word clouds (I know, I know, you're all tech whizzes after weeks of remote teaching and don't need me to tell you this BUT I'll clarify it anyway), the more a word is repeated in the responses, the larger it's displayed in the word cloud.



Interestingly, the teacher responses to this question closely mirror many of the parent responses to the same question from another survey I did (https://www.ozlitteacher.com.au/2020/04/20/parent-insights-into-the-remote-schooling-experience/#more-669). Here are the two clouds side by side (teachers on the left, parents on the right):

Now I will detail the positive and then the negative experiences of remote schooling.

Q2.

What Were The POSITIVES Of The Remote Schooling Experience?

1. Not surprisingly, the most commonly reported positive to come out of the remote schooling experience was the increase in technology skills by teachers and students. For example, a teacher commented: 'Who knew I had it in me to become a YouTuber!'.

2 . The second most reported positive: better relationships with parents. Teachers commented on how the remote schooling situation 'brought parents closer together with us,' how they learned more about the parents of their students and how they felt more supported by them because they now had a better understanding of teaching ('parents now know how hard teachers work') and their child's learning ('parents have a better awareness of their children's ability/inability'). One comment was: "We walked the journey together and came out the other side of it!"

The view of teachers on the topic of positive parent relationships mirrored the view of parents on the same topic. This is great news for student learning! As Steven Constanino (2008) stated in his book, *101 Ways to Create Real Family Engagement:*

"More than twenty years of research leaves no room for doubt: Family engagement leads to improved student achievement. Increased engagement leads to gains for all students, regardless of socioeconomic status, cultural background, ancestry, or special education status."

I don't think Constantino ever imagined a remote schooling situation when he wrote this next line, but it's more pertinent / relatable than ever:

"When the school and families have a mutual respect for one another and depend on one another as partners in education, the result is increased achievement for students."

The question now is **how can schools leverage this significant leap forward in teacher/parent relationships to positively impact student achievement in the face to face environment**?

3. After tech skills and parent communications, the next most reported benefits were:

- **More independence shown by students** – some students developed this as time went on, some teachers learned their students always had these skills but they weren't aware of them or hadn't let them express them ('the realisation that I hand hold my students too much.')
- **Communication with colleagues** – 'We've spent more time together apart,' 'amazing support from colleagues (it's always good but in this space, it was just mind blowing.)'
- **Slowing down the overcrowded curriculum'** – 'stripping back the curriculum,' 'being able to extract the essential learnings from the curriculum.'
- **Some students have thrived in the online environment** – this included students who were normally disengaged at

school, students who were quiet in the classroom and students with ADHD or ASD.

- **1:1 support for students from their parents** - 'Some of my students have really flourished having the full one-to-one support at home; this is something I can't always provide in the classroom,"it was like having numerous teacher assistants in a classroom.'

Numerous teachers made comments about the positive impact for students who had 1:1 parental support. Some comments included: 'huge growth due to the 1-1 support' and 'some kids, particularly my lower kids are coming back better than before.'

This raises questions about the equity of experiences for students in the remote learning environment. It also connects with some of the parent anxieties around reporting and assessment potentially reflecting either their poor teaching skills or their lack of ability to provide 1:1 support for their children (i.e if parents were working during this time and were unable to assist their children.)

Q3.

What Were The CHALLENGES Of The Remote Schooling Experience?

1. Workload

The number one challenge listed by teachers was workload.

- Trying to be all and do all has been a challenge – calling parents every week, zooming students, making videos of all lessons, making a video of all the videos for kids who needed help accessing work…'
- The work load was massive, planning documentation has increased, conference note taking each half hour while teaching at point of need (often had to write notes later)'
- No life balance workload doubled.'

2. **Issues With Technology** came in as the second largest challenge. In addition to no or poor internet connection, several issues arose from teachers and students adopting new platforms/programs and having to coach parents and students through these. (Taking on the role of tech support added to the teacher workload, although some teachers said this was ironed out after the few couple of weeks).
3. **Feeling Isolated And/Or Disconnected** was a concern as many teachers felt isolated from their peers as well as their students and believed their students felt this sense of isolation too. Teachers were worried about the lack of opportunity for students to learn from their peers in the remote environment in the way they would in a normal classroom.

It was evident that teachers missed being able to see and teach their students in a face to face environment every day:

- I miss my kids.'
- Not seeing kids every day and having a conversation of learning. Not reading to my students.'
- Not getting the 'high' of face-to-face teaching.'
- No incidental teaching points or correction of misconceptions. Once the work was started incorrectly it was submitted incorrectly.'

4. Finally, in addition to excessive screen time and frustrations around students or parents who didn't engage in remote learning, teachers were deeply concerned about widening **inequities** between students:

- My student experiences depended greatly on the ability of the parent to facilitate their learning. In some cases, the parents were struggling with their own mental health and as a result, remote learning was not one of their priorities.'

A Couple Of Interesting Additional Issues Raised Were:

- Issues with peers and team members- E.g. 'Disfunctioning team created lack of support and collaboration.' This was listed by 6 different respondents and demonstrates that technology really does amplify practice; if cracks exist in the offline environment they will only widen in the online environment.
- Excessive or boring online meetings- 'being subjected to pointless meetings and PD.'
- Eating way too much- This was listed by more than 1 person (and I have to say, I totally hear you on this one!)

Q4.

What Were The INTERESTING Things To Come Out Of The Remote Schooling Experience?

Numero Uno: Parental 'Support'

- How much some parents do for their kids. They won't let them learn how to use technology or do an online pre-test. Some parents speak for their children during WebEx sessions.'
- One very interesting thing is when students post work that has obviously had a lot of adult input into it. What year 2 student or for that matter myself, uses the word 'moreover'. A colleague set a pre-test to find out what was known on a topic. She stated that there would be questions that students wouldn't know but for them to do their best. Imagine her surprise when most of the tests came back with 100% correct.'
- Amazing how more work is magically correct.'

The 'over support' provided by some parents led to many teachers listing assessment of students in remote learning as difficult because they couldn't determine who had actually completed the work. Assessment was also raised as a challenge as some teachers felt they would be assessing privilege:

'Students thrived or failed on the willingness of their parents to get on board. I fear my reporting will be more on privilege (what they received at home) than on anything else.'

Another area of parental support that arose was how some viewed mistakes: 'A lot of parents don't reinforce making mistakes as part of learning (They correct their child negatively instead of constructively).'

'Seeing Different Students Shine During Remote Learning'

- The divide between the students who engaged in everything everyday, and the students who didn't engage regularly/only once a day. It wasn't representative of student academic skill, which was interesting.'
- It was interesting who did the learning and who did not.'
- Some of the better kids produced the least amount of work.'
- The children that are easily distracted in the classroom showed the most growth.'
- The different levels of motivation from students. Some I have never had more work submitted from and some are not motivated to do any. But not always who I would've expected.'
- I have been floored by the work ethic and independence of some of my students who I wouldn't call leaders in the classroom. They have shone remotely. They are just brilliant.'

Other 'Interesting' Findings:

- How amazing some EAL parents were the children's scrapbooks and work blew us away.'
- That parents found it almost impossible! I had emails saying "how do you even teach my child?"
- I haven't ever walked around my neighbourhood as much as I have this term!'
- Being able to focus on teaching more than admin'
- I actually really enjoyed having staff meetings online. I found them more structured and purposeful.'
- From a secondary teacher: 'During remote learning we have had weekly catch ups and noticed a huge differences in consistency of teaching and learning.'
- I have a greater respect for YouTubers after this.'
- How much I love to wear tracky pants and ugg boots.' (Definitely with you there!)

Q5.

What Have You Learned About Teaching Through This Experience?

Explicit Teaching

The strongest lesson learned about effective teaching during this experience was the power of short, sharp and explicit mini-lessons: '8 minutes of a carefully crafted lesson is better than 30 minutes of rambling.'

'Explicit face to face teaching and online learning platforms complement each other, not replace one another.'

Visit OzLitTeacher workshop page to access a free recording of a PD on effective mini-lessons: https://www.ozlitteacher.com.au/workshops/

Relationships Are Key

Teaching has always been about relationships and remote learning has reinforced this belief for many. 'Relationships (teacher, parent, student) are key to success in any setting.' The positive impact of relationships with parents in particular was highlighted numerous times.

Crowded Curriculum

'The curriculum is way too crowded!' 'There's far too much content in the curriculum.' 'The curriculum needs to be refined.'

Crowded curriculum popped up in many of the responses to different questions on the teacher survey. Teachers felt the stripped back curriculum presented during remote teaching was beneficial for students and they are keen to carry a simplified version forward into the face to face environment.

Teaching In General

Most teachers agreed that they'd certainly prefer to teach in a face to face environment. 'Teaching is a face to face occupation that cannot be effectively delivered totally in remote way.' In addition to listing differentiation as a challenge in the online environment, a number of teachers comment on the minute-by-minute and adaptive nature of live, face to face teaching: 'Real teaching is about responding to students needs in the moment. You can plan all you like, but much of what we do is in the moment.'

The final comment that seemed to resonate for many was that teaching in the online environment enabled teachers to 'focus on teaching more than admin,' this is an aspect of teaching they would like to carry forward into the face to face world.

Q6.

What Remote Teaching Experiences/ Learnings/Practices Will You Carry Over To Your Face To Face Teaching?

Online Platforms

Numerous teachers suggested they would continue to use online platforms such as Google Classroom and Seesaw once they returned to face to face teaching. They liked the differentiation options these platforms enabled and the ease of tracking student work submissions.

More Technology In The Classroom

After a huge technology upskilling by teachers and students, many teachers plan to incorporate more technology into their face to face lessons. Creation of video instructions and demonstrations for small groups and independent work was high on the agenda, as well as the continued use of GoogleSlides/PowerPoint to support lessons.

Parent Communications

Teachers plan on continuing regular parent communication and using technology to assist with this. Some teachers even said that they would continue to send parents a daily outline of learning and an email copy of the weekly homework. One teacher suggested they would like to offer parents the option of attending parent teacher interviews using Zoom.

My Favourite Answer To This Question:

'I am planning on asking the students this question.'

What a great idea!

It would be a missed opportunity if teachers and schools didn't reflect on this remote schooling experience and learn from the students and parents, to inform a better 'new normal' for schools. How exciting!

Q7.

Any Final Commments?

- A once in a lifetime experience (hopefully) that was interesting. I quite enjoyed this time teaching from home, although found it frustrating, annoying, rewarding, exhausting and fun as well.'
- What a chance to learn, grow, be challenged & enjoy a different facet of our job!'
- It brought the whole school teaching community closer together.'
- Parents need to be congratulated on their amazing work keeping the ball rolling.'
- I would have preferred it went for rest of term as I feel like I'm now just getting traction.'
- I was able to teach rather than crowd control as I have behaviourally challenging students in my class who dominate the classroom and take away the other students learning. Remote learning removed this issue and I was able to focus on the other children in my class.'
- Who would have thought I would be a child entertainer and have to edit my own videos!!! To then have parents critique like it was Trip Advisor!!!'
- Don't want to ever do it again.'
- Thank you for continued blogs and support in this process.' (No problems, thanks for the appreciation!)

In Summary

Countless teachers referred to the remote teaching experience as 'a hell of a ride.' And, considering the entire system transformed almost overnight, I don't think anyone could argue with that.

Although many teachers (and parents) found the time 'frustrating,' 'challenging' and 'exhausting,' there were many positives to come out of the experience as well (greater parent relationships and more tech skills being important ones for future teaching and learning).

I absolutely agree with the survey respondents who said, 'teachers are flexible, adaptable and can achieve great things even in the face of a crisis.' 'We are superheroes.' Well done everyone!

I am so excited about the possibilities that have now opened up for education as a result of this experience! Now is the time to leverage the learning from this time and dare to rethink how education looks and feels for our students. Us ed tech lovers have been banging on about re-imagining teaching and learning for years, but NOW is the time that we finally have the skills and knowledge (and experience) to be able to actually do it.

Oh my goodness, how exciting!rm a better 'new normal' for schools. How exciting!

A TRIBUTE TO SIR KEN ROBINSON

by Dr Tim Kitchen

Outside of the world of religion, it is difficult to think of any individual who has had as much influence in the world of teaching and learning as Sir Ken Robinson, who sadly passed away on the 21st August 2020 following a short battle with cancer.

Sir Ken's 2006 TED Talk '**Do Schools Kill Creativity?**' was the most watched in the history of TED Talks. It has been viewed online over 60 million times and seen by an estimated 380 million people in 160 countries.

I recall seeing it for the first time in 2006 and it changed my professional life. I've watched it many times since and it still inspires me to think about the importance of creativity and what education should really be about. Since watching that TED talk, I have dedicated my professional life to empowering the next generation to be life-long creators and to work within the constraints and obstacles of the education system to bring out the best in the students and teachers I have the privilege of working with.

Soon after his passing, **Sir Kens official website** listed some of his outstanding achievements such as being named as one of Time/Fortune/CNN's 'Principal Voices'; acclaimed by Fast Company magazine as one of 'the world's elite thinkers on creativity and innovation' and being ranked in the Thinkers50 list of the world's top business thinkers. There is no doubt that he achieved a lot and was a great orator, writer and thinker. However, those of us who have had the pleasure of meeting him would also testify to his gracefulness and the way he seemed to treat everyone he met with care and dignity no matter who they were and what position they held.

Following Sir Ken's passing, I dedicated the **Inject Creativity Live** (a weekly online show that I produce for teachers) episode for that week as a tribute to Sir Ken and invited my friends Dan Haesler and Peter Hutton to join as special guests; two of Australia's top education thought leaders and change makers.

In 2010, Dan was given a scholarship by the NSW Government to travel to the UK and spend time with Sir Ken to study how best to address well-being and depression in education. Since then, Dan has had a number of opportunities to work directly with Sir Ken and he reflected the following …

…watching how he was with people he didn't know, he makes you feel like you're a friend, he makes you feel like you're a colleague, he makes you feel like a peer. He does that regardless of who you are.

