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Editorial

Roland Gesthuizen and Pennie White
Faculty of Education, Monash University

Welcome to Volume 4, Issue 2 of our DLTV Journal. We would like to thank past Journal Editors Mike Phillips and Michael Henderson for guiding our transition in taking on the role of Editors.

Although this is our fourth DLTV branded volume, the history of our publications spans a period of nearly four decades including journals by the Victorian Information Technology Teachers (VITTA), ICT in Education Victoria (ICTEV) and the Computer Education Group of Victoria (CEGV). The staff at the DLTV office have been looking through the many legacy newsletters, journals, books and documents from our preceding teacher association archives. This is in preparation for plans in 2018 to celebrate the DTLV 40th Anniversary. Peek inside our Time Capsule segment that contributes to the preservation of our rich history by re-printing selected past papers.

We are part of two larger associations: the Australian Council for Computers in Education (ACCE) and the International Society of Technology Educators (ISTE). By invitation, Anne Mirtschin has written an article about the ISTE Global Collaboration Network for this issue. In future issues, we will be sharing stories by other ISTE colleagues.

In this issue, Katie Bourne and Elizabeth Brown from Aitken Creek Primary School demonstrate how they approach integrated curriculum with a focus on robots using an inquiry approach in the primary classroom.

Gary Bass, Mag-Net President and 2016 DLTV Leader of the Year looks to the future in his article exploring the future of Data and Artificial Intelligence and what this means for educators.

In a recent Teachmeet with the theme Megamaker co-hosted by Mei Liu (Museums Victoria) and the DLTV we were able to see innovative work being done in the Test Lab space at Scienceworks and hear presentations by participants. To find out about local events you can visit http://teachmeetmelbourne.wikispaces.com.

In this issue, there is a special focus on makerspaces with three articles detailing the experiences of three schools. James Lee reminds us of the value of play to develop passion in his article about Bentleigh Secondary College's makerspace journey. Margaret Lawson shares her experience in creating a makerspace inthe library at Mater Christi College. Matthew Harrison interviews Mel Greaves from Bulleen Heights School, about her journey in pioneering a makerspace designed specifically for students with autism.

The newly implemented Digi Tech curriculum is unpacked in the article by Paula Christophersen, who reminds us to to create opportunities for students to use real data for a real purpose in the teaching of computational thinking.

"The coolest things that I did this year was to step from the virtual surface of Mars at the Victorian Space Science Education Centre, give my first STEM presentation whilst wearing a spacesuit and meet some of my preservice teachers." *Roland Gesthuizen*

The final article is about the experience of collaborating on the creation of digital resources and thought provoking experiences relating to encountering problems of practice.

Our new editorial team hope that you enjoy reading this issue with a focus on makerspaces and digital technologies. It is our wish that they help you explore some creative ways to engage with the many dimensions of new school spaces and spark ideas for hands-on digital learning.

We look forward to hearing your comments and feedback on this and future issues.

From the President

Melinda Cashen

As we get to this part of the year it always astonishes me how much we can fit into each year and it is no different at DLTV. It is a great time, as we sit down to reflect on our strategic goals and start to consider what 2018 will bring for our DLTV members.

The 2017 strategic plan focus was to build on the benefits for members. The first step was to launch our new website with member access to past webinars, keynote presentations and resources. We are looking forward to adding to the resources package next year and sharing more webinars, videos and case studies. Along with the website we also launched the DLTV podcast where we talk to teachers, leaders and industry experts and hear about everything digital learning.

Since our last journal we have celebrated the dedication and passion of the Committee of Management at the Annual General Meeting. In an effort to make this more than just the formalities of the meeting we invited Paula Christophersen (Who writes Think before you code: Digital Technologies in the Victorian Curriculum in this journal) and Michael Henderson to share their thoughts on the future of Digital Technologies. It was a great night with members enjoying the opportunity to network and hear about what DLTV have been up to.

At the AGM we also said thank you to the long standing members of the committee, Michael Henderson and Donna Gronn who have spent many, many hours volunteering for DLTV and previously at ICTEV but have decided to step down from the committee. It was a wonderful opportunity to thank them for the dedication and time they have put into the committee and we wish them well in the future.

The AGM is also that time when we welcome new members to the committee. This year we have had Narissa Leung, Catherine Newington, VIctoria Hare, Clark Burt and Matthew Harrison join the committee and we welcome their varied expertise. We know they will all be great additions to the committee and look forward to working with them.

We also welcomed Roland Gesthuizen and Pennie White who have taken on the role of Journal Editors. As I am sure you will agree from this first issue, they are an exceptional editorial team who have managed to bring together a valuable range of articles.

Of course, a highlight of the year is always DigiCon and once again the conference was a great opportunity to showcase the outstanding knowledge and expertise we have in Victoria. The two days were packed with sessions on digital pedagogy, makerspaces, STEM and coding and it was wonderful to hear great feedback about these sessions once again.

It was also a privilege to have Tony Brandenburg, a DLTV life member join us to share his experiences with the global world of IT and hear from DLTV member Bec Spink talking about her journey to become Assistant Principal and Co-founder of Code the Future.

One of my highlights of DigiCon is when we get to present the DigiCon awards. The awards are always a special part of what we do at DLTV when we get to recognise the outstanding educators and leaders we have in Victoria. This year we recognised Steve Brophy as the DLTV Leader of the Year. Steve is an educator with over 17 years experience who always strives to break new ground and lead positive change in the promotion of ICT use in the classroom. In his current role as the Director of ICT & eLearning at Ivanhoe Grammar, Steve drives the strategic development of technology use for learning across two campuses. He has worked tirelessly to embed technology into the fabric of school life and was the 2016 DigiCon keynote presenter.

Narissa Leung was the recipient of the DLTV Educator of the Year and has been a presenter for DLTV on many occasions and is always happy to share her own experiences. Narissa is a principal at Campbell's Creek Primary School in central Victoria and her professional commitment clearly extends beyond her own school context as she expands her Professional Learning Network though the DLTV, ACCE, MAV, and various levels of the Department of Education and Training.

As part of our affiliation with ISTE (International Society for Technology in Education) DLTV were very excited to present a Making IT Happen award to Paula Christophersen in 2017. The Making IT Happen award honours outstanding educators and leaders who demonstrate extraordinary commitment, leadership, courage and persistence in improving digital learning opportunities for students and Paula's long time dedication to technology education has certainly demonstrated all of these qualities.

Also receiving the Making IT Happen award was DLTV member Anne Mirtschin, who in this issue of the journal talks about ISTE. She was lucky enough to be at the ISTE conference to receive her award for her dedication to building global connections and networks.

As the holidays approach I hope everyone has an opportunity to reflect on their year as we recognise the enormous contribution you all make to our students in the area of digital learning. We look forward to working with you in 2018.

SAVE THE DATE FOR DIGICON 2018

Thursday July 26 & Friday July 27, 2018 – ACU in Fitzroy
Expressions of Interest for those who want to share are also open. There are plenty of ways to get involved with us in 2018.
http://digicon.vic.edu.au/speakers/
Follow us @digi_con #DigiCon18

TIME CAPSULE:

REFLECTING ON AND COMMEMORATING OUR PAST

Pennie White
Monash University

Welcome to the Time Capsule, a new feature of the DLTV Journal. In this edition, we open the Time Capsule from 2011:

- Henderson, M. (2011). In professional learning the relationships are more important than content. *ICT in Education, 34*(1), 6–8
- Phillips, M. (2011). Exploring teachers' technology integration choices: Understanding knowledge and communities. *ICT in Education, 34*(1), 9-11.

The above two articles have been selected for re-print to commemorate the contribution of the outgoing editors of this journal, Michael Henderson and Michael Phillips. Together, they championed the DLTV journal since its inception.

Henderson's (2011) article, reprinted here, draws on Communities of Practice theory to investigate factors contributing to "sustained and transformational professional learning" (p. 6). Henderson's contribution to preservation of the integrity of Wenger's (1998) conception of Communities of Practice theory is significant as the term makes its way into educational policy and guidelines in Victoria (Department of Education and Training, 2017a).

Phillips' (2011) article reprinted here, also draws on Wenger's (1998) conception of Communities of Practice whilst also providing an introduction to the TPACK model. The TPACK model has also endured as a theory to inform practice and is referred to in Education Department guidelines about teaching with digital technology (Department of Education and Training, 2017b).

Henderson and Phillips' contributions predate their time with DLTV, having previously worked together as state council members of Information and Communications Technology in Education Victoria (ICTEV) and as co-editors of the ICT in Education Journal. In 2013, Michael Phillips was the recipient of the Outstanding Professional Service Award from the Council for Professional Teachers' Association Victoria (CPTAV) for his work with ICTEV.

This was the same year that the two teacher professional associations, Victorian Information Technology Teacher Association (VITTA) and ICTEV amalgamated to become DLTV. Henderson and Phillips were instrumental in this merger. Donna Gronn who led the merger of the organisations and became its first president, described DLTV as "the descendant of the Computer in Education Group in Australia" (Gronn, 2014, p. 5). Next year will mark 40 years since the foundation of the Computers in Education Group Victoria (CEGV), a milestone that will be celebrated.

DLTV has been able to provide these reprinted articles to you as custodian of its legacy organisations' journals, *COM-3* (CEGV), *Infonet* (VITTA) and *ICT in Education* (ICTEV). DLTV is currently researching options to make these past journals available online. The Journal of Digital Learning and Teaching Victoria is an artefact representing the important work of the association in developing symbiotic praxis by supporting connections between universities and schools. Henderson and Phillips' work in this space is evidence of this.

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In professional learning the relationships are more important than the content

Michael Henderson,
Monash University

Reprint: Henderson, M. (2011). In professional learning the relationships are more important than content. *ICT in Education, 34*(1), 6–8.

The design of professional learning (PL, also known as professional development) is usually focused on issues of content, delivery and technology. However, through my research over the last eight years I have increasingly come to the conclusion that designing for and investing in relationships is ultimately more important when trying to achieve sustained and transformative professional learning. In my research I draw on the theory of Community of Practice to help me understand the complex social and cultural issues influencing how and why teachers integrate technologies in their classroom.

Due to teacher preference and system level resource allocation, the majority of PL continues to be delivered in single or short sequences of face to face sessions. Unfortunately the research on these kind of models of PL, especially in the field of teaching with ICTs, reveal that they do not have a significant impact on what teachers do in their classrooms. PL needs to be meaningful and sustained over time. As a consequence in the past decade there has been an increasing focus on community based approaches, such as learning communities, personal learning networks, and communities of practice. A community perspective directs the focus of research and design towards the complex nature of teachers as members of a wider community, as professionals with unique ways to understand and manage their worlds, and as situated learners.