This resonated with me and I recalled the first time I met Sir Ken in the flesh. It was on the 2nd June 2014 outside the Rydges hotel in Brisbane's Southbank just before the 2014 EduTech conference. I was waiting for a taxi to take me to a workshop I was running for Independent Schools Queensland. A large black VIP hire car pulled up and I immediately recognised the silver hair of the man in the back seat. It was Sir

Ken arriving from the airport with his son James. He was the main keynote presenter at EduTech that year and I had the chance to meet him. I've met a number of celebrities and well-known politicians over the years, but I've never felt as awestruck as I did at that moment. My taxi arrived at the same time and I asked the driver to hold on so that I could take the opportunity to walk up to the great man as he was making his way out of his car and say to him welcome to Australia Sir Ken. I offered to shake his hand and he graciously accepted the gesture and thanked me for the welcome. He introduced me to his son and noticed the Adobe logo on my shirt. He then proceeded to tell me how much he has enjoyed working with the Adobe education team in the US over the years and asked me what I did at Adobe. We chatted for what seemed like 10 minutes, but it was probably only a few seconds, and his son offered to take a photo of the two of us. (Click here to see the blog post I wrote that day that features the picture.)

I always thought that he mistakenly thought I was his official welcoming party which is why he was so gracious and friendly with me after a long flight. But reflecting on Dan's comments, that was the nature of the great man. He treated everyone as a friend, with respect and dignity.

I had the honour of writing an acknowledgement for Dan book #School of thought and I described him as Australia's Sir Ken Robinson. In the live interview he said … *people keep using it to introduce me which is a bit embarrassing*. He told Sir Ken what I had written and his response was *I don't think he's got that quite right*. I've been critiqued by the great man. That should go on my gravestone!

Dan added that Sir Ken was keen for all teachers to understand that they are the education system and should not wait for politicians and decision makers to make changes. He said it is very easy to blame the system, however it is another thing to realise that (as far as students and many parents are concerned) we are the system and we are the ones that can make a difference each and every time we are infront of a group of students.

Peter Hutton has also shared the stage with Sir Ken on a number of his recent Australian events. A former school principal, Peter is now a convenor of the Future Schools Alliance and works with innovative educational leaders to transform their school communities so that all learners are enabled to explore their holistic potential. In the interview, Peter compared Sir Ken to the Biblical character John the Baptist because he prepared the way for the Messiah. He qualified this statement by saying we are all the messiah. We all have a responsibility to carry on Sir Ken's messaging in our classrooms and in the way we work within a broken education system.

(Click here to access the recordings of the Inject Creativity Live Sir Ken Robinson tribute.)

In Sir Ken's famous 2006 TED Talk he said, *creativity now is as important in education as literacy, and we should treat it with the same status*. His messaging on the importance of creativity in not only education but in all facets of life has been extensive.

He also emphasised the importance of encouraging failure. He said,

> *if you're not prepared to be wrong, you'll never come up with anything original … we're now running national education systems where mistakes are the worst thing you can make. And the result is that we are educating people out of their creative capacities … we don't grow into creativity, we grow out of it. Or rather, we get educated out of it. So why is this?*

Sir Ken would often criticise some of the assumed norms of education like the priority of teaching mathematics over other subjects. He questioned why we teach mathematics every day and place its importance over other areas of the curriculum? He didn't want to undermine the importance of mathematics, just question why it is seen as so much more important than other subjects that also offer important problem solving and analytical thinking opportunities. He said, *as children grow up, we start to educate them progressively from the waist up. And then we focus on their heads. And slightly to one side.*

He said that our education system has been designed around the process of university entrance and that many people who are highly talented, creative and intelligent don't see themselves that way because the system doesn't value them.

Sir Ken states, *we have to rethink the fundamental principles on which we're educating our children*. He strongly believed that we need to celebrate the gift of the human imagination and highly value students' creative capacities. He believed that the role of the teacher is to educate the whole being, not just from the neck up and slightly to one side.

Sadly, Sir Ken predicted in his 2006 Ted Talk that he would not see this future model of education, but his hope was that our children would see the new paradigm in their lifetime. With all the positive changes to education that have occurred because of COVID-19, especially in the area of digital creativity and a more student centered approach to learning and teaching, I know that Sir Ken will be looking down on us educators, trusting that we will never again return to the broken education system and each individual teacher will take on the mantel of positive change.

'We can do IT'

By Evan Rutherford
IT/STEM Specialist

We need to create a generation of critical thinkers, graduates of life who have future direction and a large breadth of skills, who embrace future change and respect the past, who think laterally with a passion and respect for culture, environment, and people.

Where do we start? We already have.

The recent forced shift into online learning has proved that teachers have the ability, flexibility, resilience, drive and passion required to evolve. We have the potential to shift into 'the unknown', and teach subject matter in ways that have never been done. We have the ability to upskill and apply knowledge in ways that cater for a range of academic levels, and create tasks online that are fun and interesting, keeping students across the country attending online classes for an extended period.

We have created extended learning opportunities, with many primary schools taking the initiative and opportunity to provide online sewing classes, building classes, origami classes, language courses, art and drawing classes, and many more - widening the curriculum in order to give learning a purpose and to help to keep students engaged.

What we need to do now (and quickly) is harness that knowledge, harness the new skills, harness that passion, harness that desire for change and apply it to the future of education. We need to repurpose schools to move from the 1870's *(Education Act (Vic) was passed in 1872)* approach to 2020 and beyond towards 'the unknown'.

Over the last months, we have started to create a plan for change.

Education should explore engagement and purpose over academic goals and compliance. We should identify what keeps the students interested in lifelong learning, exploring the capabilities and potential of the tools we have been using to expand their usage within education. We should reflect on the changes in technology, and the potential benefits of ICTs and use them to our advantage. We should identify the traits, skills and qualities required by current day employers and deeply question why *we* do things, as well as what *we* do.

As an experienced ICT and STEM teacher, I have faced a similar range of classroom battles in every school I have worked at. School leaders who are predominantly trying to adhere to archaic regulations and assessments *(fish can't climb trees)* that are passed down to them, with little room for experimentation and autonomy in the workplace. Teachers who avoid technology at all cost, and dig in their heels and refuse to change. Now that we have all been forced to learn and work with online/ICT tools, we have the funding to support and imperative to improve our teaching and learning online.

Teachers throughout Victoria, in general, are now confident to run online classes and lessons. Many are now au fait with O365 or Google Suite, enjoying quicker and focused online meetings. They are now corresponding openly with parents and students using online chat rooms. Teacher aids are contacting families of "at risk" students and schools are becoming a part of the home.

What can we do to push the I.T. snowball up and over the hill?

We can do I.T.! Some basic and practical changes we could implement now to increase the forward momentum These are but a few of the "doable" changes that we could start with.

- To continue to use online systems to set homework, have meetings, contact parents, and provide feedback to students;
- if your school has the ICT facilities, create your "in class" lesson instructions online and spend less time explaining by giving students devices and encouraging your students to be more self-sufficient (older years)
- create a summative article on how your school used technology to overcome hurdles throughout this time and *share it* throughout the education community (if we all do it, imagine the resource!)
- increase media capabilities at your school to include a blogging/recording studio and use it to promote students achievements;
- stop creating semester based reports, and put your marking and comments online daily for parents to get 'live reports' (a.k.a 'continual reporting')

- ask your students what their home learning experiences were, and *learn* from their responses, then allocate staffing and resources to try and replicate the benefits (such as many students who felt working on their own, away from others, a lot more beneficial - find them a space)
- send lesson plans/class direction home through bulk emails or online classrooms to enable parents to discuss with students what is happening at school.

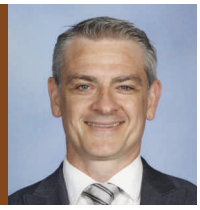
We must stop emphasising just "schooling" and refocus on "educating".

Until recently, we have not had the capability nor teacher "buy in" to allow for a major shift in education through technology. Now we have, we need to take hold and run with it. Staff meetings should be based around continued change, and the expanded implementation of ICTs. They need to recognise and discuss the current skills sought after by employers (as identified by Forbes, 2020*; 1. Data Literacy, 2. Critical Thinking, 3. Tech Savviness, 4. Adaptability and Flexibility, 5. Creativity, 6. Emotional Intelligence, 7. Cultural Intelligence and Diversity, 8. Leadership Skills, 9. Judgement and Complex Decision Making, 10. Collaboration*) and identify and promote a change in the way we structure learning to reflect these skills.

We can, so 'Let's do IT!'

Minecraft in Science During Online Learning

By Jason Coleman



Jason Coleman is currently working in a junior campus of an independent school in Melbourne as the STEM Teacher / Pedagogical & Curriculum Leader. He enjoys designing learning experiences to capture student interest, encourage critical thinking, and develop collaborative skills through the use of technology. You can follow him @jc_igs on Twitter.

Minecraft Education Edition (MEE) is a learning environment that immerses learners in an engaging world where they develop collaboration, creativity, and problem-solving skills. MEE is an educational version of Minecraft that has been built for the classroom. Tools found within this platform allow teachers and students to engage in lessons, connect within worlds, and collaborate to explore learning concepts like never before.

Students love Minecraft and although it is often seen as 'just a game', using Minecraft Education Edition in classrooms will encourage students to use it as a learning tool. MEE can be used across the curriculum developing collaboration, reflection, innovation and compassion. It also develops critical thinking, creativity and builds a sense of wonder and curiosity. Minecraft Education Edition is more than a game.

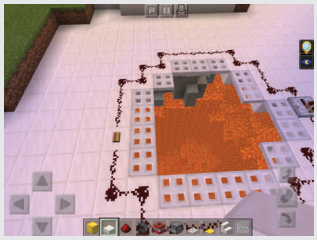
Minecraft Education Edition is the perfect tool for Science. The Science curriculum is easily explored through creative problem solving and collaboration between students.

Minecraft Education Edition has been used successfully across the Science program, allowing students to visualise and explore worlds to investigate and learn more about concepts such as biomes, adaptations, circuits, natural disasters, environmental threats, the human body and space. Students can work in many ways, independently, in shared worlds with peers or in shared worlds with an entire class. This allows for collaboration and communication that enables a positive dialogue between students, increasing understanding and depth of knowledge of key concepts.

Examples of Science Challenges:

Electrical Circuits

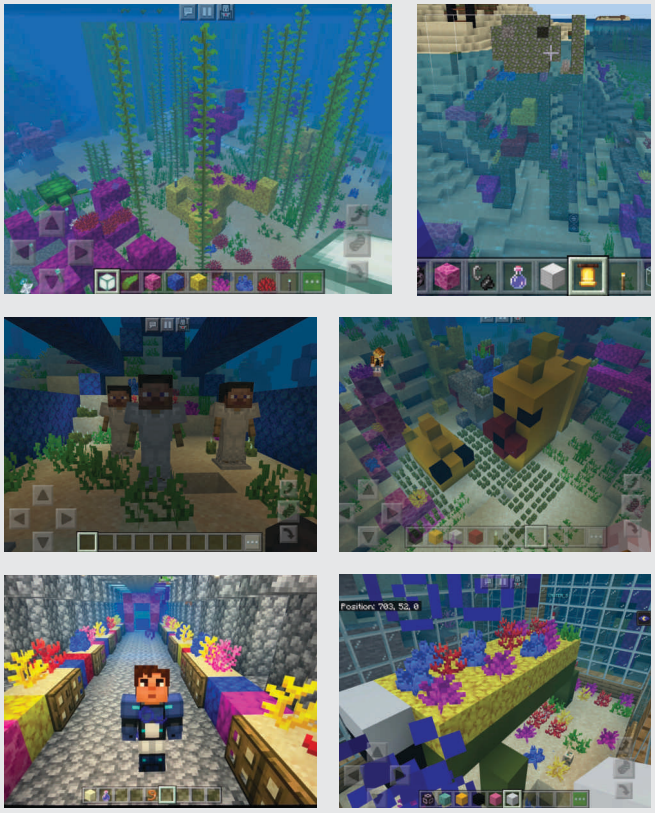
In the normal classroom environment, Year 6 students would explore the concept of electricity and circuits through a variety of hands-on construction experiences. They would normally create a variety of circuits, with lights and switches to demonstrate their understanding of the flow of energy through series and parallel circuits. As this was not possible during online learning, we explore a variety of online interactives to learn more about series and parallel circuits. I decided to use Minecraft to explore the concept in a practical sense. In this challenge, students were introduced to Redstone, a mineral found in Minecraft that helps create circuits to power levers, automate objects and power lights with worlds. Students began by completing a Redstone tutorial to learn more about the concepts of circuitry in Minecraft https://education.minecraft.net/JA2CO. They applied this understanding in the Minecraft Challenge - Power a House. In this challenge, students work independently to create a house and used an array of pressure pads, levers, music blocks, lights, and switches to make their house powered. The classes enjoyed creating doorbells, trapdoors, and automatic light systems. They shared their creations using video walkthroughs, highlighting their use of Redstone.