In essence, PL of teachers must recognise the interdependency of identity and practice. It is important to recognise that the use of the term identity is carefully applied to describe an individual's history, goals, and traits within a social context. It is argued, from a Community of Practice (CoP) perspective that learning is dependent on both doing and becoming (Wenger, 1998, p. 5). The key to this transformative process is active participation and engagement based on the complex socio-cultural relationships among participants (Carlen & Jobring, 2007; Henderson, 2006).

Community of Practice (CoP)

Wenger (2001) states that "a community of practice is not merely a community of interest. … Members of a community of practice develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems – in short a shared practice" (pp. 2-3). However, they "are connected by more than their ostensible tasks. They are bound by intricate, socially constructed webs of belief, which are essential to understanding what they do" (Brown, Collins, & Duguid, 1989, p. 34). Community of Practice places the issue of identity on centre stage. In order for teachers to transform their practices they must enter into what is essentially a personally transformative experience that occurs over time. As a result, Community of Practice begins to explain why sustained experience is valuable, and why PL must tackle more than mere technical skills.

Situated learning at its grass roots argues that learning is a matter of enculturation (Brown et al., 1989). A CoP perspective "encourages us to consider educational designs not just in terms of techniques for supporting the construction of knowledge (let alone in terms of delivery of curriculum), but more generally in terms of their effects on the formation of identities" (Fowler & Mayes, 1999, p. 11). At a community level, both practice and identity sustain a community and therefore learning (Wenger, 1998). Wenger (1998) argued that a community's cohesion is a product of the extent to which practice and identity are invested in mutual engagement (doing things together), joint enterprise (responding together to the organisation's needs and goals), and shared repertoire (resolving problems together). Consequently this research has developed a model of community cohesion (see Figure 1) to guide the design of PL.

An example of mutual engagement could be teachers who work together, have coffee together, attend meetings together, etc. The same teachers would be involved in joint enterprise, such as responding and aligning themselves to the same departmental requirements and guidelines. Furthermore, the teachers would share their repertoire of ways in which to meet their needs, such as the departmental requirements. In this way the teachers reshape and reinforce their identities as members of the community as well as negotiate and propagate the community's practices. Through this process they are not only coming to understand the world in which they live but also shape their identity through the relationships of their CoP. The central role of the social, over the individual, is emphasised by the terms mutual, joint and shared.

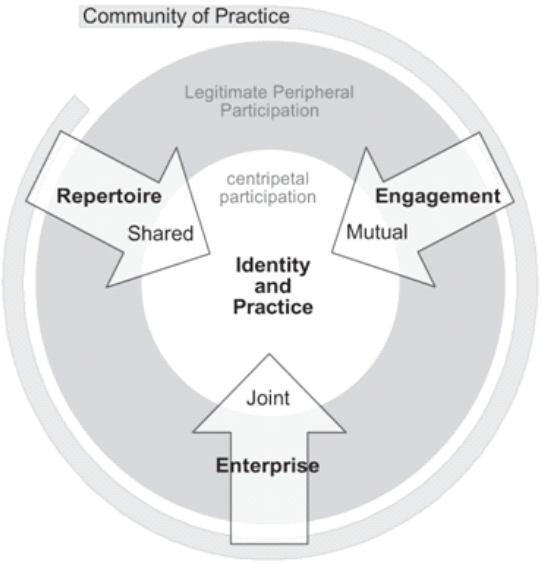

Figure 1: Model of community cohesion

Practice and identity cannot be externally defined. While a set of procedures can be imposed by the institution, the practices surrounding those procedures are a result of negotiated meaning by the community members. Similarly job descriptions do not define members' identities. Communities of Practice, and therefore learning, cannot be designed, created and controlled. This is significant for the current investigation because it suggests that we cannot create a Community of Practice for specific PL goals. However, Wenger (1998) argues that while you cannot design the learning you can design for learning. In other words you can design an environment that will either facilitate or frustrate emergent practices and identity. Wenger (1998) draws on the concept of legitimate peripheral participation and states that "required learning takes place not so much through the reification of a curriculum as through modified forms of participation that are structured to open the practice to non-members" (p.100). Learning is more than a process of handing down a defined body of knowledge to newcomers, rather it is best described as a process of catching up to a dynamic, changing and essentially social practice. Aspects or versions of these practices are offered to newcomers who can legitimately participate in a centripetal trajectory. Furthermore, Wenger (1998) points out that practice is not a result of design but a response to design. Therefore it is important that any design for learning balances prescriptive measures with that of emergent practices.

Lessons learned

In this paper I will share two lessons I have learned from my research about how to design for transformative and sustained PL.

Lesson 1 – PL needs to be designed so that success can only be achieved when participants support their fellow community members.

All aspects of the PL course design, including the time-line, content, goals, and assessment need to be based on a unifying philosophy: support your fellow community members. Using the community cohesion model (see Figure 1) as a design framework this sets the tone of engagement, becomes a core enterprise, and establishes the need and authority for shared repertoire. In other words, in order for teachers to complete the PL they had to engage with each other, respond to common challenges, and share practices. For instance, the teachers were asked to investigate different topics and to give feedback to the group on what they felt was important. The other participants responded to these contributions as a way of providing support and further investigating the ideas reported. Unless the contribution was discussed the task was seen as incomplete. One teacher in my research commented: "you're accountable to them as well and their learning is reliant on your participation so if you haven't participated then you know you've let them down." Although the core materials of the course were provided, the essential element of critical evaluation was left to the participants and consequently, when combined with the need to support each other, both encouraged and gave license for the sharing of opinions, experiences, stories, ideas and even divergent trajectories of inquiry.

Lesson 2: PL needs to be designed so that participants are immediately, and over time, engaged in meaningful interpersonal interactions.

A CoP is a site of authentic learning where participants make meaning of their environment and negotiate solutions to problems. While the teaching profession could be described as a CoP, individual teachers do not usually mutually engage with the teaching profession at the global level. Instead, they engage with localised versions of the CoP, which could be at the level of their school, department, interest group, etc. Transformative and sustained PL is dependent on the formation of a localised, coherent CoP where the participants do things together and form a sense of belonging and accountability (mutual engagement). This common frame of reference is then the basis of understanding how problems can be resolved, what is important and what should be done (joint enterprise). As the participants engage with each other, responding to problems, they form a unique social history that includes not only a communal memory of action but also a raft of tools, concepts and language that helps them in engaging with the core practices, and thereby also defining the boundaries of the CoP (shared repertoire). In simple terms we need to bring teachers together frequently over time, to work together with real problems (not limited artificial tasks provided by the instructor) long enough for them to develop usable language, concepts, problem solving skills, and world perspectives which will transfer with them into their classrooms.

In my research the consequences of PL groups who do not engage with each other is simply that they do not develop a sense of mutuality, and consequently are less likely to invest effort over time. In light of this I have found the very first moment of PL to be critical in developing a sense of mutuality. For example, a teacher in my research indicated that he felt disconnected from his group because he did not participate

early in the PL and that as a consequence the "main impetus for actually getting things done was emails from the facilitator suggesting that we should be making comments and getting involved". Since the community lacked mutual engagement, and a clear sense of direction, it necessarily relied more heavily on the facilitator and was characterised by a teacher led instructional model.

Conclusion

PL design needs to *focus on relationships*. Relationships built on mutual engagement sustain participation. Supportive relationships between members of the community (including the facilitator) can leverage individuals to continue participating. Consequently, PL design needs to include social activity that values and legitimates meaningful relationships. It is something more significant than merely adding a social discussion forum or buying lunch for the course participants. It requires a re-consideration of who has control over negotiating meaning in the course. Relationships of mutual engagement mean being involved in what matters. Thus a central aim of PL courses needs to make relationships a core enterprise. This is remarkably different from most PL which value content and skills, relegating relational activities as a last-minute add-on. PL within a CoP framework therefore inherently values tools, discourse, objects and activity that support members engaging with each other in profound ways.

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Exploring teachers' technology integration choices: Understanding knowledge and communities

Michael Phillips,
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Reprint: Phillips, M. (2011). Exploring teachers' technology integration choices: Understanding knowledge and communities. ICT in Education, 34(1), 9-11.

Effectively integrating emerging technologies as part of teaching practice is an ongoing challenge. Research supports what many teachers and researchers have been suspecting for years: that technology integration is not happening, happening too slowly, or happening with little or no effect on students' learning (for example: Donald, 2002; Kuhn, 1977; Marks, 1990). Despite this, many of us have experienced successful technology integration or witnessed colleagues effectively introducing a new form of technology into their teaching practice. There is a general consensus of what good teaching with technology 'looks like': engaged students, authentic learning tasks, opportunities for collaboration, and co-construction of subject knowledge involving both the teacher and students. However, most professional learning/development approaches are clearly not making this a reality. In addition, the research literature reveals that there is little understanding of the ways in which teachers develop knowledge about pedagogical integration of technologies within their unique communities of practice, whether at the school, department, or classroom levels.

This problem has led me from a decade in the classroom to now studying full- time as a PhD student with the goal of revealing ways in which to more effectively identify, support and plan for teachers who are learning to integrate technologies into their classroom practice. At this stage of my work I am exploring a new, as yet untested approach that intertwines two existing theories; one that looks at the social and cultural aspects of teachers' work (Communities of Practice) and the other that examines the development of teachers' knowledge (Technological, Pedagogical and Content Knowledge or TPACK). This paper briefly outlines these theoretical frameworks and what I propose to do.

Many studies have examined factors influencing teachers' technology adoption (for example: Somekh, 2008; Straub, 2009) however the complexity of teachers' work has made it difficult to develop a robust and effective model of teacher professional learning. As experienced teachers will tell you, every time you teach a class you need to work with unique factors generated by the individual experiences of each student every day. The combination of your students' experiences together with many other variables such as your teaching style, the subject you are teaching and the technology available to you can be considered as a particular Community of Practice with complex interdependencies. Much research over the last three decades on the adoption of technologies in classrooms has been over-simplistic and has not encompassed the complexity of teachers' Communities of Practice. In response, Mishra and Koehler (2006) developed an alternate framework which allows for the unique cultural and social aspects of teachers work to be considered alongside the practical considerations of technology availability and subject matter.

Mishra and Koehler's (2006) TPACK framework has informed both theory and practice and is based on the premise that three core components are at the heart of good teaching with technology: Content Knowledge (CK) about the subject area you are teaching; Pedagogical Knowledge (PK) which can be simplistically described as knowledge about the processes and practices of teaching and learning; and Technological Knowledge (TK) or an understanding of the opportunities offered by different hardware and software.