Addressing Global Environmental Issues

Underwater Sculpture Gardens

As part of Science Week, Year 4 and Year 6 explored the theme, "*Deep Blue: innovations for the future of our oceans*", by



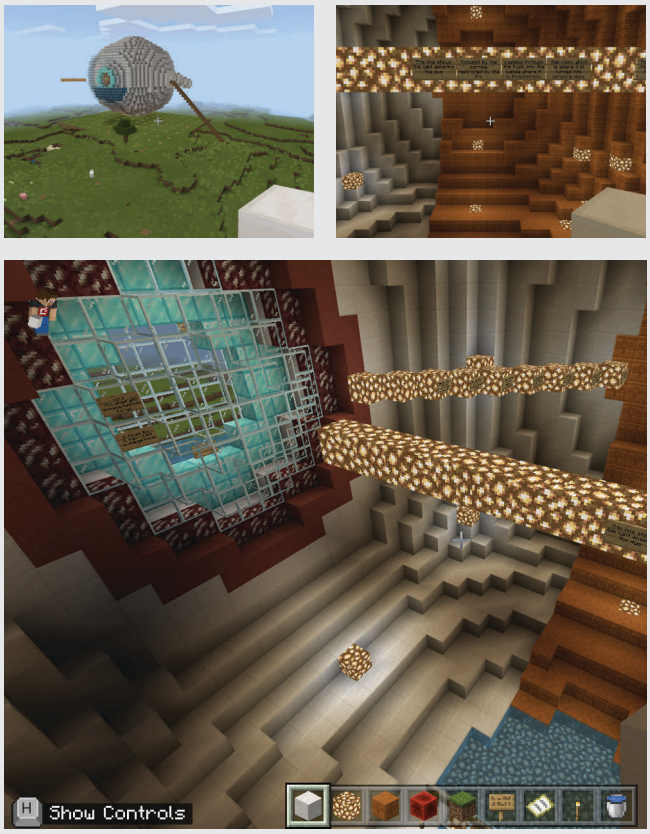
learning more about how people like Jason Decaires Taylor, a sculptor, are regrowing coral in damaged areas across the globe. Students were introduced to Jason's sculptures, https://www.underwatersculpture.com/, and his work on the Great Barrier Reef at the Museum of Underwater Art https://www.moua.com.au/. Students explored the coral reefs around the world and discussed the environmental impacts affecting these sensitive areas. Classes were shown how Jason is attempting to regrow reefs around the world by using underwater sculptural gardens. These sculptures to provide an environment perfect for coral to regrow and thrive. Students were then placed in collaborative groups and were asked to create an underwater sculpture garden based on a theme. Team leaders were selected to capture the group's build through images and a walkthrough video. All classes were also shown how to use a structure block that enables the structures in Minecraft to be saved as 3D files and 3D printed. We are looking forward to recreating the sculptural gardens back in the Science Room.

Physical Science

Exploring the Human Eye

Minecraft Education Edition contains an amazing lesson and challenge library that educators can use. The resources are categorised into subject areas and have lesson plans and outlines for all experiences.

My Year 5 students were learning about light and how the eye works. Classes discovered how cones and rods enable us to see colour and shades. Students used modelling and annotated ray diagrams to demonstrate understanding. To learn more about how the eye works we explored the human eye in Minecraft Education Edition https://education.minecraft.net/world/f0f6d0bd-54ad-4fd8-92c4-865540d67b1c. The human eye was presented as a 3D model that contained signs and boards to help the students understand how the parts of the eye work and help us to see. This immersive lesson engagingly provided clear information that deepened the knowledge of all students



Minecraft Education Edition has allowed learning to continue in an engaging manner that students love. The immersive nature of MEE has enabled students to envision aspects of their world in 3D and work together to learn, create, collaborate, and begin to design solutions for issues in their world. It has been a wonderful platform for learning more about Science concepts and I look forward to using MEE in future explorations.

Create and Perform/CAP in the STE/AM Context – Taylors Lakes Primary

Altan Riffat at Taylors Lakes Primary School
altan.riffat@education.vic.gov.au

The CAP (Create and Perform) program at Taylors Lakes Primary School is a specialist program offered to grade 4 - 6 pupils over 4 terms. CAP has its origins in the disciplines of Art, Music and Coding. However, rather than teaching 3 distinct entities, CAP integrates the three learning areas through the Digital Technologies curriculum. Under one umbrella it utilises the creative elements of coding and a range of digital platforms for Music and Visual Art learning areas.

Pupils negotiate design briefs where the requirement is to develop interactive games using Scratch. The context of the game is negotiated and based on the following criterion referenced assessment:

- Purely a platform game with connectivity to digital devices i.e. MakeyMakey/BBC:Microbit/Arduino Uno
- Curriculum Focus for example, quizzes based on units of study/classroom themes i.e. Gold Rush, Solar System, Gravity and Forces, Indigenous Studies
- Physical Science: Connecting to digital circuits using ICBs to trigger events based on user input
- Conductive materials and low voltage devices and circuits: Raspberry Pi

Using digital platforms pupils include their own visual art works, musical arrangements and sound effects. Some digital platforms include:

- ArtRage (paint program)
- Logic ProX and Garage Band (DAWs/Digital Audio Work Stations)
- Sonic Pi (programming music using a variant of the Ruby command line language)
- Some Python and C (for challenging high achievers)
- Scratch (core language for visual sequencing, conceptualising algorithmic thinking and utilising audio extensions for musical arrangements)

Children code to learn rather than learn to code

Each area integrates to provide a climate of learning based on creatively developing digital solutions to solve problems and emulate interactive environments. Students design algorithms to emulate scenarios. Then, they enrich the immersion with music and art to entice interaction, engagement and connection to real-world application. This provides a purpose for musical composition and performance, a purpose for coding and a purpose for the production of visual art works.

Traditional instruments and voice are also encouraged. Students have opportunities to compose backing tracks (with Sonic Pi and GarageBand). They accompany their compositions with keys, guitar, percussion and voice. We call this the Sonic Pi Band.

Students are immersed in concept development over the first 2 terms with explicit focus on each curriculum area's learning outcomes. Terms 3 and 4 is where the integration occurs. When the projects are complete, children "play" each other's games. They become the beta testers and share content, ideas and discuss solutions in enjoyable ways. They draw on the artist, musician, problem solver, coder/decoder, programmer, designer and engineer in themselves; their soft-skills. They engage with systems that are repeatable, connected to contemporary contexts, integrating content for meaningful application.

Student Feedback

Some pupils in the grade 5 area were asked what they think of the program (CAP). They like it :)

What parts do you like best?

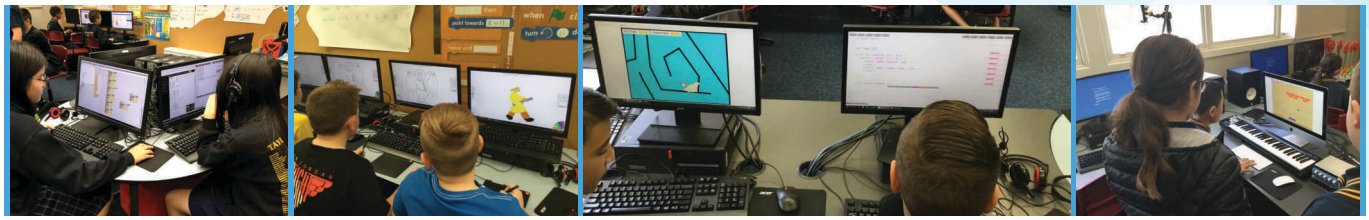
I like Sonic Pi. I like the coding part better than Scratch.

I like making the game because I can add art to it.

I like the music Mr. Riffat but my gran wants to know why everything has to be digital these days." (grade 4)

ArtRage Mr. Riffat. I love painting with it now I know how to use the pad and pen.

The coding is my favourite. I like programming and music. My father is a programmer and he loves Sonic Pi.



Staff Views

What about the hands-on stuff! Why should 'kids' be in front of a computer all the time!

Mate, it's great. I love the STEM stuff you're doin'.

When I sit in your class, I learn so much myself.

All good as long as I get my APT.

The students are engaged Altan. We don't see them in front of the office... as much ;)

Perceptions are always out there and can be affective to the implementation of innovative ideas. However, there is the greater good which can be observed in light of curriculum outcomes and pupil interaction. When they are engaged and derive enjoyment, pathways are accessed. Perhaps, as a measure, some perceived losses pale in comparison to the successes. Perceptions are always out there and can be affective to the implementation of innovative ideas. However, there is the greater good which can be observed in light of curriculum outcomes and pupil interaction. When they are engaged and derive enjoyment, pathways are accessed. Perhaps, as a measure, some perceived losses pale in comparison to the successes.

Recommendations and Considerations

As a basis to program pedagogy; it is crucial to view Digital Learning Technologies (DLT) as the umbrella Domain. It serves as a super-class to each of the other KLA sub-class entities in Digital Audio/Music, Digital Art/Visual and Programming/Coding/Sequencing. STE/AM is integrated across each of the subsets. DLT is the pathway to student engagement and connectedness in 21st century contexts. Agency, differentiation and diversity are implicit and directly link to HITS applied in the program. All assessment (of learning) is drawn from each domain's content descriptions.

To facilitate, there are some points worth considering. Implementation is really a school-based decision and can be applied in ways that are unique to each school requirement. Consider the following scenarios:

Scenario 1: As a specialist area, you can potentially integrate specialist music, visual art, programming and physical sciences (STEM) under one Specialist Program i.e. Create and Perform. You could call the program CAP/tiv8 or something else with a catchy overtone (the name is moot but the processes are relevant).

Scenario 2: As a specialist area isolate one aspects of DL i.e.

- Digital Audio
- Digital Art
- Coding (with the integration of physical devices and physical Science).

Teach each as a distinct domain or Specialist area not unlike traditional approaches.

Scenario 3: Like scenario 2 but applied in generalist classroom settings either as a unit of study or part of a STE/AM project.

Each scenario has PMIs (pluses, minuses and interesting points). Consider all in balance as you decide which scenario has the best fit.

Budget and Resourcing

Budget is always a factor. Note that you do not require all of the following.

With the right resources and teaching/learning model, the CAP program can be rigorous and repeatable. The following materials are not all essential but I do have access to them as a Scenario 1 setting. My program covers 450 pupils in a weekly cycle of 1-2, 55 minute specialist sessions at TLPS (grades 4-6). Terms 1 and 2 are dedicated to each Domain, term 3 looks at programming techniques (with a focus on algorithmics). Term 3 leads into term 4 by providing a bridge to the Design Brief and Gamifying. This is where we link the STE/AM processes and evoke a richness that draws on multi-modal learning, diversity, agency, engagement and connectedness.

Hardware

- Raspberry Pi (3B+ or 4): Includes free, open-source Raspbian OS and productivity tools i.e. C, Python, Ruby, Scratch, Sonic Pi and more.
- QWERTY Keyboard and Mouse
- Screen/Monitor

- Headphones and splitters
- Laptop/Desktop
- Computer Lab access if possible
- Digital Drawing Pad and Pen i.e. Wacom Intuos (comes with Corel Painter Essentials).
- Digital electronics kit and solderless breadboard
- Arduino Uno
- MakeyMakey and/or BBC Micro:Bit
- Loose conductive materials
- PA and Studio Monitors

Software

- Sonic Pi (free installation)
- C compiler (for example, GCC) and Python IDE (both optional but free)
- Scratch (free): Preferred block scripting due to extension for interfacing with other devices and the new Music extensions
- Arduino IDE (free and integrates the C compiler)
- Digital Audio Workstation/s: Logic Pro X and Garage Band or Pro Tools
- Audacity (Free)
- ArtRage or Corel Painter or GIMP (free) or other preferred painting application. We prefer ArtRage 6.

I recommend starting on a small; scale down. Then, scale up over time. Break each Domain into the respective discipline. Teaching each as an independent unit of study until pupils are reasonably conversant with both the traditional aspects and the digital content. Allow two terms. Slowly build to the game context and design brief (if the intention is to go this far). At this juncture, the opportunity to completely integrate all domains becomes achievable. The second half of the year provides scope for this and opportunity to teach at point-of-need.

The biggest 'bye-in' for me is in the design process itself. This is where the juicy stuff lives. Pupils grab digital tools to express innate artistic expression in media arts, grapple with logic and problem solving to create algorithms that emulate requirements (for the game or other). Students universally expand on a range of multi-modal thinking processes in tangible ways that can be shared, performed and enjoyed. Being meta-cognitive, children draw on required thinking processes that are integrated and not in isolation. They create something that can be performed and shared. Through this unique synthesis of thought, programming, media and peer to peer engagement, pupils connect with systems that are not vague echoes consigned to past curriculums. In contrast, the context is punctuated in a contemporary paradigm which builds on the past and points the compass towards the future.

Creating a code club for wellbeing, leadership and of course fun!

By Steven McGlade

Previously a programmer for Iron Monkey studios and working on games such as Need for Speed, The Simpsons and Sims 3, Steve made the change to teaching to share his knowledge with students and teachers alike. Currently a teacher at Gladstone Park Secondary College he teaches ICT, VET Digital Media and Mathematics. He has held many roles such as: ICT Faculty Coordinator, SNR, GPSC Code Club coordinator, IT Manager and eLearning Coordinator at GPSC. Currently Steve is a Year 8 Level Coordinator and ICT Learning Specialist.

I have always had a passion for coding and design. It was a way that I found I could express myself when I was younger. This is what led me to studying Games Programming at RMIT and pursuing a career as a Games Programmer. In this role I worked on games such as Need for Speed, The Sims and The Simpsons for several different mobile phone platforms. I was exposed to working with many different people who all had a variety of great skills from the programming, art, design and management fields. A career change to teaching allowed me to share my passion with others. When I began teaching I set about changing some resources at my school to engage a wide variety of students and learners. This is where the journey began.

I have always been a great advocate for students to share their passions and enthusiasm for programming, art and design. This is where the idea started to create a club at my school where students could come and learn to code, work on their art, and work on their designs and to share their work with others. This was something that I did not have when I was at school and that I wish was there for me.

What I didn't anticipate was the amount of students that would attend every week. It first started as a weekly club and then students wanted more. I slowly saw more and more students attending and sharing their work with myself and other students, asking questions about their ideas and how to develop them. Teachers came along to ask questions about coding and how they could integrate coding in to their classroom activities. I also began to see students forming friendships that would carry out in to the yard. This is where the club took on a new meaning of wellbeing, friendship and leadership.

Upon reflecting about the creation of the club at my school I started to think about the main points that made it successful. Consider the below if you're thinking of creating a code club at your school:

ENGAGE WITH STUDENTS

Engaging with students was a greatly rewarding part of having a coding club. Talking with students and encouraging them with what they were creating or what they are interested in can make a student's confidence rise greatly and give them someone that they can feel comfortable talking to.

Some of the students may not have had the best grades in the school and may not even receive praise outside of school, so encouraging them to continue with their passion can be a great way to boost a student's engagement level and give them a safe space to be.

CREATE THE CULTURE YOU WANT

Within my school there has been a culture that males are interested in computers and technology more so than females. This is a culture that I wanted to break. With this in mind I encouraged all students to attend through year level assemblies and made sure to create a culture within the club of inclusion. I was able to do this by showing videos of successful females working in the IT industry. This saw many female students attending every week and saw our general numbers in enrolments in to ICT subjects increase also in the following year.

BE ENTHUSIASTIC

Your enthusiasm will create enthusiasm and feelings of inclusion for the students. Most that attend are students who do not participate in sports at lunch time - this is a space that they feel they own and are inclusive of everyone. Don't be afraid to share some of your passions and to pass on your knowledge or opinions on what the students are creating. Make sure to take advantage of any free excursions or incursions that could be offered to the club's students. I have used ACMI (Australian Centre for the Moving Image), AIE (Academy of Interactive Entertainment) and programs from my school's local council for excursions and incursions to reward students who are truly passionate and enthusiastic.

LET IT EVOLVE

Let students have a say - how do they envision their club? Students gave me the idea to run a term long competition in different ICT fields and to have presentations at the end of the term with prizes for best programmer, best animation, and best designer. Consequently, students have an aim and can show their leadership skills by working in groups.

Make sure to have special events for students so that they feel included and they feel that this club is something special to them and something that they can look forward to coming to school for.

LET GO OF WHAT YOU ARE USED TO DOING…

As teachers we are used to having order and structure, and sometimes flexibility can be a challenge. I have found that being able to let students create what they would like to by working in groups has been a great opportunity for them to engage with each other and demonstrate their leadership and communication skills. I had to take off my classroom teacher hat and let the students lead the learning.

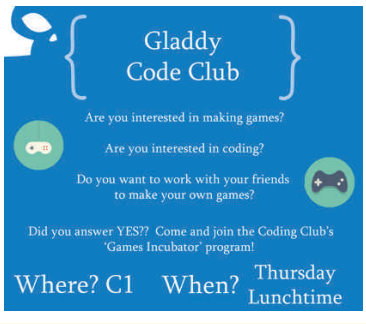
Students became so enthusiastic that they started to all wait at the door as soon as the bell rings for lunch and don't want to leave! They are able to learn lifelong skills as they are passionate about what they are creating.

WHERE TO START….

Starting is always the most difficult part!
Useful tips for getting started:

Promotion of the club

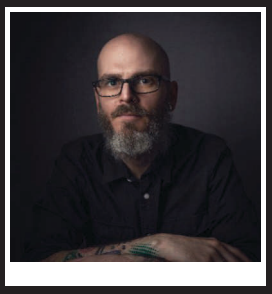
- Year level assemblies
- Daily bulletins
- Posters around the school
- Get students to do the grunt work, get them to spread the word
- Get other teachers involved - you can't do everything!
- Have a plan of how you would like to run the club
- By year level
- By working groups etc.
- Have your opening spiel ready and make it encouraging and inspirational! This is what will get the students who are unsure to take an interest.



Overall it has been a great experience for me as a teacher to facilitate a Code Club at my school. It has been able to make students enthusiastic about the subject of I.T. and more importantly school as a whole. Code Club is definitely a worthwhile endeavour and journey to take for any teacher!

OUR CENTAUR FUTURES

by Corey J. White
https://coreyjwhite.com/
https://nothing.substack.com/



Corey J. White is the author of Repo Virtual and The VoidWitch Saga Killing Gravity, Void Black Shadow, and Static Ruin published by Tor.com Publishing. He studied writing at Griffith University on the Gold Coast, and is now based in Melbourne, Australia. Find him on twitter at @cjwhite or on instagram at @coreyj.white.

It seems that whenever AI is discussed we're only ever moments away from someone making dire warnings about a Skynet future where sentient machines will kill us all. There are a number of reasons why I find these proclamations intellectually lazy (sorry Stephen Hawking, not sorry Elon Musk). For one, these warnings disregard our responsibilities as caretakers to any nascent non-biological intelligence we might one day create, but also this sort of hyperbole has no bearing on the very real issues we see with Machine Learning (ML) today.

With "AI" being such a technological buzzword, the realities of the development of neural networks and ML systems is greatly obscured. These aren't autonomous systems; they are built by people and companies with specific beliefs and biases, who are often trying to secure funding or contracts from bigger companies or governmental organisations with their own internal biases. There are countless examples of racial bias in judiciary algorithms that have a real, and often devastating, effect on the lives of individuals, yet the PR departments of Silicon Valley continue to peddle the lie of unbiased algorithms. Even if these systems were unbiased (and remember, they're not), I'm less interested in a future where we let ML systems run things for us, and more interested in a future where we use MLS *in conjunction with* human intelligence.

The codified rules, clear victory condition, and complexities of chess made it the perfect field of play for AI development for decades. Out of this struggle between human and machine chess players has come a hybrid sort of gameplay called Advanced Chess, or Centaur Chess – where a game is played between 2 teams made up of a human and a machine. Where the mythological centaur is half human and half horse, the chess centaur is half human and half machine.

On the topic of Advanced Chess, **author and futurist James Bridle said:**

> One of the most startling findings of Advanced Chess is that while even a modest chess computer can now thrash any human player, a human and a modest computer working together can beat a much more powerful computer playing alone. There's a transformative combinatorial effect at work that magnifies the strengths of both ways of thinking (and, to my mind, emphasises their differences in interesting ways).

Neural networks have the benefit of being able to crunch huge amounts of data and be able to find interesting, and sometimes obscure, solutions to a problem that a human might simply never have arrived at. Still, a neural network can't be said to *understand* a given problem, task, or game. They process the data that is given to them in the way that they've been trained. A centaur approach, however, gives us access to the ability to sift through masses of data to find more obscure solutions, but then use human reasoning, understanding, and even intuition to choose the best "move". Here we see a possible blueprint for the future, where ML can help us develop truly innovative approaches to our own work in any number of fields – even creative areas.

Holly Herndon is a musician, artist, producer, et cetera with a PhD from Stanford University's Centre for Computer Research in Music and Acoustics. Her 2019 album *PROTO* was created in collaboration with a neural network named Spawn, created by Herndon and her partner Mat Dryhurst, and trained with the help of an ensemble of singers – so whilst Herndon sought to make use of ML in creating the record, she also recognises the importance of human collaboration. In the **press release for the album**, Herndon said:

> There's a pervasive narrative of technology as dehumanizing. We stand in contrast to that. […] Choosing to work with an ensemble of humans is part of our protocol. I don't want to live in a world in which humans are automated off stage. I want an AI to be raised to appreciate and interact with that beauty.

Herndon's prior work was already experimental in its sound and creation, with strong theoretical and philosophical themes, so it's not surprising that she's at the forefront of AI *collaboration* in music. Herndon's development of Spawn and the album

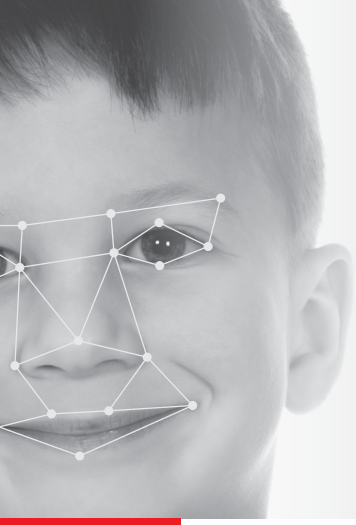
Proto may have coincided with her PhD thesis, but I imagine a future where not only are ML systems readily available "off the shelf", but where machine wrangling is an extremely valuable, if not *necessary*, skill – much in the way that digital literacy has become necessary for education, employment, and many other facets of modern life.

Imagine a research AI that you can send out to gather results for a paper you need to write. The neural network could likely gather a staggering amount of data, but by checking over the results yourself you could train it to find and highlight only the specific information you need. A ML research assistant you could train would prove far more useful than corporate search engines that try their hardest to keep you within their own closed gardens.

Brian Eno's *Oblique Strategies* are a famous tool for stimulating creativity and getting past blocks, and this is another area where ML systems could excel – and indeed, **GPT-3 is already showing great promise with text generation.** By training a neural network on your past work, it may be able to extrapolate new paths forward, or stun you into a creative sprint with a phrase, image, or bar of music that would never have occurred to you without assistance but which sparks something new and unique.

These are just a couple of examples, but with the right tools and time for training, any number of areas and tasks could be further explored with assistance from ML systems. Over the coming years the tech giants will try and sell us ML in all sorts of packages for their own profit and benefit, but ML can and should be a DIY tool for all of us to train, tweak, and use however we need. This is a reality already for people with the technical know-how (as well as the time and patience), but I eagerly await the democratisation of machine wrangling – for the (probably open source) developers who can open the field up to your average tech user.

When all of us have built, trained and worked with our own neural network, it will get harder for the tech giants and tech-surveillance wannabe-authoritarians to lie to us about "unbiased" algorithms. We'll have the knowledge to push back against the technocrats who think our world and our lives are reducible to data. We aren't data, we aren't numbers, but we might just be half-centaur. And with machine learning to augment our own intelligence, we could just find some new paths forward we never could have found on our own.



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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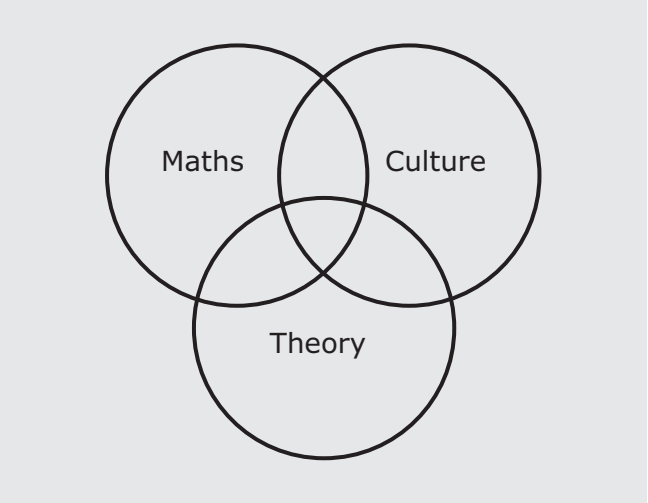
Culturally Situated Design Tools: Dotted Circles Exemplar version 2

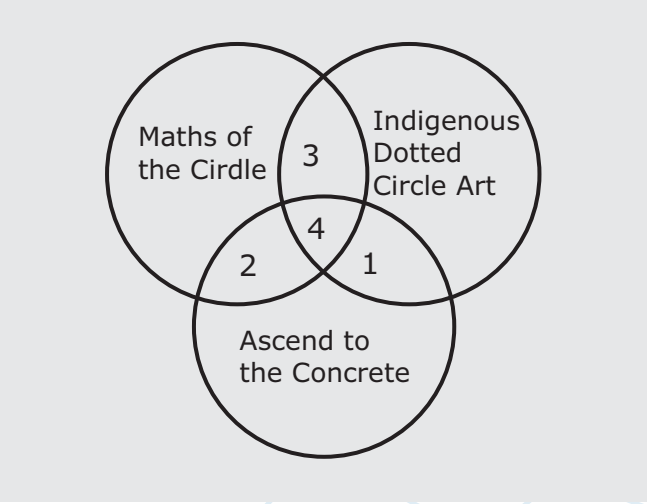
By Bill Kerr

aka Tribal Modernism aka ethnocomputing

It begins like this:



and develops into this:



This began as an exploration of a good way to teach maths to indigenous Australians. It has turned into an integrated curriculum approach with maths as one of the important elements. The elements of integration include art, aboriginal culture, technologies including digital technology, maths and story telling

A powerful idea from indigenous culture is the circle. This was highlighted by Chris Matthews at the final session of ATSIMA 2018 (Aboriginal and Torres Strait Islander Mathematics Alliance).

The numbers (1), (2), (3) and (4) on the diagram refer to particular interfaces within the overall picture. I'll use those interfaces to describe the approach in more detail.

(1) The interface between Indigenous Dotted Circle Art and Ascend to the Concrete.

The dotted circles are prominent in western desert aboriginal art (Papunya Tula) dating back to the early 1970s. I was surprised to discover the assertion in a couple of books by Ian McLean that aborigines invented the idea contemporary art. It makes for interesting history and I'll have to summarise that story at another time. Dotted circle art in indigenous culture is a powerful theme, not tokenistic. Ian McLean coins the term "tribal modernism" to describe the growth of the Papunya Art movement:

> The Western Desert painters remain committed to their tribal traditions. They did not abandon them for the promises of Westernism but instead insisted on the contemporaneity of their tribalism. This is perhaps the greatest shock of the art movement from an artworld perspective: it is tribal modernism. Thus it challenges the self-defining paradigms of both Western modernity and the artworld.
>
> - *Rattling Spears, p. 121*

The following example comes from a public poster about NAIDOC week:

(2) The interface between Maths of the Circle and Ascend to the Concrete.

Mathematical abstraction is often cited as a pinnacle of Westerm culture.

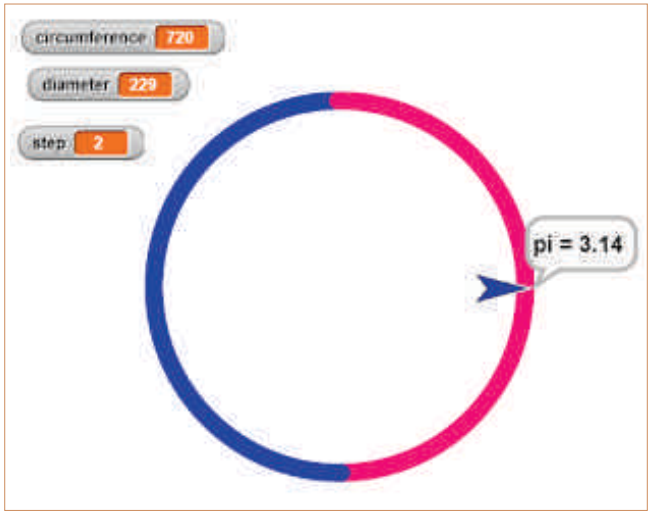
However, some authors have presented original interpretations. Ascend to the concrete comes from the philosophy of Marx. Andrew Pickering's mangle analysis of Science speaks of the dynamic interaction between the material (machines) and humans. Epistemological pluralism, where the bricoleur approach is recognised as both valid and powerful, comes from Papert and Turkle.

By mathematical abstraction I mean, pi = circumference / diameter and the other formulae that flow from that. Mathematical abstraction is powerful, I agree with that. However, it is also a double headed beast. To abstract a circle, as in a textbook maths representation, is to oversimplify the richness of real circles found in art and nature.