While one could examine each of these individual forms of knowledge in an attempt to understand why teachers adopt or reject technology as part of their classroom practice, "it is the interactions, between and among these components, playing out differently across diverse contexts, that account for the wide variations seen in educational technology integration" (Cox & Graham, 2009, p. 3). CK might, for example, simply be the ability of a teacher to represent the topic they are teaching in different ways. The options available to a Science teacher presenting the flow of electrons in a Science class might include text book diagrams, student construction of clay models or the written presentation of facts on a whiteboard. These are all valid options for a teacher if they are considered independently of pedagogical considerations such as the age, ability and preferred learning style of students; however, if a teacher considers these pedagogical elements, Mishra and Koehler (2006) would classify this as Pedagogical Content Knowledge (PCK).

Similarly, if a teacher considered using computer-aided models (TK) to represent the flow of electrons to students without

considering the pedagogical implications of the technology, this would be considered Technological Content Knowledge (TCK). Mishra and Koehler (2006) argue that a deep understanding of all three forms of knowledge (TK, PK, CK) is required to teach well with technology. This combination of all three forms of knowledge is known as TPACK and is represented in Figure 1.

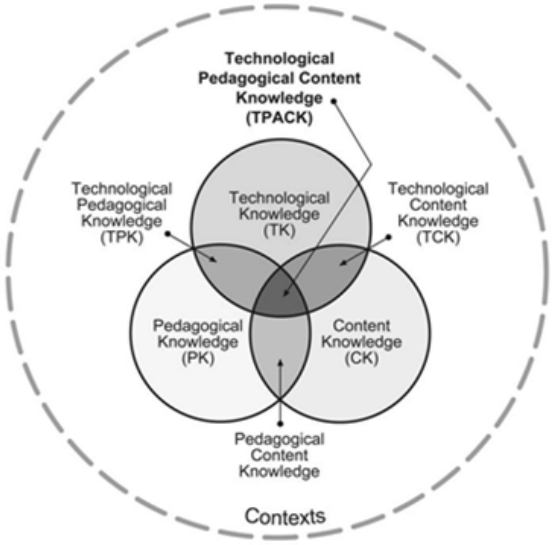

Figure 1: Technological, pedagogical and content knowledge (TPACK) from http://tpack.org/

The introduction of the TPACK model by Koehler and Mishra (2006) has had "a profound impact on the field of educational technology" (Cox & Graham, 2009, p. 60) yet it is not without its limitations or critics. Graham (2006) claims that "while hundreds of studies claim TPACK as a theoretical framing, very little theoretical development of the model has occurred" (p. 1953). Effectively, Mishra and Koehler (2006) have provided researchers and teachers with an understanding of what forms of knowledge teachers need to develop to effectively integrate technology into their classrooms or what good teaching with technology 'looks like', however significant questions remain unanswered. Of particular concern to teacher educators is how teachers acquire TPACK and specifically, by which path do they arrive at that knowledge? Cox and Graham (2009) have stated that, some seem to believe that teachers should first acquire TCK and then the TPACK will come as they enact their knowledge in a pedagogical context. Others feel that it is first necessary to have a knowledge of the general uses of technology in the classroom (TPK) before one can fully utilize subject-specific methods (p. 69).

In an attempt to better understand teachers' TPACK development and ultimately the factors affecting their pedagogical technology integration choices within their own school setting, my PhD study aims to incorporate elements of Wenger's (1998) Communities of Practice (CoP) with existing understandings of TPACK to contribute new understandings to this gap in current knowledge.

The CoP framework is based in the notion of situated learning which argues that learning is a matter of enculturation (Brown, Collins, & Duguid, 1989). It is my contention that teachers' TPACK development occurs, in a large part, when they are introduced into, and participate as, members of a variety of CoP that co-exist in every school. As practicing teachers, we are familiar with this process - 'newcomers' are introduced to the practices, beliefs and values by 'old timers' from a CoP. It is through this introduction and on-going participation that I believe many teachers develop CK, PK, and TK and ultimately their own understanding of TPACK.

My current research aims to focus on the shared repertoire or "routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions or concepts that the community has produced or adopted in the course of its existence, and which have become part of its practice" (Wenger, 1998, p. 83). Through an examination of these practices I hope to be able to map the development of various combinations of knowledge described by the TPACK model in different individuals within a CoP. This mapping process will provide a valuable initial step in understanding how membership of a CoP contributes to TPACK development and ultimately an understanding of the factors that affect teachers' pedagogical technology integration.

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The ISTE Global Collaboration Network

ISTE (the International Society for Technology in Education) has a diverse international community. There are many Professional Learning Networks (PLNs) within the ISTE community. Members can join a PLN based on their personal interest areas. They can interact with people across the world, of like-minded passions. The Global Collaboration team is one of the newest networks and was started by Australia's Julie Lindsay in 2014. This PLN has 18,500 members across the globe.

Anne Mirtschin

Leader at Large, ISTE Global Collaboration PLN

One of the new ISTE student standards is that of Global Collaborator - *students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.* This falls neatly within the focus of the Global Collaboration PLN. Collaborator is also one of the ISTE Teacher standards.

The ISTE Global Collaboration PLN promotes digital technologies for connecting and collaborating beyond the classroom walls. The network offers best-practice curriculum design to embed global learning experiences into everyday teaching. The community shares tools and methods, curriculum developments, and opportunities for collaborations. The leadership team is global in nature coming from Singapore, USA, Australia, Kuwait and Uruguay. Online monthly meetings are held.

ISTE has a Global Collaboration community site for people to join where conversations, discussions and interactions can take place. One of the latest discussions centres around "Global Collaboration with the Sustainable Development Goals in Mind". Bi-weekly Twitter chats are held at 8am Saturday morning in the moderator's time zone (either USA or globally based). The twitter hashtag is #ISTEGlobalPLN. Follow @ISTEGLobalPLN on twitter. There are monthly webinars and a website is under development. The leadership team offer presentations, poster sessions and organise a playground at the annual ISTE conference. The poster sessions are always popular. In San Antonio, 2017, there was a Networking Fair, 'The World is Our Classroom' poster session; and an interactive lecture style presentation "Twitter Tools for Global Collaborators."

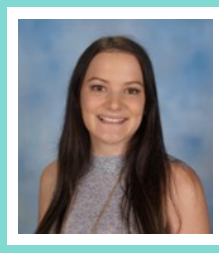
ISTE Networking Fair poster session with Amy Jambr

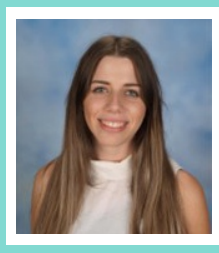
Presenters at ISTE Twitter Tools for Global Collaboration

A popular new addition to our ISTE conference activities was the Great Global Scavenger Hunt where interested people met at a designated time and formed small teams to join in the hunt. A social gathering at a Mexican restaurant completed the activity. The PLN team also curates an ISTE conference list to aid in connecting members. Another new focus is the integration of the United Nations Sustainable Development Goals with the ISTE Standards.

The map above shows where the some of the Global Collaboration PLN attendees come from.

Inquiry into
DIGITAL TECHNOLOGIES IN THE EARLY YEARS





Katie Bourne and Elizabeth Brown
Aitken Creek Primary School

Through the Technologies curriculum, we can provide students with cross curricular opportunities to consider digital technologies as solutions in their problem solving. Classrooms that offer inquiry, whether digital or not, allow students to develop critical thinking skills, deeper understandings and a stronger ability to apply learnt knowledge. It is imperative we don't dismiss or underestimate these skills in the early years and instead take advantage of their curiosities and excitement, especially when using digital technologies. When planning an inquiry unit into digital technologies, it is crucial that all areas of the curriculum are considered and intertwined, so students can see the relevance to their own self.

"Inquiry is the pursuit of understanding"

- Leslie Memme and Kari-Lynn Winters

The inquiry unit into robotics that we planned was built around the 3 levels of thinking in the Technologies curriculum:

- Systems Thinking; develop students understanding of how digital systems work and the interconnectedness of different systems
- Design Thinking; the process of identifying problems, planning solutions and reflecting on their effectiveness
- Computational Thinking; ability to predict outcomes of algorithms, breaking down problems and organising and interpreting data

Setting the scene:

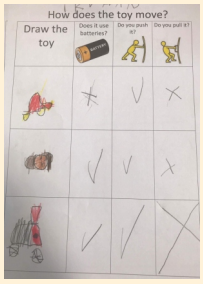
We teach within a cohort of 170+ Foundation students, 63% of which have English as an Additional Language (EAL) background. All students have access to a BYO iPad program as well as access to digital learning equipment, such as BeeBot, Ozobots, Sphero, Littlebits, Dash and Dot etc. Students already had some basic concepts of simple digital technology language and exposure throughout the school year. However, their understanding was quite superficial and we wanted them to have a deeper understanding of how and why robotics work and can be useful in real world contexts.

Inquiry process:

Inquiry is essential when teaching in the early years as it supports students in developing their curiosities. Nothing is more important than considering the students interests when planning an inquiry unit, and *seeing* that learning is student driven. Teachers have an important role throughout the inquiry process, ensuring that learning has purpose and scaffolding the students to become lifelong learners through the development of soft skills. The first part of the inquiry process is vital in finding out interests, current understandings and misconceptions in order to plan a successful cross curricular unit.

"The role of the teacher is to create the conditions for invention rather than provide ready-made knowledge"

- Seymour Papert



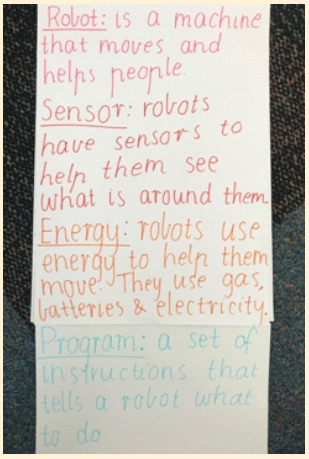
Forces and power - toys

Students brought a toy to school from home that moves and explored the types of forces or power they required to make them move. They compared the types of power various toys utilised and established meaningful insights by making personal connections to familiar objects.