Rather than dry as dust textbook maths I strive here for material based, hands on, models that will engage, motivate and educate. The long term goal is to teach maths and the computer coding of maths. But dry abstractions, learn C = 2piR, then plug in the values and get the correct answer, often does not engage or promote meaningful understanding.

How do we make the derivation of pi more concrete? One good way is the rope activity. Walk out 7 steps along a rope being held by a partner. Then walk around your partner in a circle counting your steps. If you get 44 steps then you have an approximation for pi (44/14 = 22/7). Repeat this process for different radii. Notice that the value of C/2R or C/D is always roughly the same. Why is that?

Moreover, a sprite on the computer sits at the boundary between the abstract and the concrete, a visible thing, almost tangible. Program it to move in a circle. That is abstract. Then see the sprite move in a circle. That is concrete. Add some colour and other effects, such as lumpy dots. That is enriched concrete or artistic concrete with an underlying abstraction. We have ascended to the concrete.



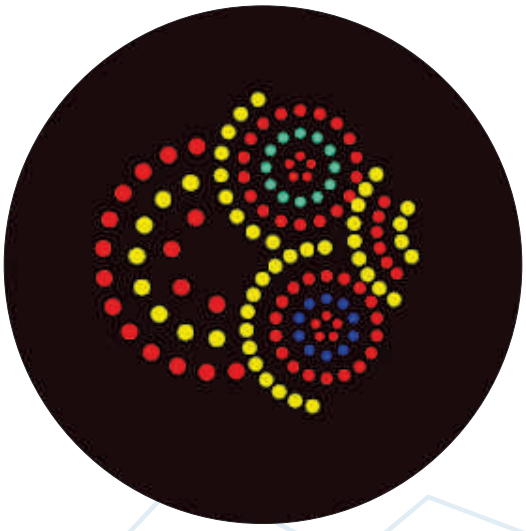
Snap! program estimating pi by measuring circumference and diameter

(3) The interface between Maths of the Circle and Indigenous Dotted Circle Art

How do we make the maths artistic and the dotted circle art mathematical? This can be done with computer programs such as Turtle Art, Scratch or Snap! There are various ways to draw circles on the computer. A good way to do a dotted circle was to start in the centre, lift the pen, move radius, put the pen down, draw the dot, lift the pen and return to the centre. Then turn a little and keep repeating the process. Computers are fast, one of their great strengths, so it doesn't take long.

I spent a fair bit of time experimenting with colours of both dots and background and how to do lumpy dots, more in keeping with the art form. I am doing this for the user but the how to can be read in the code. The art and maths intermingle in a transparent process.

I got this far trying to imitate the above NAIDOC poster using Turtle Art:



(4) In the middle of the three rings above is a sweet spot, I hope. As I develop my understanding of the 3 teething rings the sweet spot becomes sweeter

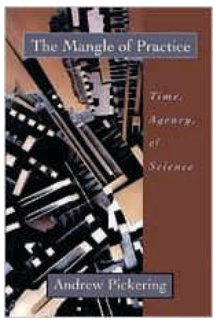
My interpretation of ascend to the concrete in this context goes like this: It refers to a journey from the first exposure to a concept (eg. the circle) to an exploration of its properties (eg. pi) and then returning to the concrete circle in the world armed with a theory to put into practice (eg. understanding and using computer code to draw interesting and artistic circles)

Although it's not in the teething rings above digital technology is a wonderful device to present the abstract concretely. As well as that digital has become / is becoming the new dominant medium since you can arguably develop more powerful, more flexible and more evocative representations than in previous mediums. I have to qualify that though. Papunya Tula art is far more evocative than the puny representations I have developed so far digitally. Rather than trying to duplicate Papunya Tula art I have moved to the position of using aspects of it as inspiration to develop a new form of digital art. Each has its own strengths and weaknesses.

Here is a summary of the approach. Take a powerful idea from indigenous culture and represent it using a variety of technologies! Start with the cultural theme so that the technology serves and enables different forms of expression of the culture. ie employ and mobilise the motivational aspect that comes with tapping into personal culture. Then use technology (both digital and non digital) to make the abstract ideas within the powerful idea more concrete.

We end with an enriched circle, a rich art form. Not traditional art. Nor an abstract disembodied circle. Rather a form which has elements of both abstract maths and traditional aboriginal art. Call it **indigi_maths_art**. Call it **tribal modernism**, a mongrel of the traditional and the modern. It's part of the work of cultural extension.

PERFORMANCE TAKES PRECEDENCE OVER REPRESENTATION



In an earlier version of this essay I talked about representing the circle in various ways. Since then, I've been persuaded by Pickering that real knowledge arises through performance and representation is an after the event disembodied abstraction.

Performance is real time interaction between humans and machines to achieve a goal specified by the humans. This is a difficult path marked by resistance and accommodation to that resistance. Teachers understand this and are continually modifying their lesson plans to better fit the needs of their students. For Pickering, this is the true nature of scientific knowledge. It is part objective, part relative (or subjective) and part historical. Science is material, not just knowledge. Historically, this is true. Galileo used the telescope to help start a scientific revolution. Machines were at the heart of the Industrial revolution. Galileo's work was dramatic performance. I am taking Pickering's insight to help map out a performance based educational pathway. The modern machine that can assist us the most is the computer.

One goal is to master the user interface, to use the computer effectively. In developing this app I want it to be easy enough for the naive user to create interesting art quickly. And I want it to be open and transparent so the user can readily look under the hood to see how it was made.

Another goal is to teach computer coding. Computer coding has become more popular, largely through the lead provided by Scratch. Nevertheless, not all students find this easy or are led to more complex coding. Even though block coding is easier than text coding still not all students become engaged with it. This is partly a cultural issue.

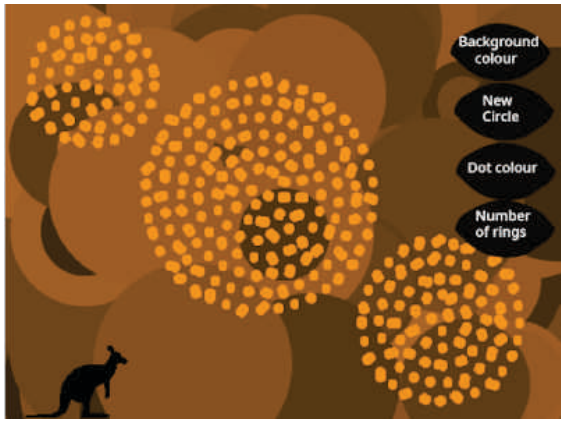
To learn to code is an arduous, sometimes difficult process and the cultural image of the highly skilled computer geek is a barrier to overcome here. Why would an indigenous student want to learn to code? The answer or pathway offered here is that it provides an opportunity to create some interesting and culturally relevant art forms. Hopefully, that might enhance engagement and learning further.

Tinkering or tuning is an important part of the learning process for both teacher and student. Humans tune the machines. The machines tune the humans. This process operates on me as the developer of this software app. Does it engage the student and help achieve the long term goal of teaching maths? A curriculum is an instrument too. Try the activities, see if they succeed. They will succeed for some but not for others. Then tweak them, think of new activities. This is a never ending developmental process. One goal was to teach the maths of the circle. Pi stuff. Are we succeeding?

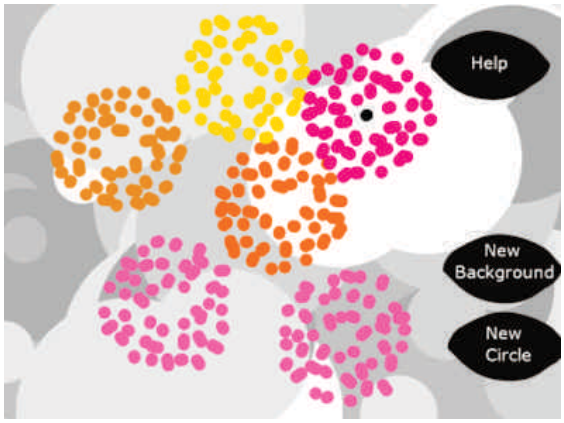
Some of the many possible **performances** (previously I said representations) with which I have made some progress so far include:

- The art itself (dotted circle theme). I have looked at the art and bought some books about it. I've yet to actually do the art myself but am looking for that opportunity
- Language English: Tell the story of the Papunya Tula art movement and find out what the circles represent
- Humans with rope, make a dotted circle or just a circle. This can be used to estmate pi concretely.
- Snap! program estimating pi by measuring circumference and diameter.
- Turtle art: For artistic effects and special fast primitives, such as arc, with the 2 inputs of angle and radius, arc: angle radius, see first iteration of a NAIDOC week poster using Turtle Art
- Scratch application, see dotted_circles_version_1
- Scratch: Cloning circles. I've done this in other contexts and it could be adapted to this context.

- Snap! and Scratch compared: Hal Abelson's objective ("programs must be written for people to read, and only incidentally for machines to execute") can be achieved more readily with Snap! than with Scratch. See a comparison between Scratch and Snap!
- Snap! application, see dotted_circles_4

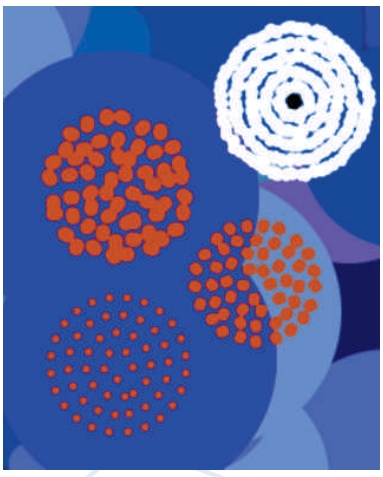


This artwork was made with the Scratch application, dotted_circles_version_1 Click on the link and do your own performance.



This artwork was made with the Snap! application, dotted_circles_5 Click on the link and do your own performance.

Another Snap! application work of art:



Here are some more possibilities which I have thought of but haven't attempted to implement yet:

- Language Pintupi / Luritja: introduce some
- App Inventor: dotted circle with one phone or many phones
- Photography: Show some pics of dotted circle art, perhaps from overhead using a drone
- Robot (which robot?) draws the dotted circle
- Microbit: Use radio to send a message around a circle (what message, can it be interactive? A message about the Papunya art movement)
- E-Textiles: dotted circles on a beanie
- Circuit Playground Express: it's already a circle
- Chibitronics: circuits on paper

There are a lot of ideas here. I'm sure that more could be added by others with knowledge of the three themes: dotted circle art, the maths of the circle and theories which make the abstract more concrete.

THEORETICAL REFERENCES

Rattling Spears: A History of Indigenous Australian Art (2016) by Ian McLean

Ch 5 *The Invention of Indigenous Contemporary Art* outlines the history of the Papunya Art movement through the lens of "tribal modernism" (p. 121)

How Aborigines Invented the Idea of Contemporary Art: Writings on Aboriginal Contemporary Art (2011). Edited by Ian McLean.

For more background on Marx's theory of ascending to the concrete to see:

Dialectics of the Abstract and the Concrete in Marxs Capital by Evald Ilyenkov

Epistemological Pluralism and the Revaluation of the Concrete (1992) by Sherry Turkle and Seymour Papert

Culturally Situated Design Tools (CSDT) by Ron Eglash and co

Many cultural designs show how math and computing ideas are embedded in indigenous traditions, graffiti art, and other surprising sources. These "heritage algorithms" can help students learn STEM principles as they simulate the original artifacts, and develop their own creations.

NB. The recommendation to study Andrew Pickering comes from a Ron Eglash article, so I am indebted to him for that as well.

The Mangle of Practice: Time, Agency and Science (1995) by Andrew Pickering (download the whole book)

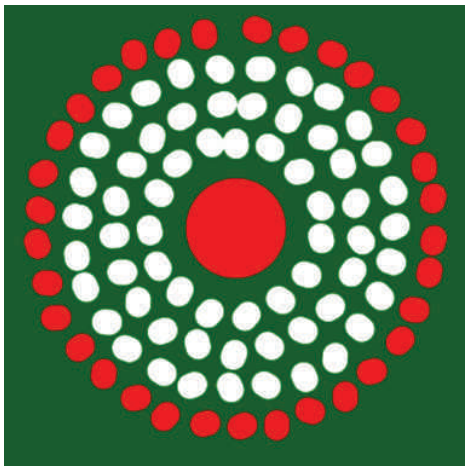
Andrew Pickering offers a new approach to the unpredictable nature of change in science, taking into account the extraordinary number of factors: social, technological, conceptual, and natural that interact to affect the creation of scientific knowledge. In his vie w, machines, instruments, facts, theories, conceptual and mathematical structures, disciplined practices, and human beings are in constantly shifting relationships with one another "mangled" together in unforeseeable ways that are shaped by the contingencies of culture, time, and place.

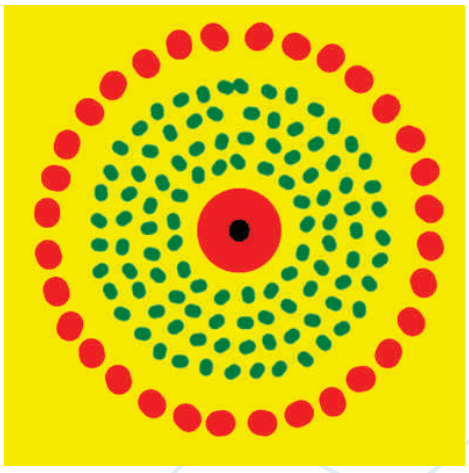
Dotted Circle samples

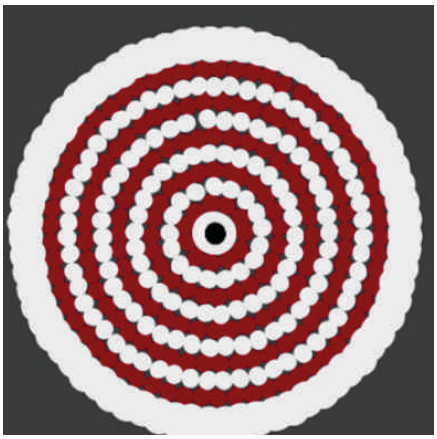
By Bill Kerr

Bill is a digitech teacher in Alice Springs, Northern Territory. This contribution is adapted with permission from his blog http://billkerr2.blogspot.com

A good app IMHO. Here are some sample art works I made with my dotted_circles app. The first two are me just playing around but the bottom two are attempts to imitate a portion of aboriginal art from the exhibition book referenced at the end.