Links to curriculum:

Science: Physical sciences (forces), Recording and processing

Mathematics: Data representation and interpretation

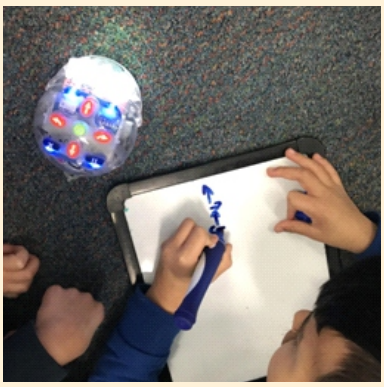


Making a glossary (reading texts, experimenting)

During literacy, the children were exposed to various texts about technology and robotics. Whole class focuses involved building vocabulary through co-constructed glossaries in which these were continuously referred to and built upon throughout the term to strengthen student understandings.

Links to curriculum:

English: skills such as inferring, vocabulary, questioning, summarising and so on.



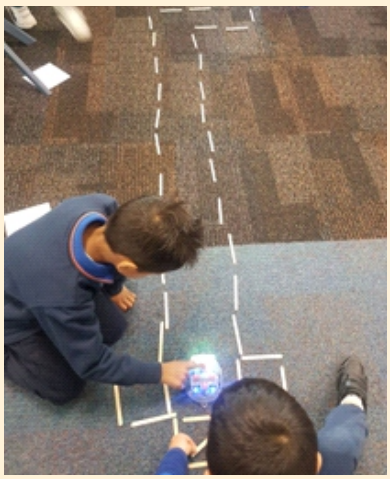
Programming - algorithm (patterns)

Students used their understandings of patterns and topic specific language to create algorithms so that they could program BeeBot. They collaborated with their peers and took turns at writing patterns, pressing buttons and challenging one another to follow the algorithms.

Links to curriculum:

Mathematics: Patterns and algebra, Location and transformation

Personal and social capabilities: Collaboration



How robots move - directional language

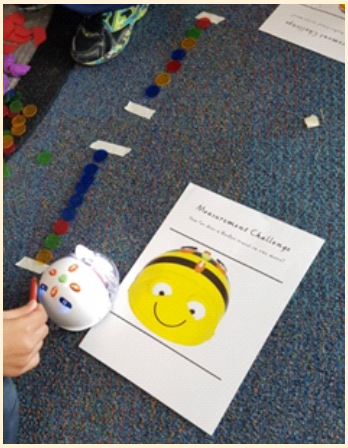
Students made paths for BeeBots and Ozobots and then coded them in order for the robots to move correctly through them. They then used their iPads to film and record their voice explaining the directions that the robots moved.

Other links to the curriculum:

Mathematics: Using units of measurement, Patterns and algebra, Location and transformation

Critical and creative thinking: Meta-Cognition

Personal and social capabilities: Collaboration



How robots move - measurement

Students explored how BeeBot moves by finding out how far it travels in one move. They used a range of resources such as counters, unifix or natural resources to measure and record how far it moved.

Links to the curriculum:

Mathematics: Using units of measurement, Patterns and algebra, Location and transformation

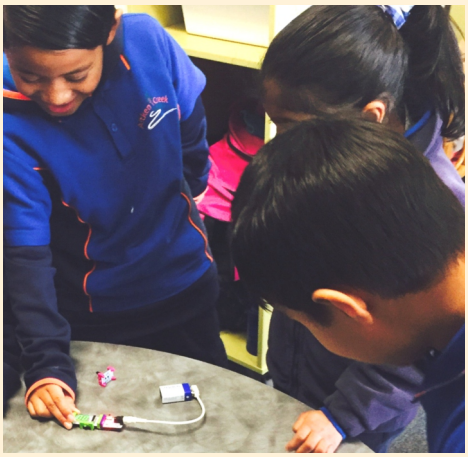
Comparing and contrasting (Katie)

Students explored numerous robotics, such as Ozobot, BeeBot and Sphero, to identify features that they had. They then collected yes/no data on the features (wires, lights, wheels etc.) and organised this into a simple data display.

Other links to the curriculum:

Mathematics: Data representation and interpretation

Science: Recording and processing



Exploring circuits

Students experimented with the functions of Little Bits. Some students decided to follow a set of instructions while others explored through trial and error. They developed vocabulary such as 'input', 'output', 'wires' and 'battery' and used this to label photographs or record their voices on their iPads explaining how circuit work.

Links to the curriculum:

Personal and social capabilities: Collaboration

Science: Planning and conducting, Communicating

Mathematics: Patterns and algebra

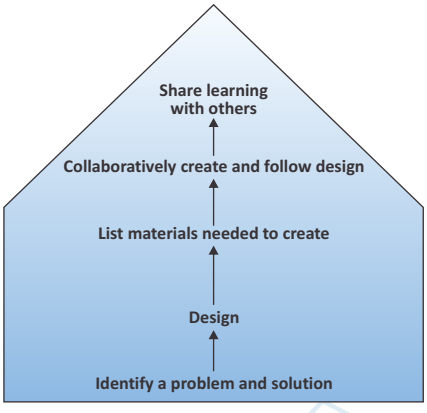
Critical and creative thinking: Reasoning, Metacognition

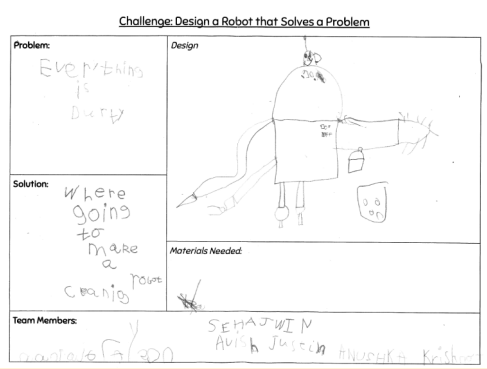
Outcomes: student understandings and exhibition - posing the question/challenge.

- Planning and designing (Liz-design/Katie-problem/solutions)
- Exhibition photos (Both)

The design process → problem/solution → plans → materials list → collaboratively creating robot → Exhibition

At the end of the unit, students were able to apply what they had learnt by responding to a challenge of designing and creating a robot as a solution to real world problems. This process demonstrated their level of understanding and was used as a rich assessment tool as it required various understandings and skills to be put to practice.



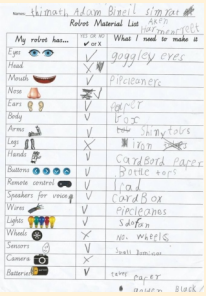


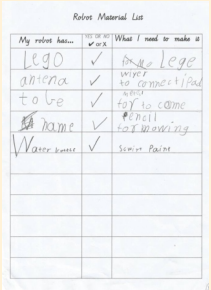
One of the groups of children read about elderly people who experience trouble standing up and need assistance. The children identified this as a problem and designed a "doctor robot" to aid in helping such people to stand up. They listed some materials they would need to make this robot and substituted these for craft materials.

Links to the curriculum:

English: Text structure and organisation, Phonics and word knowledge, Creating literature, Creating texts.

Speaking & Listening: Expressing and developing ideas, Interacting with others.





This group of students had identified a problem of not having enough lego for a building they were making. After planning, they created a list of materials by identifying what would work best for each part of their plan.

Students wrote descriptive pieces about their robots, explaining what materials they used, what parts the robots had or how they worked. This was presented at the exhibition alongside their robots.

Students used Book Creator on their iPads to create advertisement posters to send to their families and friends about the exhibition.

Links to the curriculum:

English: Text structure and organisation, Phonics and word knowledge, Creating literature, Creating texts

References and further readings:

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ARTIFICIAL INTELLIGENCE

Are there implications for education?

Gary Bass
President Mag-Net Online Association of STEM Educators Inc.

Arthur C Clarke, in the 1970s, famously observed "Any teacher who could be replaced by a computer, should be." He was referring to his 'electronic tutor' which would have easy access to facts and figures and should be used to train teachers. He was of the view teachers could not be replaced. Meanwhile, 37 years later that observation still holds true.

Despite rapid advances in computing speed, connectivity and availability the human teacher continues to provide a superior learning experience for students.

Over the period since Arthur C Clarke's observation, teaching, learning and schooling have evolved. However, the fundamental experience is about experience, acquiring knowledge and understanding.

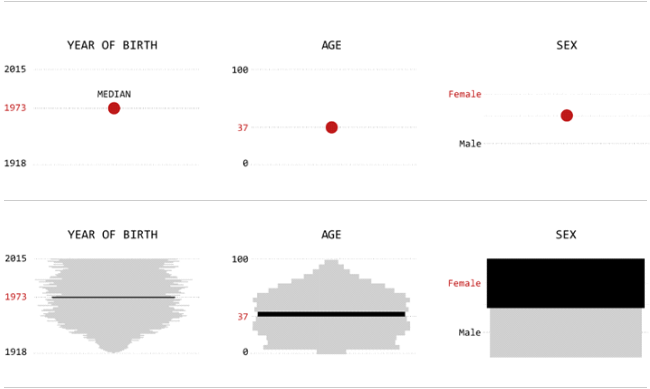
IJCAI-17 MELBOURNE

The proceedings of the latest International Joint Conference on Artificial Intelligence (IJCAI-17), held in Melbourne August 2017. URL: https://www.ijcai.org/proceedings/2017/

Teaching methods have undergone a multimedia transformation, though the fundamental approach has been largely constant. Telling stories is the way humans relate to knowledge. Basic facts and data are now easily accessed anytime, anywhere. With the advent of 24/7 data availability a 'fog' has descended over the ability to make and take decisive action.

(To know, but not understand: david weiberger https://www.theatlantic.com/technology/archive/2012/01/to-know-but-not-understand-david-weinberger-on-science-and-big-data/250820/)

Data driven decisions are now more difficult than ever before, when perhaps what we need are information driven decisions. Means and modes often disguise more than they reveal. When teachers apply their semantic skills it is the outliers which are of interest. Computer learning obliterates these 'blips' and normalises any data to reflect the central seeking tendency of big data.



Mean can obscure details, for teachers it is the 'blips' which give the insight.

Flowing data by Nathan Yau

https://flowingdata.com/2017/07/07/small-summary-stats/

Teaching and learning is all about personalised experiences, an individual's perspective is the means of engaging and empowering a learner to seek their own understanding. Schooling with adaptive algorithms may identify a students' progression point as an historical statement, however improving that position requires aspiration and inspiration by the learner to shift their achievement to a higher level.

AI and computers are brilliant at recording history. Precedent (past precedent is a tautology – future precedent is a guess!) may or may not predict future achievements, however as the eleven plus exams demonstrated, they do limit future

achievement by imposing limited expectations on the learner. My students who undertook adaptive mathematics testing soon learned that by providing two clearly wrong answers early in the test, they were then provided with an easier workload and gained a better report because they 'improved' after initial low grade start. If they achieved 100% correct, the questions were more difficult and their report showed no improvement over the course. AI systems can be 'gamed'. Successmaker, in 1997, was an adaptive learning program which received huge 'hype'. <Gartner HYPE cycle: URL: https://en.wikipedia.org/wiki/Hype_cycle >The idea was students would undertake a programmed learning course and emerge with improved knowledge of the topic under study. At enormous cost, this program was deemed to be a failure as it treated all students the same. There was no personalised dimension. Students did not 'engage', they were not empowered to take responsibility for their own learning. There was no urge to discover and use the information to make or tell a story. Every input students made was assessed, with no time to 'play' and make mistakes. Students quickly discovered that no matter what they did there was always more to do. (ICT:Changing Education, Chris Abbott p.77)

Project based learning has received some attention over recent years. While very expensive in time and resources the results are very impressive. The programme can be totally individualised, students negotiate many aspects of their learning. Students become empowered beyond the period of study and often continue with strong interest and activity long after assessments and reports have been issued.

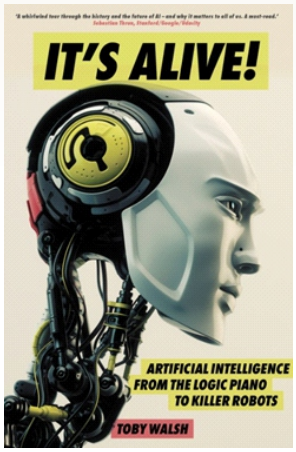
AI has strengths, but the ability to have semantics is not 'yet' one of them.

Meanwhile AI can release teachers from the drudgery of administrivia. Smart notices, only relevant and appropriate information needs to be presented. Voice activated everything. Typing is no longer a skill necessary for anyone. Filing systems, database lookups provide just in time rather than just in case information. In that regard dramatic culling of study topics can be undertaken. Teachers may dream of the ultimate correcting algorithm, however there is no substitute for a teacher reading for understanding (or watching a student made video clip), questioning a student to elicit a response then weighing up and gauging their level of achievement.

For example: Fractions as a topic in mathematics could easily be incorporated into an incidental experience rather than dominating mathematics at many year levels for years with repetition and duplication. Similarly, graphing would become data visualisation, logic would be included into early and middle years. Currently logic is not explicitly studied at any level, including VCE IT. Yet logic is a basic skill in every subject at every level. There are many other topics which dominate student study requirements which are now redundant in the age of ready data access. Many of the reasons why these topics remain is as a legacy of simply they are easily tested and can be commonly agreed as a 'standard'. Anything that would replace will be subjective. So fractions remain.

Taken to the extreme, AI threatens the concept of 'schooling', where groups of students are arranged in 'classes' and seek sufficient knowledge to be certified or 'pass' at a predetermined standard. There is no requirement for a student to go anywhere if the AI can be available 24/7 and the demonstration of acceptable progress on learning tasks posted online can be shown.

Flipped classroom movement has attempted to increase the value of the face to face opportunity. Teachers and groups of students in a learning setting provide an opportunity to learn more and faster than is possible online and physically isolated. Similarly the tendency to wax lyrical about the 'engagement potential' for VR (virtual reality) experiences overlooks the need to be more than entertaining. As television and videotape had previously claimed, images will revolutionise the way students learn. Though that statement depends more on the quality of the content and the task than a clever walk through in ancient Rome. Being a virtual tourist into places inaccessible by time or space may or may not lead to greater learning or gaining a better understanding.



https://www.blackincbooks.com.au/books/its-alive

Published August 1st 2017

Teachers provide the insights in such situations, guiding the student experience. Whether AI systems can scale to provide greater exposure to 'the best' teachers remains to be seen. Whether this can be automated is also a question yet to be resolved.

If the purpose of education (and schooling) is to better equip learners with wisdom and knowledge to be productive citizens, then the current schooling and AI systems fall dramatically short.

Ask anyone about their most memorable moment of schooling and without exception it is never the time they gained a high score on an assessment. Invariably it will be an emotional moment when they gained an insight into themselves or others. That is a part of the human condition.

AI can assist, supplement and enhance however education, learning and teaching should be so much more than the simple algorithms currently and foreseeably possible. Perhaps re-visit this topic in another 37 years (2054) and see how the progress is going.

Our Makerspace Journey:

Bentleigh Secondary College

James Lee
Head of eLearning.

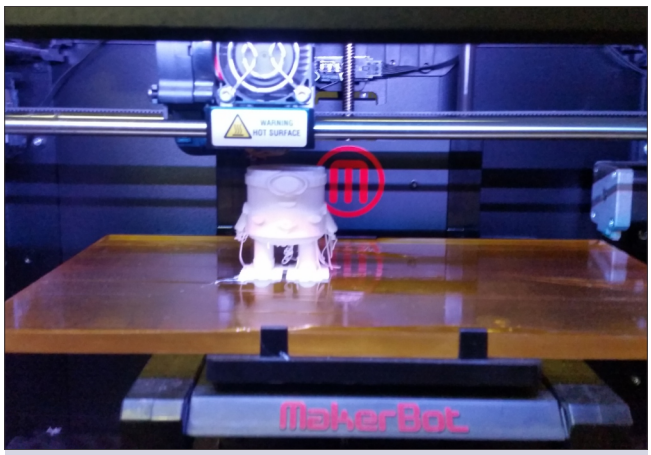
The development of our makerspace was not actually initiated by school, but through the curiosity of a (then) Year 7 student in 2015, who was eager to learn how to code. Hearing about the HTML/CSS course we offered in Year 9 IT, he asked if he was able to access the tutorials we provided them with so he can try it himself. A few days later he devoured the whole course, and came back with some of his interested friends asking if we had any more courses in other programming languages like C++ and Java.

Feeling limited by only being able to offer coding classes within our IT electives and the scope of what they can learn within, we discussed the idea of running an after school club of students who were interested not only in coding, but robotics, computers and developing STEAM based projects. The idea grew, and we "recruited" other students to become leaders in this club such as a Year 8 student who was an expert in Arduino electronics; a Year 9 student who was expert in Linux based operating systems; and a Year 7 who was proficient at building computers. With a group of committed students, we got to work.

We developed a club name (Byte Club) and a membership form that required students and parents to sign featuring terms and conditions particularly in regards to safety. We meet once a week after school on Thursdays from 3:30pm to 4:30pm.

We initially started with collecting old equipment from the IT office to take apart and explore in the library, but that got messy quickly. We were allowed to relocate the club and the equipment in an old storeroom and classroom in the Technology block.

We found that as the club grew, more support from other teachers was needed. So we now have two more teachers who volunteer to attend every so often only to mentor and supervise the students (we never leave them unsupervised). We enforce the idea that this is not a classroom nor do we take attendance; students choose to be there to learn and do and are free to come and go as they please as long as they have an idea of what they want to do in that time.



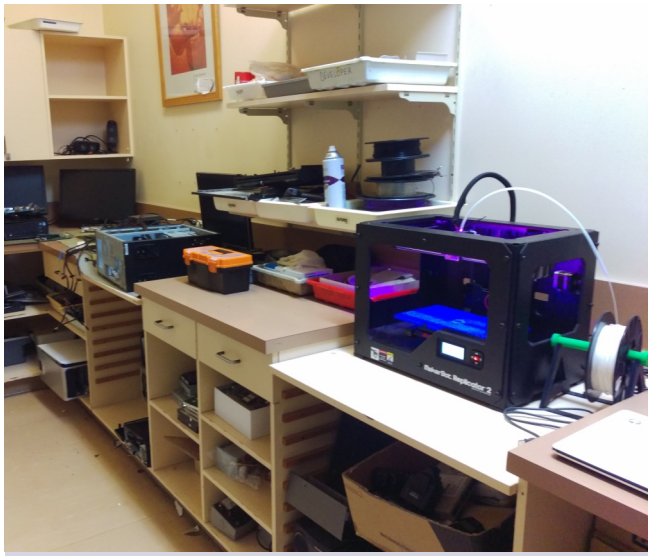
A student prints out a minion she designed on Tinkercad.

We have four tenets of Byte Club: To watch (others do projects); To assist (others with their projects); To Learn (how to do projects); and To Make (their own projects). This caters for the different skill levels and abilities of each member. A student who is good at coding but not at robotics could get help from a fellow student robotics expert, and vice versa for example.

The Byte Club room features a 3D printer the school had acquired earlier on, a large LCD screen that allows a raspberry pi to be attached and coded/configured, and even a set of taps to clean up and for experiments that might require water.

Our collection of equipment is growing based on generous community donations of old computers, laptops and other electrical equipment that we are repurposing (including a Wii!). We are also given a budget to purchase new equipment from the school.

With this we have sets of Little Bits electronics which allow magnetic connecting of components to form circuits, machines and new inventions without prior knowledge of electronics needed. Combined with recycled containers and materials,



Makerspace room 2.0

donated Lego/meccano sets, and or designed components printed on our 3D printer - this is all one needs to invent prototypes of any innovative technology idea they might have.

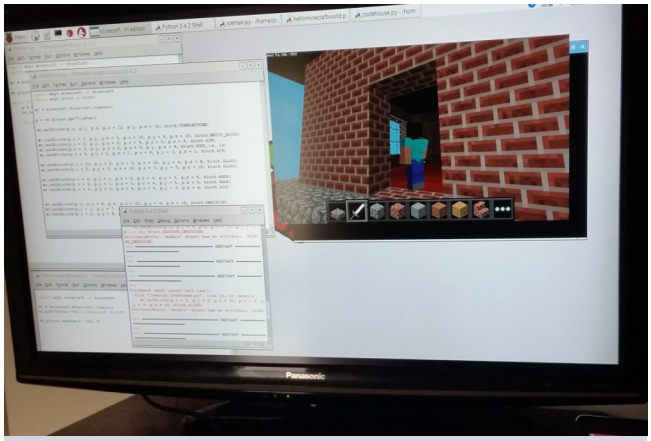
We have "Makey Makeys" which were ordered from the US to allow students to turn any conductive object into a keyboard. For example, turning a bunch of bananas into a piano, or using playdough to create buttons and controls for a PC computer game. We have Arduino kits for the more advanced, allowing students to explore building and controlling through code basic circuits of LEDS and servos which are essential components for basic robotics.

We have Raspberry Pi's with Raspbian OS installed. This comes with a free version of Minecraft that students can learn to make "mods" using guided lessons on Python programming.