Go to the Snap! app dotted_circles_6 and do one yourself!

https://snap.berkeley.edu/snap/snap.html#cloud:Username=mongrelvygotsky&ProjectName=dotted_circles_6

Reference:

unique perspectives:PAPUNYA TULA ARTISTS AND THE ALICE SPRINGS COMMUNITY (2012)

(with the last two designs I have attempted to imitate a fraction of the art work on pages 2 and 80)

Issues arising:

My overall goal is not to imitate Papunya Tula art but to find new forms to teach maths and computer coding to indigenous students.

This is an app which builds a bridge between maths and computer code to make art. When introduced to students what will the learning outcomes be? I suspect they will learn something about design but it would take a lot more input from a teacher for the students to learn computing coding and maths from this. Nevertheless, it may motivate them to do so.

The User interface is poor. Since the user has to poke around and find the values to change in the Scripting Area. Important issue but I'm not sure at this stage how to improve it. ie. you can do good art with this app but need patience to master the user interface. Not good since UI is a huge issue.

There is a big story to tell about the Papunya Tula art movement, which I have yet to tell, although others have.

The learning theory was discussed in an earlier article: Culturally Situated Design Tools: Dotted Circles Exemplar version 2. In two phrases (1) performance above representation (2) ascend to the concrete.

LAW AND ETHICS IN EMERGING TECHNOLOGY

Stephen Trouse

The author, Stephen Trouse B. Eng., Dip. Ed. is a teacher of I.T., Maths and Physics at Flinders Christian Community College in Tyabb, and the founder of Clearsoft Pty Ltd, a software development company providing bespoke solutions for a wide range of enterprises. He has worked in many and varied roles throughout his career and brings this passion and experience into his classroom and work. He has two beautiful and talented children and considers his greatest achievement the legal right to fly a light aircraft upside-down.

I hope, dear reader, not to slip into a lengthy and boring explanation of what the law is, or the vagaries of ethics and morality, but I would like to lay a quick and shoddy foundation (in an editorial style for the extreme latitude it provides me), thus –

I have always seen the law like the Old Testament of the Bible, and ethics as embodied in the New Testament. While the former conjures the allusion of "an eye for an eye" and, arguably, has its historic basis in the Decalogue (more commonly The Ten Commandments, and especially "You shall not kill" and "You shall not steal"), the latter gives way to statements like "Do unto others as you would have them do unto you" and "Love your enemies and do good to those who persecute you".

The law is relatively easy. We establish a social contract which is embodied in an agreed constitution. We establish punishments, then those who enforce those punishments, followed by a contingent of fine upstanding citizens who then spend their careers making a not insubstantial living arguing that same system to achieve their own outcomes.

Ethics is not so easy. It relies on an unenforceable, ill-defined concept of maintaining the good of others, society, the environment and so on. Moreover, ethics and law are intertwined in a centuries-old dance where morality and rules interchange regularly. Consider extinct laws against such practices as adultery, abortion, and same-sex marriage. For a lighter topic, why not consult *The Locomotive Act (1865)* regarding the waving of a red flag before a powered vehicle? About now you might start to see the tortured relationship between the two, but there is one more point I would like to make.

The law is a massive, lead weight. While it is precise, it is slow to shift, and this with great effort. Ethics and morality are much more agile, but you are very likely to get a dozen versions of what is right. A psychopath will not see your point of view no matter how watertight your argument is!

So then, what of the future? While the heavy mass of law is moving, our emerging technology is moving much faster. For me, the two which immediately spring to mind: Artificial Intelligence and a super-fast, globally available Internet.preceding discourse.

Artificial Intelligence

Artificial Intelligence (AI) is presenting in every sphere. This exceptional (and very simple) biomimicry of the neuron draws its inspiration and versatility from the brain. The explosion of applications in this field is largely due to the exponential increase in processor speed. A software "neuron" needs to be trained to achieve accurate results and the training process must iterate through an entire set of training material (say 10,000 images of cats) many, many times, slowly approaching optimum operating values. Such cycles are known as epochs, and for a half-way decent neural network you could expect many thousands of neurons. Let's say 10,000 cats by 10,000 epochs by 10,000 neurons, and each neuron dealing with potentially 1,000 inputs (*As I was going to St. Ives…*[1]) and we suddenly have an awful lot of floating point operations to deal with – I make it 10^{15} to train the thing! This comes nowhere near to rivalling the human brain with 86 billion neurons. Figure 1 shows the concept and one implementation of the preceding discourse.

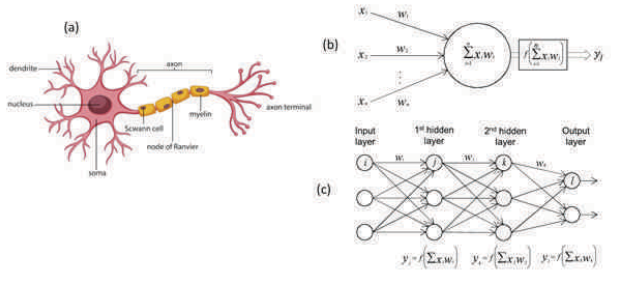


Figure 1 Representations of (a) a neuron (b) the computer equivalent and (c) neurons connected in a simple neural network

In a delicious irony, AI is also set to revolutionise the legal profession. I love this quote from Edwina Rissland[2]:

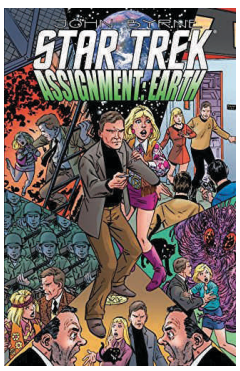
> *"… how to use them ultimately in a computer program that can perform tasks in legal reasoning and argumentation, such as analogising favourable cases and distinguishing contrary ones, anticipating parries in adversarial argument, and creating artful hypotheticals."*

The mystery of AI baffles even the proponents who, as development progresses, really don't know how the beast behaves. In his article *"AI is now so complex its creators can't trust why it makes decisions"*, Dave Gershgorn[3] says

> *"…there's a core problem with this technology, whether it's being used in social media or for the Mars rover: The programmers that built it don't know why AI makes one decision over another."*

What if a prison sentence were dictated by AI, having been trained in the art of sentencing? Wouldn't it be reasonable that the accused knew *why and how* the determination was made?

Project this into the near future of androids. I don't mean robots, which have been with us for a long time (manufacturing, self-checkouts etc.), but replicants of the human species. While they appear primitive now, a few short years could see a responsive, humanoid being. Will they be the new sex workers? Is it moral to provide these to disabled people to provide for their needs? Is it moral for an "owner" to do anything they like to these machines? Is it infidelity? At what point are they sentient and by what standard? This is nothing new and the question has been around since the 1965 premiere of *"Star Trek"*. The brilliant BBC series *"Humans"* intimately explores these themes, and while the lawyers will argue for decades over the rules, the moral imperative requires more immediate attention.



The power to influence

There have been a lot of articles circulating about "deep fakes" and the ability to emulate speech and vision. We have long been able to manipulate photographs, but AI opens up the greater ability to almost flawlessly manipulate video with surprisingly little training. Long gone is the truth of the expression "seeing is believing". Even if a cast is known to be fake and subtitled thus to circumvent the law, the images can influence the mind. This emerging technology has great power to change our perception of reality and blur truth and lie. Morally, I suggest that we consider the truth of inestimable moral value, but there are many whose alternate morality might consider these (visual) lies to be quite acceptable if that achieve the outcome they pursue.

The alleged interference in the U.S. elections by Russia has been widely reported, but a recent report on ABC's *Media Watch*[4] uncovered a disturbing local event similarly eroding our sense of truth. The hashtag *#DictatorDan* (alluding that Daniel Andrews was resorting to totalitarian tactics) was said to have been used 71,000 times over the space of a week which of course gave Twitter's algorithm permission to boost those tweets to the top of the tree. The vast majority of tweets (51,000) came from just two purpose-built fake accounts ("burner" accounts). I don't think *The Spam Act (2003)* specifically addresses this sort of thing, but would we consider it morally reprehensible?

It was Hiram Johnson who said in 1918, *"The first casualty when war comes, is truth"*. Is this some new form of war we are entering?

If you need further convincing, go to https://www.thispersondoesnotexist.com and refresh the page a few times. The images are entirely generated by computer using a neural network known as a Generative Adversarial Network (GAN). This has one engine to generate the face and another to detect it as a fake. The second reports back to the first where it needs to improve and finally this is the result: lifelike photographic renditions of faces of people who don't exist! However, if you look very closely there is always something not quite right despite their amazing quality, and like Malcolm Gladwell says, that tiny instinct is often the one you should pay attention to. What a world we are entering!

The Internet of Things

Parallel to the development of AI lies the development of the *Internet of Things* (IoT). On my desk I have a tiny Arduino board equipped with Wi-Fi and a tiny display, and capable of running for months on two AAA cells. It can be deployed anywhere for just about any purpose and this matchbox-size unit is gargantuan against what's now possible. The cost is low and the applications, many. A constellation of satellites such as SpaceX's Starlink™ project, and potentially the high speed of 5G mobile could see an explosion of interconnected devices. We have a legal framework for dealing with the privacy of the individual, but would this overwhelm an already heavily loaded legal system, unable to move quickly enough to counter wave after wave of data breach or hacking? The sheer scale of the near future opens up a Pandora's box of security issues. Ethical behaviour is the only insulator between society and chaos. If an Internet-enabled pacemaker is hacked and disabled by a "code kiddie", is it murder?

Neuralink™

Elon Musk's other vision (if the domination of space travel, digging vast tunnels and electric vehicles weren't enough) has been to get in our heads. The concept of Neuralink™, which provides a brain-to-technology interface, opens up even more of a Pandora's box. While I have often wished I could record my dreams and analyse them, this technology might go a little too far! Yet, it potentially offers hope to millions suffering from debilitating diseases and injuries. The downside is the ability to implant ideas and content directly unto your brain for the ultimate virtual reality experience. A study in 2014[5] revealed that:

> *"Visual information taken in by the eyes when watching a video flows directly to the occipital lobe and is then sent "up" to the parietal lobe [whereas] during imagination, the researchers identified an increase in the flow of information from the parietal lobe of the brain down to the occipital lobe."*

If we are able to circumvent this process, will our ability to discern reality from imagination blur? Could we send someone mad, or convince them to do something against our inhibitions – Freud's "Thanatos" or "death-wish"? Where does the law stand on that?

Conclusion

So, we face a perfect storm. Not one technology, but the coming together of many technologies offering greater speed, power, and ubiquity: the IoT, Starlink™ or equivalent connectivity mechanisms and, in particular, AI. Are we prepared? If the law cannot keep up, might a set of guiding morals, widely and rigorously defended, be our only defence against a poorly regulated future?

I have probably added nothing to what a thousand science fiction movies haven't already said. The Channel 4/Netflix series *"Black Mirror"* is probably one of the most dystopian of the breed, but the one which has, in my opinion, the most accurate rendition of the morality/technology/legal divide. Charlie Brooker said in interview about his series:

> *"…the world of social media and the world of the Internet is kind of like a weird dreamscape we're all involved in… When you're looking at your phone you slip into a little coma and out of it. The world inside there doesn't feel entirely real, and when you meet people for real they're not like they are on social media… that weird and slightly sinister dream world is creeping more and more into the real world. It's both sinister and weirdly reassuring to think, is that it's something we're going to snap out of…"*

That sounds a little like a Zoom class!

Time will tell.

[1] I. Opie and P. Opie, The Oxford Dictionary of Nursery Rhymes (Oxford University Press, 1951, 2nd ed. 1997), pp. 376–7.

[2] Rissland, E. (1990). Artificial Intelligence and Law: Stepping Stones to a Model of Legal Reasoning. *The Yale Law Journal, 99*(8), 1957-1981. doi:10.2307/796679

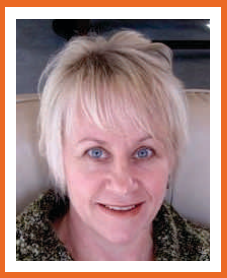
[3] Gershgorn, D. (2017). AI is now so complex its creators can't trust why it makes decisions. *Quartz,* https://qz.com/1146753/ai-is-now-so-complex-its-creators-cant-trust-why-it-makes-decisions/, Accessed 24 Sep 2020

[4] ABC *Media Watch* 21 Sep 2020 with expert commentary from Timothy Graham QUT. https://iview.abc.net.au/show/media-watch 3'36" – 9'30"

[5] Bergland, C. (22 Nov 2014) Imagination and Reality Flow Conversely Through Your Brain, *Psychology Today*, https://www.psychologytoday.com/us/blog/the-athletes-way/201411/imagination-and-reality-flow-conversely-through-your-brain, Accessed 24 Sep 2020

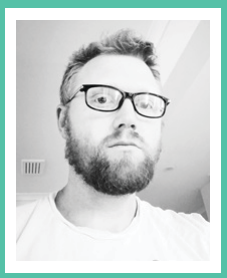
CS IN SCHOOLS

WORKING WITH THE IT INDUSTRY TO BUILD CAPABILITIES FOR A DIGITAL FUTURE



DR NICOLA CARR

is a Senior Lecturer at the School of Education, RMIT University. Her background and research interests are mainly in the role of technology in school and teacher education, including a focus on pre-service teachers' conceptualisation and actualisation of STEM Education. Nicola is a past Committee member of DLTV.



DR GRANT COOPER

is a Lecturer in Science and STEM education at RMIT University. He is an educator, researcher, learner and maker. His research interests include the examination of emerging STEM education discourses, pre-service teacher preparation of STEM-related literacies/perceptions and how digital technologies such as VR have the potential to transform teaching and learning spaces.