Little Bits play

Students are also able to learn coding, video editing, graphic design or 3D design using guided online websites tutorials and lessons facilitated by our staff supervisors or student leaders. Such websites are http://code.org, https://scratch.mit.edu, https://codeacademy.com, https://circuits.io, https://learn.sparkfun.com, http://appinventor.mit.edu, and https://tinkercad.com.

We have old laptops and computers we are rebuilding, reinstalling and repurposing. One project would be to eventually set up our own local network of computers which can be experimented with to learn about network and internet security, load, penetration testing and protection, or even set up a Minecraft server. Another idea would be to donate working repurposed computers to the community.



Minecraft modding a Raspberry Pi

The number of members attending sessions grows and shrinks throughout the years due to school and after school commitments, though there is always a small group of students who attend each session. We had students of all kinds of backgrounds and skill levels join. As our original founders got older with more commitments, they made way for new leaders to take over but are always happy to lend a hand if needed.

We believe that through play comes passion, and from passion comes purpose. Byte Club offers experiences in a fun environment surrounded by like-minded people that many would not find anywhere else. We encourage students to have a go at things they've never tried, to see if they might have a natural skill in particular areas. We encourage students to support and guide others exploring in areas they are skilled at.

Making catapults

Makerspace Spotlight:

MATER CHRISTI COLLEGE

Margaret Lawson
STEAM Coordinator

Margaret Lawson drew upon her 20 years experience as an Information Technology teacher to explore an innovative and creative space that challenge students. Mater Christi College is a Catholic Secondary College in Belgrave, Melbourne with a population of 700 students. Margaret works both as a Teacher Librarian and STEM Educator.

Our makerspace is located as part of our Learning Commons. Both the space and equipment are available to staff and students from 7.45am – 5pm. For our makerspace we have a dedicated area that runs down one side of our main learning area and bookcases under a standing desk that store equipment that can be pulled out and set up when needed.

We also try to Instagram as many of the activities as possible as a way of keeping a record of what we do. Using a tool called Prinkl we can then make posters or paper cubes which showcase the activities that we have instigated across the year. This is an easy and effective way of showing people what we can do in the space.

Our makerspace resources are available at any time to use, however every Thursday we run a formal structured taster activity. We set up desks, mats, equipment and instructions and encourage students will sit down and play with the equipment. If students like what they taste, they are encouraged to then access the equipment outside this structured time. Most of the equipment can be accessed without permission, however the 3D Printers need to be booked, especially when there is a class needing to use them.

Five ways to get your Makerspace Buzzing

Over the last three years we have run many different activities in our makerspace, here are some of the strategies that we use to make them BUZZ.

1. Make sure the activity is hands on, mess is good!

Some of our best activities have involved lots of mess and lots of noise.

During the Christmas break we got one of our long desks raised and turned into a standing desk for our 3D Printers and Raspberry Pi computers. But underneath it looked naked. We purchased four Ikea KALLAX 2x2 bookcases and turned the construction of these bookcases into a lunchtime activity with teams of students.

Standing bench in the Learning Commons
Source: https://www.instagram.com/p/BaFpDxwhlNa/?taken-by=konstantkaos

We advertised the "The Flatpack Challenge" and over a number of weeks and momentum grew as our STEM leaders took control over the promotion and the organisation of the activity. Learning Commons staff prepared the space and organised prizes.

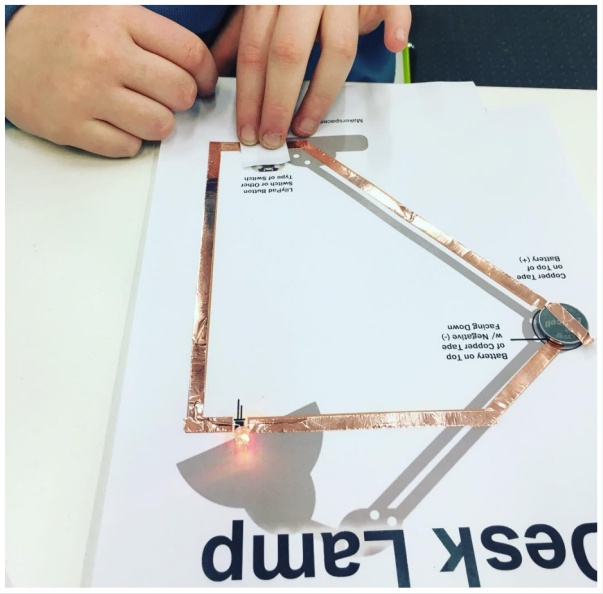
Four teams competed for the prizes and had to fully construct the bookcases without any left-over parts. There was much

laughter, collaboration and communication. The quickest team took 13 minutes to construct one bookcase and by the end of lunch all four were constructed. They are all still standing and full of our makerspace equipment!

Other events that have proven successful has been, making slime, bookbinding and medieval leatherwork.

2. Make sure that the taster activity is short enough to be repeated a number of times.

Throughout our lunchtimes, we have groups of students who wander in and will sit down at the table we have set up and just play with the equipment. The structured activity has to be short enough to finish during lunch and complete with instructions, so that several groups of students can have a go at tinkering.



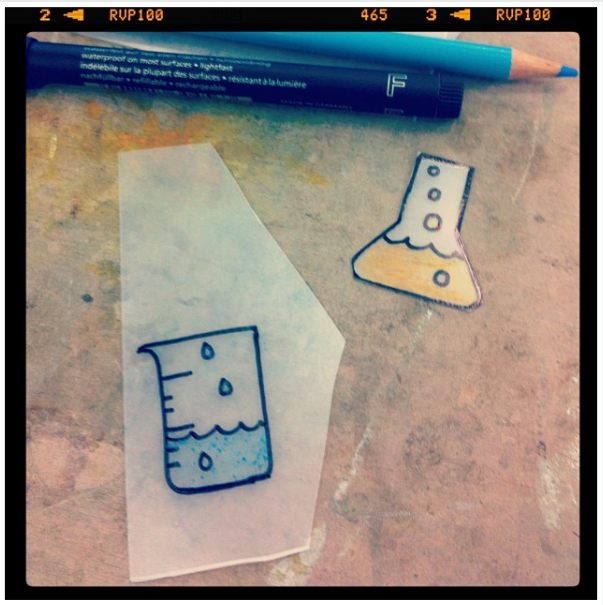
Creating Basic Circuits
Source: https://www.instagram.com/p/BYuwVMeB9FG/?taken-by=konstantkaos

Tasks that are completed over a number of lunchtimes or in after-school sessions are a bit more complex, but the students involved are already invested in the learning and are motivated to work through the problem solving process themselves.

3. If students can walk away with a product, then they can show their friends (and promote your makerspace).

Makerspace activities where students take something away with them, works in a similar way to marketing promotional materials. Some students return to the makerspace asking "can I make one of those" and the ideas spread!

As part of science week, we ran an activity where students could design earrings, brooches or keyrings from scientific images using Shrinky Dink plastic. Many students chose beakers, element symbols and scientific logos.



Creating Shrinkable Plastic Keyrings and Jewellery
Source: https://www.instagram.com/p/6rrP8iLTQS/?taken-by=konstantkaos

Students used permanent markers and pencils to colour their shapes and then we used the staffroom oven to shrink them. Our instructions for this activity included showing the students how much the shrinkable plastic shrank by creating a ruler to scale and then shrinking it down. Students then had to workout the size that their pre-shrunk plastic needed to be to get the desired effect. A great activity in Mathematics!

We have also made hand bound notebooks from recycled materials and lanterns with LED lights. These are all short sharp activities that can be easily replicated many times throughout one lunchtime.

4. Provide instructions that students can use after the activity has finished.

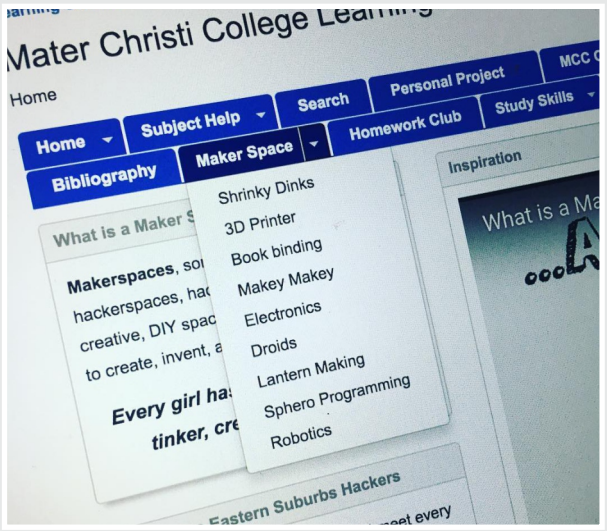
We use our Libguides as a way of documenting the activities that we do ensuring that there is an electronic footprint of the work that we are doing.

Instructions are generated for learners that need a bit more scaffolding and lots of links and video's inspire students to involve themselves in the maker-movement. The Libguide grows and develops according to student (and teacher) interest.

When lunchtime workshops are conducted, we try and include take home instructions encouraging further exploration of the activity.

Often students will return asking to make something that another student has created, and we direct them towards the equipment and the instructions and encourage them to tackle the task by themselves.

5. Get your student leaders involved in promotion and running of the activities.



Our Makerspace Libguide is accessible to anyone who has access to the internet.
Source: https://www.instagram.com/p/BaF0CRJhx0x/?taken-by=konstantkaos

In addition to the Ikea challenge, another of our more popular workshops was Origami with Anri. Anri, a Year 10 student had done her MYP Personal Project on the Peace Cranes of Hiroshima. We had her work displayed in the Learning Commons and we ran a number of lunchtime workshops where students learnt how to fold their own cranes.

Up and coming planned makerspace workshops, include Rube Goldberg machines with our Spaghetti Machine Engineers that came third at the competition at University of Melbourne earlier in the year. Giving students the opportunity to teach others and hopefully infect them with their interest in STEM based activities.

Students that are involved in shaping the space can speak at assemblies and write newspaper or newsletter articles, adding an authentic voice to the activity.

Where to from here?

Our makerspace events are driven by opportunity, availability and budget. We try and link into events that are happening around the college and places like Daiso [bargain Japanese shop], Reject shop and Kmart provide us with low cost materials that students can tinker with.

With the sourcing of soldering irons, "learn to solder" kits and some adafruit arduino boards at the end of 2017, we are hoping to ramp up our makerspace offerings to include more technical and electronic activities.

There is also the opportunity to extend the guided makerspace activities into an "afterschool" time slot where students can tinker or program for longer than 40 minutes. Of course these activities are guided by student interest in the space and effective advertising.