INTRODUCTION

In Australia, as in many other countries world-wide, there is a shortage of secondary teachers qualified to teach computer-related subjects (Weldon, 2015). Consequently, teachers with limited experience, knowledge and confidence in teaching computational thinking, coding and programming are being asked to teach the Digital Technologies Curriculum. A 2016 study into out-of-field teaching, that is where teachers are teaching into disciplines in which they have no formal qualifications[1], showed that more than half of teachers taking computing and IT classes in years 7-10 across Australian secondary schools are not formally qualified in that field (Weldon, 2016). As a result of the lack of teachers with relevant skills and confidence to teach coding, some secondary schools struggle to implement some parts of the Digital Technologies curriculum or outsource delivery to after school coding clubs or commercial providers, including Grok Learning[2]and CodeClub[3].

Secondary schools are in need of new and innovative solutions to the problems they face in implementing the Digital Technologies Curriculum. Teachers need effective professional learning to improve their competence and confidence in relation to teaching coding and the Digital Technologies Curriculum. Secondary schools are looking for access to curriculum materials that are easy to use and understand and that can adapt to different models of implementation.

CS in Schools is a program that aims to help schools increase their capacity to implement the Digital Technologies through an innovative model that pairs teachers, pedagogy experts, with computer industry professional, content experts, to co-teach a 10-week programming curriculum for two terms to Years 7 and 8 students (Williams, Williams & Kendall, 2020). CS in Schools follows a similar approach to the Microsoft TEALS program that has run successfully in the US and in British Columbia, Canada

(Granor, DeLeyser & Wang, 2016). The program partners teachers with computer professionals who volunteer their time in schools to work side-by side over two terms to help the teachers become more competent and confident at teaching coding and computational thinking.

The *CS in Schools* program commenced as a pilot in Victoria in 2019 and despite the restrictions of a COVID-19 world, has continued to grow in 2020. This article reports on the findings of the independent evaluation of the 2019 Pilot program carried out by the authors.

PROGRAM EVALUATION

The evaluation of the CS in Schools pilot program aimed to investigate:

- changes in teacher self-efficacy (self-reported confidence and competence) in relation to teaching coding as a result of participation in the program;
- teachers' experiences of the CS in Schools program; and
- industry volunteer experiences of the CS in Schools program.

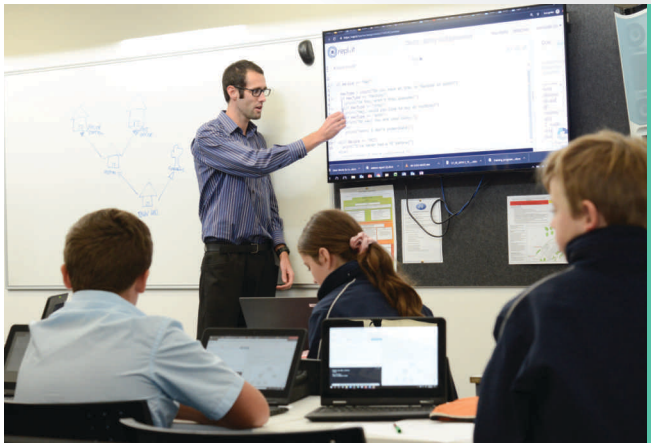
All teachers and industry volunteers were invited to participate in the evaluation. Eight of the ten participating teachers and seven of the fourteen volunteers agreed to be part of the evaluation. Semi-structured interviews of between 30-60 minutes were held with the teachers and volunteers. All participants were asked about their backgrounds and experience with computing and education, the context and motivation for participating in the CS in Schools pilot program. Industry volunteers were also asked for feedback about the efficacy of the workshop held before the commencement of the program as well as questions designed to elicit their perceptions about the value of their participation in the program. Teachers were asked about their prior experience with coding and their confidence to teach coding prior to participating in the CS in Schools program. Teachers were also asked about the effectiveness of working with an industry volunteer in the classroom and the impact of working alongside an industry volunteer on their confidence and competence to teach coding and computational thinking. Interview questions were informed by the nature of questions contained in teacher self-efficacy scales designed for large-scale studies (Cooper & Carr, 2019, Nadelson, Callahan, Pyke, Hay, Dance & Pfiester, 2013; Yadav, Mayfiled, Zhou, Hambrusch and Korb, 2014; Jaipal-Jamani & Angeli, 2017; Rich, Jones, Belikov, Yoshikawa & Perkins, 2017).

CS IN SCHOOLS PILOT

The first stage of the *CS in Schools* program was piloted in 2019 in eight Victorian secondary schools, across various sectors (e.g. government, catholic, independent) in metropolitan and regional locations. Fourteen volunteer computing professionals worked with ten secondary school teachers across the eight schools in their classrooms. The Pilot commenced in January 2019 with a two-day training workshop for the fourteen computing volunteers, designed to orient them to the Victorian secondary school context. Volunteers participated in a range of sessions designed to familiarise them with what to expect in the classroom, building relationships between students and teachers, how students learn, presentation and vocal skills as well as the CS in Schools syllabus that they would co-teach with the teachers in the classroom.

CS in Schools provides detailed lesson plans and teaching resources, assignments, software, and hardware where required. *CS in Schools* also provides training for volunteers, and on-call (online and phone) support for schools and teachers. *CS in Schools* has designed and developed approximately twenty hours of coding lessons, based on the use of Python programming language, and is aimed at Year 7 students. The curriculum is designed to be delivered in two contact hours per week for approximately 10 weeks. Schools are provided with an Industry Volunteer, someone from the IT sector with relevant computer programming knowledge, who takes the lead in the first term teaching the pre-designed lessons, then remains in the classroom in the second term to mentor and support the classroom teacher as they take on the lead teaching role. The materials are provided free of charge, and schools and teachers have ongoing access to the materials under a creative commons license. The *CS in Schools* 2019 pilot was intended to trial and evaluate the model with a view to extending the program to more schools in more locations in 2020 and beyond.

WHAT WE FOUND



The School contexts

The contexts of the participating schools varied considerably. The independent schools typically had superior network reliability and access to a wider range of resources than their counterparts in the Catholic and public sectors. The schools also served very different communities that impacted the cultural and social capital that students brought with them to their participation in the program, manifested in the schools' abilities to garner support for their IT programs and in students' awareness of IT as a potential career option.

Teachers in the government schools all commented on the challenges their schools experienced in identifying sufficient appropriately qualified staff to teach computer programming. In five of the participating schools, the implementation of the Digital Technologies curriculum, prior to implementing CS in Schools, had been focused on teaching specific applications such as spreadsheet, web design or database programs, or units on cybersafety. Others had relied on block programming languages such as Scratch to address the programming demands of the Digital Technologies curriculum, largely because that was what their teaching staff were able to teach. In two government secondary schools, staff who had either been recently appointed or who had personal skills in programming had pushed for an increased emphasis in their schools' curriculum to be placed on programming or coding. It was into these contexts that CS in Schools entered.

Teachers' IT backgrounds

The majority of teachers who participated in the CS in Schools pilot program were not originally trained in computer science. Only one of the teachers in the pilot program had a formal qualification in computing as part of their original undergraduate studies. Only two of the teachers in the pilot had undertaken additional formal training in programming or computers in education. Most of the teachers in the pilot who were teaching IT related subjects were mainly self-taught in computer programming. This pattern reflects national data about the prevalence of out-of-field teaching that shows over half of teachers who teach computing and IT classes in years 7-10 are not formally qualified in the field (Weldon, 2016).

Teachers' self-efficacy pre-CS in Schools

The majority of the teachers in the CS in Schools pilot had limited knowledge of teaching coding using Python, but the majority did not see this as a key barrier. Teachers were asked about their self-efficacy, or their belief in their ability to teach junior secondary students about computer programming prior to the introduction of the CS in Schools project. Most of the teachers interviewed believed they were sufficiently experienced in teaching programming previously, or sufficiently knowledgeable about the principles of computer programming and confident that, given time and access to supporting resources, they could develop the skills and knowledge required to teach programming to junior secondary students. As Peter[4] teachers said, '*If you said I have to teach it tomorrow I probably would have died. But if I had a holiday break to skill up, I would be fine.*'

Four of the teachers had relied on the block programming language, Scratch, for teaching programming, and three schools had used existing online coding programs such as Grok Learning as their computer programming curriculum. However, all but one teacher felt their own programming skills in text-based coding programs, such as Python, were relatively weak, even though their understanding of coding concepts were not. Lack of familiarity with Python specifically was not considered to be a barrier since they understood the principles of programming and were confident that they would be able to work I out, as Gary put it, '*I'm pretty good at doing things on the fly, so I would have worked it out.*'

In contrast, two of the teachers expressed very low levels of confidence in their capacity to teaching coding, despite being give the responsibility within the school to implement the Digital Technologies Curriculum. Simon admitted '*I have low coding skills. I my IT classes I might have a few kids who code as a hobby who help me.*' Isobel similarly expressed low confidence, saying '*I'm not confident to teach a whole class.*'

Teachers' self-efficacy post-CS in Schools

Teachers were asked to report on the impact their participation in the *CS in Schools* program had on their competence and knowledge about teaching coding. All teachers reported increases in their confidence and competence to teach coding as a direct result of their participation in the *CS in Schools* pilot. Even those teachers who were experienced and confident in coding reported that their knowledge of coding generally and their knowledge of the Python programming language improved as a result of their participation in the *CS in Schools* program. Mark was the teacher with the most experience and confidence in teaching with Python. Even he experienced significant growth in his capabilities and his confidence as a result of participating in the CS in Schools and saw new possibilities for teaching and allowing him to extend his students' learning about coding:

> *What we did extended me because some of the content that we did in the CS in Schools program I had not done before. I learned new things. I was conscious that I haven't thought to do some of these things with the kids because I didn't have the knowledge myself. I definitely think it's given me a much better understanding and shaping the different possibilities and ways to do things. My confidence is much higher than it was.*

Peter echoed some of Mark's sentiments:

> *I had an understanding of Python but nowhere near as far along as it is now. Without the CS in Schools program I would have been able to teach [Python] but not as well as this. The [CS in Schools] program has helped immensely and now I will be able to teach in a really well structured way [Peter]*

For Simon and Isobel , who had the lowest initial self-efficacy, their jump in confidence was the most substantial:

> *My participation in the CS in Schools program has contributed massively to my confidence. Now I am much more confident, especially using the CS in Schools curriculum program [Simon]*
>
> *My skills are much better. Much better. [Isabel]*

It could also be argued that the CS in Schools program acted like a scaffold for teachers to develop their content knowledge and consequently their self-efficacy to teach coding.

Helping time poor teachers

A key component of the CS in Schools program is that it offers schools a resource that is already planned out in detail, with all required teaching and learning activities provided and a platform into which students can code. The program can be immediately implemented in a classroom over a typical term without teachers needing to spend considerable amounts of time developing a scope and sequence, lesson plans, assessment tasks and associated teaching and locating or creating teaching and learning resources. Susan and Simon's comments are indicative of a shared sentiment amongst the teachers:

I loved that they just had it all; the presentations, the resources. It was just there [Susan]

So I think one of the main benefits of CS in Schools thing was the activities were there, the curriculum was followed, it was done and all you really had to do was learn it and implement it. [Simon]

Nearly every teacher made a positive comment about the time they were able to save as a result of having detailed and comprehensive curriculum content provided to them. For Gary, this freed up his time to explore Python in more depth, to develop his own skills, as he puts it, 'It's created space to come in and tinker, It's very hard to teach Python if you can't do it [yourself].' Because he did not have to spend time developing the lesson plans and locating resources, Gary had time to develop his own coding skills, which in turn increased his confidence to teach in what for him was an out of field teaching experience.

Quality of content

The CS in Schools curriculum is based on a pedagogy of explicit instruction. The first part of each lesson involves teacher-led exposition of the key concepts to be addressed in that lesson, followed by a hands-on activity undertaken by the students. A set of slides is provided to each teacher and Industry Volunteer for each week of the 10-week curriculum as part of the CS in Schools program.

All of the participating teachers made positive remarks about the comprehensive and clear nature of the teaching and learning content of the CS in Schools program and the logical progression of the content from simple to more complex programming operations.

> *It [the resources] was very well balanced. There were points where I would look at the slides and think, everything you are saying and your lessons you've planned has a slide for every single thing that you're actually saying. [Peter]*
>
> *I didn't realise how in-depth and how good the resources were going to be [Susan]*

For Matt, the impact of the highly detailed and comprehensive lesson outlines was that his students probably had 'a greater understanding of programming and Python as a whole.'

Explicit teaching, which lies at the core of the *CS in Schools* program, is a very traditional pedagogy and used extensively across Australian secondary schools, however not all teachers and schools will want to adopt this approach. There is scope within *CS in Schools* to adapt the program and opportunities exist to work with *CS in Schools* team to include a more varied range of teaching and learning strategies that align more with student-centred, social constructivist pedagogies.

Access to on the spot knowledge and skills

A key distinguishing feature of the CS in Schools program compared to other externally provided coding programs and curriculum is the role of the Industry Volunteer in the classroom. The teachers were unanimously positive about the knowledge and skills the Industry Volunteers brought with them into the classroom. Having that extra expertise on hand meant that errors could be identified and resolved on the spot, as Susan commented:

> *what I liked about the CS in Schools program, was if I got stuck there was somebody else who was more experienced in coding and they might be able to figure out where the error was [Susan].*

Simon reinforced this view with his reflection:

> *it's a lot quicker when you've got someone that can I suppose just help you out in real-time rather than spending an hour or two trying to work something simple out. [Simon]*

The CS in Schools program saved teachers the time they would otherwise have to spend after school or between classes identifying the students' coding errors and investigation possible solutions. In addition to saving teachers' time, the ability to solve problems in the spot also helped to maintain student engagement during lessons. On the spot troubleshooting was seen as a significant benefit the CS in Schools program brought.