RESOURCES

Mater Christi Makerspace Homepage
http://materchristi.libguides.com/learningcommons/makerspace

Invent to Learn by Sylvia Libow Martinez and Gary Stager
https://inventtolearn.com/

Meaningful Making: FabLearn
http://fablearn.org/resources/

Creating an Inclusive Makerspace Culture: Bulleen Heights School

Matthew Harrison
University of Melbourne

Mel Greaves
Bulleen Heights School

There has been a global wave of enthusiasm for 'makerspaces'. These spaces are popping up in primary and secondary education settings, but also in places that serve as community hubs, such as public libraries, museums and art galleries. Makerspaces are intended to provide a safe space for budding engineers, creatives and software developers to hone their skills through hands-on experimentation and collaborative learning. One place where this trend has yet to really catch on is in special education settings. Mel Greaves at Bulleen Heights School is looking to change that by founding one of the first makerspaces designed specifically for students with Autism Spectrum Condition (ASC). I sat down to talk her and find how she has adapted this concept for her students.

Matt: Can you tell me a little bit about your school and your students?

Mel: We're an autism-specific school, and we have two campuses. A primary and a secondary campus. We cater for approximately 140 students on each campus.

Matt: What made you become interested in makerspaces?

Mel: I have always been interested in innovative teaching and learning practises. As part of my role as leading teacher at the school, I'm highly focused around building teacher capacity in the areas of Digital Technologies and the STEAM-based areas of the curriculum (note: STEAM stands for Science, Technology, Engineering, Arts and Maths).

Matt: Have you seen any really good examples of makerspaces in either mainstream or special schools?

Mel: I haven't seen any makerspaces in any other special schools. I'm sure they exist, I just haven't seen them. I guess I have been doing a lot of reading about makerspaces. To me they are a way of incorporating STE(A)M subjects alongside those 21st-century skills, such as collaboration and creativity. It is really important for students to apply those skills in meaningful projects.

Matt: What are the challenges of introducing a makerspace in a special school setting?

Mel: I guess for all schools, the primary challenge is money. There's no getting around that. It does require some investment to get a new program up and going. To get students together with resources such as staffing, equipment and PD. It also, requires space. Whether for storage of equipment to be borrowed from, or as in my case, where I've chosen to have a specific designated leaning space. A supportive and forward thinking Principal Class team is essential. I've had to persuade leadership that giving up a space for this project is worthwhile pursuit and investment. Having this dedicated space, and supporting the philosophy behind, requires a bit of a leap of faith on their behalf.

For children with autism, the challenges to the makerspace are more about supporting skills development required for the projects themselves. The challenge is not so much getting students involved. A student who wants to create a video game needs to be encouraged to explore how that can be achieved and scaffolded or work towards achieving that. Students with autism require a lot of structure, and traditionally people tend to think of people with autism as not being very creative, or not able to think laterally. This is not always the case. I think for me, the challenge has been 'how to get the kids started in something that's meant to be really student-directed, creative, and collaborative?' Keeping in mind, these students may not have been widely exposed to these types of activities in the past.

Matt: How do you support these students who we think of as needing routine?

Mel: The way I approach it is, I start off being quite structured. For instance; I have a lunchtime club to get a mixed group of students involved. I've gone around and given them ideas of things that you could do in the makerspace. "In the makerspace, we could do this." and "This is the equipment in the makerspace. How could you use it?" "What might you like to work on?" I'd say, often, to start with, most of them just want to use the amazing Lego. I'm like, "Okay. What would that look like? What would you like to work on? Would you like to make something with Lego and create a stop-animation? Are you going to use the robotics?" etcetera.

Getting them to try and brainstorm what they're wanting to do in the space, is probably the hardest part. What works the best is giving them set challenges as class groups. "Okay. I want you to design the longest marble run." My advice is to begin by giving them really specific set projects or challenges, to get them having a go at working through a design brief. To get them exploring. To get them creating. To get them collaborating.

Matt: What's been the most popular project at your school?

Mel: A combination of movie making, with stop-motion animation and making props for movies. Last year we had a life-size Tardis built. These projects definitely fit into our STEM work. I worked with the teacher of that class to get her students using STEM principles a lot more, starting with the Lego. The students just love doing any challenge with the Lego. They love it.

Matt: That's really awesome.

Mel: Having said that, a lot of them really love just using low-tech items, such as creating with; cardboard, masking tape. Getting them started with set specific challenges. "I want you to see if you can build me a bridge that holds up a 5 kg weight."

Matt: What's been the biggest surprise from starting a makerspace at your school?

Mel: I guess my biggest surprise is how excited people outside of the school are as well, when I talk about my makerspace and when they visit and see it. It's always nice to know that other people outside of the school are really excited about this stuff, as well.

Matt: What is your top tip for teachers starting a makerspace in a special setting?

Mel: There's a lot of cheap, low-tech equipment that you can get. It doesn't need to be all about expensive robotics or expensive kit and Makey Makeys. You don't need all of that to get started. You don't need a 3D printer. You can start off with some donated Lego and cardboard and sticky tape. There's a lot of free online coding software to get kids engaged in making digital content.

Matt: Thanks Mel for sharing your insights with the DLTV community, and I look forward to coming to visit your Tardis soon!

Melanie Greaves is a leading teacher and Digital Technologies specialist at Bulleen Heights School in Melbourne Victoria. Melanie is helping to lead the design of the ABLES assessment tools for the Victorian Digital Technologies curriculum for students with disabilities. Matthew Harrison is a lecturer and researcher at the University of Melbourne, and a Digital Technologies leader at Waratah Special Development School.

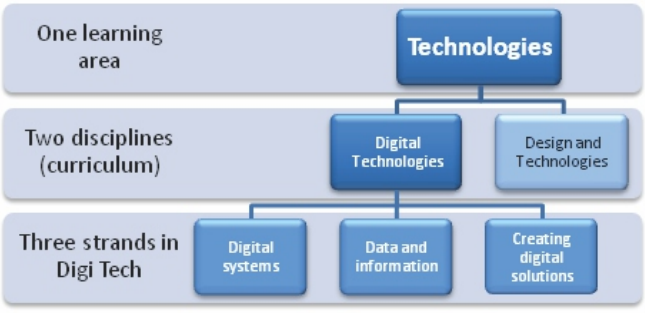
THINK BEFORE YOU CODE:
Digital Technologies in the Victorian Curriculum

Paula Christopherson

Introducing the curriculum

Digital Technologies (Digi Tech) is one of two disciplines within the Technologies learning area, with the other being Design and Technologies. The Digi Tech curriculum is new, with its conceptual roots in computer science. In essence, Digi Tech involves students creating digital solutions through the use of information systems and specific ways of thinking. It is about solving problems through the creation of digital solutions that require an understanding of computation principles and practices. Figure 1 shows the structure of the Technologies learning area and the strands in the Digi Tech curriculum.

Figure 1: Structure of Digital Technologies within the Technologies learning area



The study has five aims (VCAA, 2017c) and these should be the key reference points when developing teaching and learning programs. These programs should focus on students:

- designing, creating, managing and evaluating solutions that are innovative (non-routine) and sustainable
- applying computational thinking concepts
- confidently using digital systems to acquire, communicate and create data, information and solutions
- applying social, ethical, legal and technical protocols when communicating, collaborating and creating information and solutions
- applying systems thinking to monitor, analyse, predict and shape interactions between people, the environment, data and digital systems.

Key messages about Digi Tech

There are several important messages that schools should consider when implementing the Digital Technologies curriculum.

Mandate

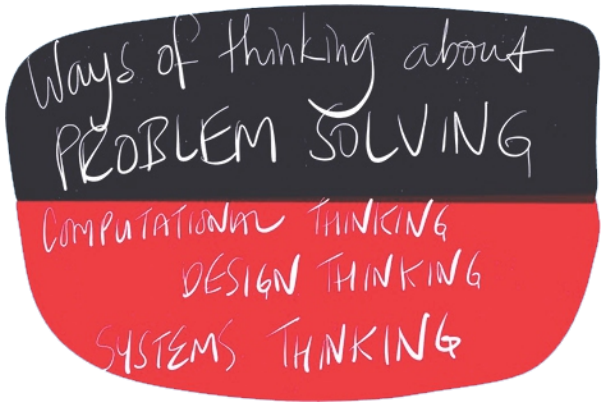
All government and Catholic schools are required to provide students with the opportunities to demonstrate the standards in Digi Tech from Foundation to Level 10. Offering the highest band (Levels 9 and 10) differentiates Victoria from all other states and territories, where the band is optional. Schools are expected to have commenced the implementation of the curriculum this year.

Ways of thinking

Digi Tech is as much about using different ways of thinking about problem-solving as it is about using different digital systems. The curriculum requires students to apply computational, design and systems thinking to create digital solutions, as shown in Figure 2.

Up to 50 per cent of the curriculum can be learned 'unplugged', meaning not using a digital device. This is a clear

Figure 2: The Digital Technologies curriculum involves applying a set of thinking skills. Image courtesy of Paul Clapton-Caputo, Department for Education and Childhood Development, SA.



point of differentiation from ICT, which is dependent on the use of digital devices to perform tasks such as communicating, acquiring and creating data and information.

Nomenclature

Digi Tech is not a new name for ICT or eLearning despite the fact that some learning areas refer to digital devices used by students as digital technologies. Developing ICT capabilities mean students becoming effective users (or consumers) of ICT to support their learning in all fields of endeavour. In this instance, students use solutions developed by other people to create and communicate information. Typically within the Victorian Curriculum explicit references to ICT are embedded in the content descriptions for some learning areas. For example, at Level 6, English, students learn how to 'use a range of software, including word processing programs, to create, edit and publish written and multimodal texts' (VCAA, 2017a).

This contrasts with the Digi Tech curriculum that focuses on students becoming confident *developers* (or creators) of digital solutions. For example, at Levels 5 and 6 students learn to 'develop digital solutions as simple visual programs' (VCAA, 2017b). In Digi Tech students are creating their own solutions rather than using others. They might be instructing a robotic device to 'collect' objects or creating a grammar game or creating a friend-matching app.

Unpacking the strands

While the content of the curriculum has been organised around three strands, there is an interconnection between these. There needs to be respect for the integrity of each content description within a strand as well as an understanding of how they all fit together when solving problems.

Digital systems

This strand focuses on the hardware and software that when combined form digital systems. Digital systems can be networked to support the transmission of data and information across a connected set of digital systems. The curriculum also examines information systems that comprise digital systems, data, processes and people. Student learning across the Digital systems strand progresses from exploring and using digital systems, through to a study of how digital systems form networks, culminating in the study of how data is protected, moved and controlled at Levels 9 and 10. Examples of digital systems and peripherals include notebooks, laptops, mobile phones, robotic devices, digital probes and speakers.