Another advantage of having the industry volunteers in the classroom was their ability to draw on their experience to provide authentic examples of how coding is applied in the larger world to augment the curriculum. The 'real life examples Nina shared of what coding might look like in the real world – they [students] loved it' was seen by Steven as much more engaging than if he alone had taught the content. The authenticity of knowledge and experience was also valued by Nellie who admitted to 'borrowing' her volunteer to take him into her Year 10 class. The students in this class were 'really excited to have him there, they could ask him questions about their computer programming and show him their code' [Nellie]. Nellie's students also asked questions about IT careers and opportunities and the interactions with the volunteer generated a high level of motivation amongst the students.

In situ professional learning

The CS in Schools program provides teachers with an in situ form professional learning for teachers who have been allocated responsibility to teach coding but who may have limited coding skills and experience. For Susan the biggest advantage of this form of professional learning was its authenticity and the fact that to attend this professional learning didn't involve taking time out of the classroom.

> *The fact that somebody was coming in and they were going to teach us was the selling point. They were going to teach us during class, which meant we didn't need to take time out, we didn't need to go off on a PD and leave work for our classes. They were going to come into our class and teach us during our class time what we need to teach for our next class. Isn't that just - how can you say no to that? [Susan]*

This approach reflects what we know about effective teacher professional learning

Overall impressions

Overwhelmingly the teachers participating in the CS in Schools pilot had highly positive experiences and believed in the efficacy of the program. All of the teachers interviewed indicated a desire to continue to implement the program in the future. The following comments were reflective of the overall impressions given by the teachers:

> *The resources are great. Please keep doing it. Please keep sending volunteers. [Susan]*
>
> *Amazing to have volunteers teach and be able to ask them questions to clarify. [Isabel]*
>
> *Grateful our school chose to put up their hand to do the project, I would love to continue with it. [Isabel]*
>
> *I think it was really beneficial for us to be a part of the pilot. I would like to see it happen again maybe next year. [Peter]*
>
> *I'd like to deepen the relationship and the partnership. [Gary]*
>
> *I'd happily continue [Matt]*
>
> *Yes, I'd do it again [Simon]*

BARRIERS

Teachers and volunteers identified a number of barriers during the implementation of the CS in Schools program. These largely related to the availability of appropriate IT network infrastructure, hardware, software, access issues and student IT literacy. Many of the barriers related to setting up the volunteers into the school network, setting up students' access to the Python learning environment, so were high impact barriers in the first week or two of the program. However, once these issues had been resolved their impact was low. The awareness and use of social-constructivist pedagogies by volunteers in the program is also another important consideration as the initiative progresses.

Access and infrastructure

There was a significant difference between the experiences of the CS in Schools implementation in the independent and Catholics schools compared with the Government schools' sector. The CS in Schools program uses an external online platform to host the students' coding project, requiring a certain amount of latent bandwidth for successful implementation. The independent schools had significantly faster and more reliable networks than most of the Government schools resulting in fewer interruptions due to network dropouts or slowdowns.

Industry Volunteers in Government schools also reported delays in being given access to school networks, since they had to go through school IT technicians to be connected. Many Industry Volunteers lost time in the first week because they were unable to access the school's network because of these delays. At times, students needed to download additional code from a library to complete a project. In one school at least, access to that library was blocked by local filtering and security protocols and the school's IT technicians were not responsive to requests to provide access to that site. Similar frustrations were reported by teachers at other Government schools about the impact of the school's IT technicians' control over the network and how at times that acted to block the effectiveness of the CS in Schools project.

Many of the schools had prescribed bring your own device (BYOD) programs in place where students are required to purchase or lease specified laptop computers. Students needed to download Chrome as the preferred browser. In some schools this proved to be an initial barrier as time spent installing Chrome meant a delay in teaching the content of the CS in Schools curriculum, as exemplified by this typical observation from Jason:

> *Most of the kids were using Internet explorer because that's what the computer comes with so we had to spend the first class just making sure everyone got Chrome installed [Jason]*

Nellie, a teacher in a government school, was surprised that many of the Year 7 students in Term 1 did not know what a browser was, and that there were different browsers, let alone know how to download and install one.

Student issues

One of the biggest frustrations for teachers and volunteers alike was the challenges of managing password access for students. In Term 1 particularly a lot of time was lost in helping new Year 7 students establish connections to the school network as well as to the online environment used to support the Python programming.

> *A lot were able to log on but then forgot their passwords, so had to get password re-sets. We'd ask them to write their passwords in their diaries and they didn't write it down or would forget their diaries. Constantly have these issues [Kieran]*

Simple solutions to managing passwords were implemented by some teachers, for example using a written template and requiring students to record their initial passwords at the beginning of the term, then ensuring that template was in each class throughout the term.

Access to student laptops was varied. In schools with class sets of laptops, the computers were generally old and slow, which interfered with the efficacy of the program. Even in schools with BYOP programs, students frequently forgot their laptops, had flat batteries, or their computers were with the technicians. As Brendon stated:

> *I found that the kids constantly will not bring in their laptops. They'd have to grab a school one and there's not always enough [Brendon]*

Most schools had a class set of 'spare' laptops that would be distributed amongst students who did not have access to their own laptop or who had been allocated a desktop computer that wasn't working effectively, however, in many cases there would be students sharing a computer which meant that not all of the students had the opportunity in each lesson to work on their own coding projects. Further, shared laptops also meant more time in logging on and setting up.

Some of the teachers made comments about the lack of computer literacy among some, but not all, of the Year 7 students, particularly in relation to students who had used tablet devices or mobile phones in their primary school years and who were accustomed to touch screens rather than to computer keyboards, as Brendon and Jason commented:

> *The fact that they [students] just hate their laptops but do anything on their phones. The fact that they'd rather do something like coding on a mobile device blows me away. They don't know where everything is on their keyboard, how to navigate the cursor, copy and paste properly, they always want to click everything because they're use to touch screens. [Brendon]*
>
> *I found that most of the students struggled on a computer really. Like they play games with touch screens and they're pretty fluent with that, but I found their skills with the keyboard were missing. They don't know how to copy, paste, some basics that we assume in the program. [Jason]*

Two teachers from two government schools observed that the children who struggled with learning coding were those students who also had issues with their general literacy and numeracy. Poor English literacy skills and numeracy skills make coding in any language much more difficult.

Timetables

Each school timetabled their classes differently but most classes participating in the *CS in Schools* Pilot program had at least one double period of coding each week. Teachers and volunteers alike commented on the loss of focus and concentration in the double periods. This seemed counter-intuitive since double periods would give students more time to work on mastering their coding. However, the issues with diminishing concentration and engagement in double periods potentially reflects the explicit teaching pedagogy embedded in the *CS in Schools* program. If double periods are common, then a potential consideration is to reduce the proportion of exposition in the lessons and increase the proportion of hands-on learning activities.

CONCLUSION

The response to the CS in Schools Pilot Program was overwhelmingly positive. Teachers' confidence in their capacity and skills in teaching the Digital Technologies curriculum increased significantly. Teachers spoke positively about the high quality of the teaching and learning resources that come with the CS in Schools program and how much time these resources have saved them in developing curriculum. The time saved was time that teachers felt they could use to 'tinker' and learn more about programming in text-based languages, which in turn made them even more confident to teach text-based programming. However, the most valued element of the CS in Schools program was the Industry Volunteers. Having access to expert knowledge and skills on the spot in the classroom was invaluable to the teachers, in terms of quick responses to students that kept them engaged in their learning, in terms of time saved having to investigate the issues/problems that students came across during their class, and importantly in terms of free, in situ professional learning related to the Digital Technologies Curriculum.

What the evaluation also revealed was that to maximise the benefits of the CS in Schools project, schools should proactively plan to minimise the issues experienced by schools that participated in the Pilot Project. For example, by:

- developing a system to support students who are new to secondary school to manage passwords and logins effectively
- facilitate network access for Industry Volunteers ahead of the term commencement
- facilitate access to required code libraries
- set up Chrome browsers on student laptops prior to term commencement

- ensure an appropriate timetable that makes the most of what the CS in Schools program can offer.
- timetable CS in Schools classes in locations within the school with strong wifi signal

CS in Schools 2020 and beyond

Since the pilot project CS in Schools has continued to work with a growing number of schools across Victoria and across year levels, with programs now available for Years 7 & 8, Years 9 & 10 and Years 11 & 12. Eight of the ten teachers in the 2019 programme have returned for a 2020 programme that develops more advanced skills, and seven of the eight schools are continuing to work with the CS in Schools Program. CS in Schools has added approximately 20 schools, 50 teachers, and 45 volunteers (Williams, Williams & Kendall, 2020).

For further information about how your school could participate in the CS in Schools programs see https://csinschools.com/

[1] Teachers are regarded as formally qualified to teach a subject if they have studied it above first-year university level and have also been trained in teaching methodology for that subject.

[2] Grok Learning is an initiative coming out of the University of Sydney that provides online courses and modules to teach programming, using a subscription service. Grok Learning also implements the NCSS Challenge, a five week programming competition for schools based on Python the includes access to online self-paced modules to teach programming https://groklearning.com/

[3] CodeClub is nationwide network of volunteer-led coding clubs, based in schools, libraries and other community centres, with sponsorship from the Telstra Foundation https://codeclubau.org/

[4] Psuedonyms have been used throughout this article to protect the identity of the participants in the research

REFERENCES

Cooper, G., & Carr, N. (2019). *Primary Pre-Service Teachers' Perceptions of STEM Education: Conceptualisations and Psychosocial Factors*. In T. Barkatsas, N. Carr & G. Cooper, STEM education : an emerging field of inquiry (1st ed., pp. 167-189). Netherlands: Brill Sense.

Granor, N., DeLyser, L. A. & Wang, K. (2016). TEALS: Teacher Professional Development Using Industry volunteers, in proceedings of SIGSE 2016, Memphis, TN. DOI: http://dx.doi.org/10.1145.2839509.2844589.

Hobbs, L. (2018). *What now for STEM?* In T. Barkatsas, N.

Jaipal-Jamani, K. & Angeli. C. (2017) Effect of Robotics on Elementary Preservice Teachers' Self-Efficacy, Science Learning and Computational Thinking, *Journal of Science Education and Technology,* 26, 175-192. DOE: 10.1007/s10956-016-9663-z

Nadelson, L. S., Callahan, J., Pyke, P., Hay, A., Dance, M. & Pfiester, J. (2013). Teacher STEM Perception and Preparation: Inquiry-based STEM Professional Development for Elementary Teachers, *The Journal of Educational Research*, 106(2), 157-168. doi: 10.1080/00330671.2012.667014

Jaipal-Jamani, K. & Angeli. C. (2017) Effect of Robotics on Elementary Preservice Teachers' Self-Efficacy, Science Learning and Computational Thinking, *Journal of Science Education and Technology,* 26, 175-192. DOE: 10.1007/s10956-016-9663-z

Nadelson, L. S., Callahan, J., Pyke, P., Hay, A., Dance, M. & Pfiester, J. (2013). Teacher STEM Perception and Preparation: Inquiry-based STEM Professional Development for Elementary Teachers, *The Journal of Educational Research*, 106(2), 157-168. doi: 10.1080/00330671.2012.667014

Weldon, P. (2015). *The teacher workforce in Australia - supply, demand and data issues*. Camberwell: Australian Council for Educational Research. Retrieved 15 August 219 from https://research.acer.edu.au/cgi/viewcontent.cgi?article=1001&context=policyinsights

Weldon, P. (2016). *Out-of-field teaching in Australian secondary schools*, Camberwell: ACER

Williams, H., Williams, S & Kendall, (2020). CS in Schools: Developing a sustainable coding programme in Australian schools. In *25th Annual Conference on Innovation and Technology in Computer Science Education*, June 15–19, 2020, Norway. ACM, New York, NY, USA, 7 pages. https://doi.org/10.1145/1122445.1122456

Yadav, A., Mayfiked, C., Zhou, N., Hambrusch, S. & Korb, J. T. (2014) Computational thinking in elementary and secondary teacher education. *ACM Transactions on Computing Eduation*, 14(1), 5:1-5:16. doi:10.1145/2576872.

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DLTV COMMUNITY GRANTS

Inspiring and innovative ideas from our membership!

As you would imagine there was a great deal of interest in this initiative. The list of our successful applicants from our first are listed below (in no particular order). In order to springboard the project, some proposals were fully funded whilst some were partially funded.

As you can see, there are many interesting and worthwhile projects and we look forward to hearing about how they progress in the coming months.

Jeremy Chen
Baimbridge College

PROJECT

Make Maths Fun and Alive with Meowbit

Adrienne Donoghue
Kilbreda College

PROJECT

Sparking an Interest In Coding and Electronics for Girls

Richard Cromwell
Traralgon College

PROJECT

Utilising Modular Robotics Kits to Engage Students and Teach in New Ways

Sarah Gale
Genazzano

PROJECT

'GenMakes' - a maker space for Years 7-10 promoting the use of DigiTech

Corrie Barclay
Ashby Primary School

PROJECT

Student-led "Ashby Connect FM!" Internet Radio Station

Nicole Hall
Newborough Primary School

PROJECT

Coding Skills with our Middle Years Students with Make'n'Code Classes

Bryan Stone
Shepparton Christian College

PROJECT

Pi "Visual Communications Raspberry Pi"

Stacey Lamb
St. Bernard's Primary School Wangarratta

PROJECT

Humming along in STEAM Learning

Gillian Kidman
Monash University & St Peter's Primary School

PROJECT

Engaged Exchanges: Teaching and Integrating Inquiry Learning in Online Environments

Sarika Kewalramani
Monash University and STEM Incubators (Community partner)

PROJECT

Robotics and Coding: Enhancing Disadvantaged Children's Communication and Language Development

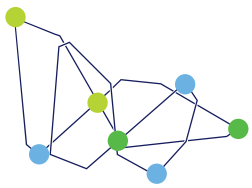
More exciting news coming soon!

As this journal goes to press. We are delighted to be evaluating our second round of community grants. We have received some very innovative and inspiring projects across a diverse range of schools from around the state. In our next issue we look forward to sharing some of the winning projects with our DLTV community.

Digital Learning and
Teaching Victoria
61 Blyth Street
Brunswick VIC 3056 Australia

Phone: +61 3 9349 3733

Email: office@dltv.vic.edu.au
www.dltv.vic.edu.au



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