Data and information

This strand focuses on four key areas, namely:

- how data is accessed and checked for its validity
- how data is presented in order to improve the communication of its message
- ways in which data is represented digitally to enable processing and storage, such as in binary form
- creating ideas and information for sharing online.

Aspects of this strand have the closest connections to some other learning areas, particularly with respect to the quality and presentation of data, so many school programs would already be addressing some of this content. Figure 3 teases out some of the content areas in this strand, using colour coding to indicate the band at which content is covered.

Creating digital solutions

This strand provides the content for the processes involved in creating digital solutions, namely analyse, design, develop and evaluate. These processes differ in name from the Australian Digital Technologies Curriculum; however, the content descriptions are almost exactly the same. The Australian Curriculum has five processes. See Table 1 for a comparison of processes between the two curriculum documents.

Analysis involves identifying the individual elements of a problem and considering the cause-and-effect connections between these elements. It also involves stating what the solution needs to be able to do (functional requirements) and the characteristics the solution should possess (non-functional requirements).

Design involves writing the set of instructions for how the solution is going to be created and documenting how the solution will look—it is about 'how', whereas analysis is about 'what'. The set of instructions (procedures and decisions) is called an algorithm.

Figure 3: Mindmap of key content in the Data and information strand

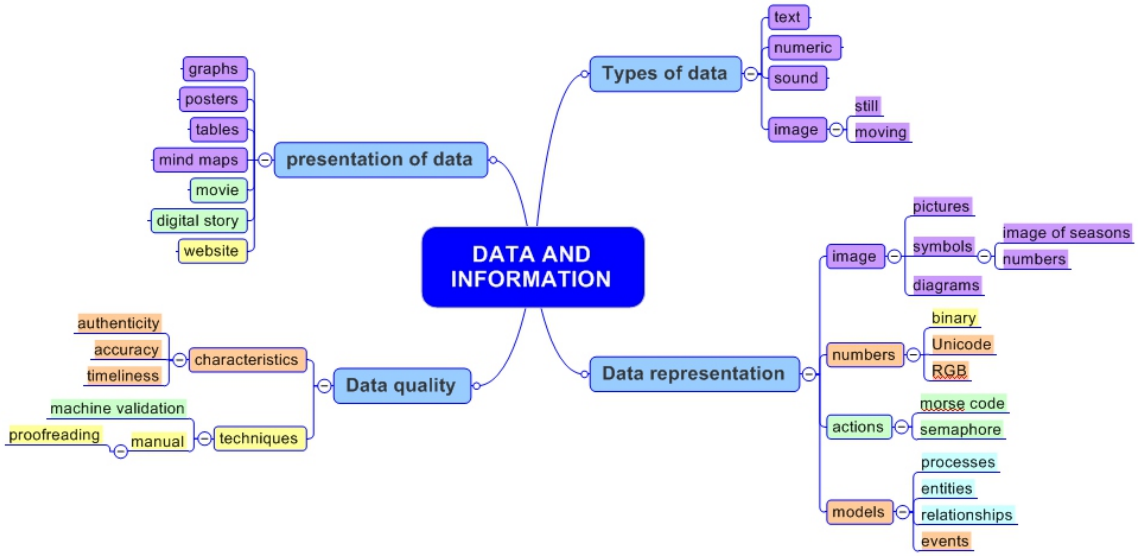


Table 1: Comparison of processes for creating digital solutions

Victorian Curriculum processes	Australian Curriculum processes
Analysis	Investigating and defining
Design	Generating and designing
Development	Producing and implementing
Evaluation	Evaluating
	Collaborating and managing

Developing is the process of bringing the set of instructions to life, typically through the use of a programming language. This is usually referred to as 'coding'. The development process is about enacting the design. While most of the development process is achieved through coding, it also involves using application software, such as the Microsoft and Adobe suites, to support the creation of solutions. Over the bands, students progress from using block-based (image) languages that have no syntax, such as Kodu and Scratch (Levels 3 to 6), to procedural/scripting languages, such as python and Ruby (at Levels 7 and 8), and object-oriented languages, such as Scala at Levels 9 and 10.

Evaluation involves considering if the solutions developed by the students and others are 'fit for purpose'. Students progress from evaluating solutions that meet specific personal needs (Levels F to 2) through to considering the risks associated with their solutions, if implemented, and their levels of sustainability and innovativeness (Levels 9 and 10).

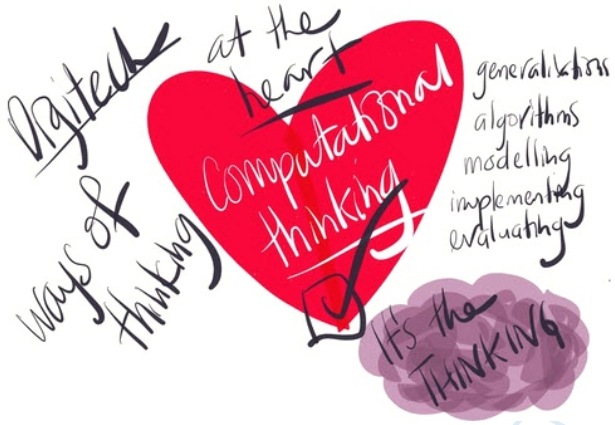
Ways of thinking

A defining feature of a computer-science based curriculum is the particular ways of thinking about problem-solving that involves computation. In the Digi Tech curriculum the driving force is computational thinking, in combination with design thinking and systems thinking. The weighting given to each of these ways of thinking will vary depending on the process and the nature of the problem. These skills take practise, and teachers should be always on the lookout to find opportunities in all learning areas to develop these capabilities.

Computational thinking

There are many definitions of this term but as a generalisation computational thinking (CT) involves representing human knowledge in a way that can be transformed into solutions using digital systems. It is a hybrid of thinking—a multifaceted way of approaching problem-solving, as shown in Figure 4.

Figure 4: Computational thinking is at the heart of the Digi Tech curriculum. Image courtesy of Paul Clapton-Caputo, Department for Education and Childhood Development, SA.



Some aspects of CT include:

- identifying patterns—it is about finding similarities within and between problems, and data. It involves identifying repetition so you can remove it, as well as identifying errors that do not fit patterns
- precision—this is the hallmark of algorithms (a set of procedures and decisions required to solve a problem). The quality of a solution is as good as the instructions. There is no room for second guessing, so sequence and syntax are essential. It is similar to a recipe or a knitting pattern—if you miss or reorder a step you are likely not to create what was intended. See Figure 5 for an example of a knitting pattern, which is an example of an algorithm

Row
4. K
5. Repeat row 3
6. K
7. Repeat row 3 (repeat row 3 once more for larger size)
8–13. K 5 (6–7) rows
14. K to last 6 stiches, k2tog, k1, k2tog, k1 (2nd circ) k1, k2tog, k1, k2tog, k to end

Figure 5: Extract of a knitting pattern (Lewis,2008)

For a solution to work correctly every step in its development must be logically scheduled and expressed in the correct form. Students begin writing algorithms from the F to 2 band. Algorithms can be described in many ways, one of which is using flowcharts to visualise the algorithm, as shown in Figure 6. This flowchart shows the steps and decisions (formulation rules) to make the present participle of a verb. Try the process with the word 'bake'

- decomposing—the process of breaking down a task or problem into smaller, manageable parts. This allows separating elements within a problem according to their type. It is about chunking to help make problems more clearly understood
- logical thinking—it is about using reasoning to come to a conclusion, based on an analysis of facts. For example, in English you could ask students to explain what they think a character will do next in a novel, or explain the character's actions in the story so far. In Digi Tech students would use logical thinking to predict the behaviour of simple programs
- abstract thinking—this is the process of simplifying a complex problem to define its main ideas. This is achieved by focusing on the important things and ignoring irrelevant details. It is about filtering in order to concentrate on what is important. Abstraction is typically applied when analysing problems, as you need to distil facts in order to arrive at the main ideas; however, when writing algorithms, it is necessary to ensure that all steps and decisions are recorded logically and precisely.

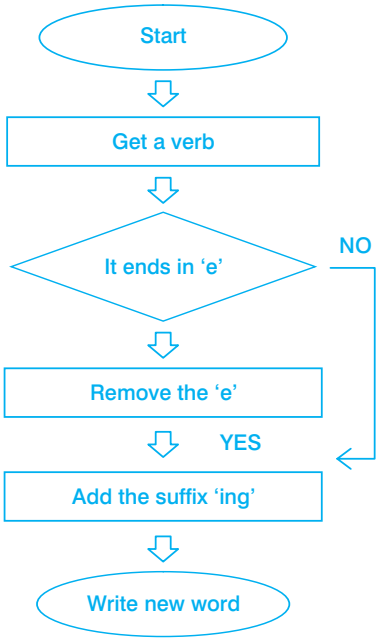


Figure 6: Formulation rule for making a present participle of a verb using a flowchart (Izu & Weerasinghe, 2015, p. 17)

Design thinking

This type of thinking is more than creative thinking. It involves devising a strategy in order to:

- understand design problems
- generate and visualise ideas
- analyse and evaluate ideas for further development.

Designing thinking goes beyond imagination. It requires the creation of a solution and its innovation (or implementation). In a school setting the innovation step is rarely achieved, but should not be ignored as an aspiration. **Note:** The Digital Technologies curriculum does not require students to implement their solutions.

Ideation is the creative process that underpins design thinking.

According to Nijstad, De Cruc, Rietzschel & Baas (2010), creativity is typically defined as 'the production of ideas, problem solutions and products that are both novel (original) and appropriate (feasible, potentially useful)' (p. 35).

Creativity typically involves both divergent (creative) thinking and convergent (critical) thinking. It involves generating ideas that need to be assessed in order to select the preferred option that in turn will be further developed into a solution. This requires flexibility of thought as well as persistence in systematically striving to achieve an appropriate new or novel solution.

Time is required to develop the design-thinking subsets; time to generate ideas without passing judgment on their merits, and time to filter these ideas using criteria to determine the preferred idea. Students need time to incubate their ideas, but there are many competing demands on time in schools, sometimes leading to short cuts in teaching and learning.

We need to be careful of not falling into the trap of assuming that creativity is just innate—that we cannot help students become flexible thinkers, hence creative ones. Unfortunately non-creative behaviour is learned. From the age of seven or eight years children become more socially aware and lean towards conformity. This is often coupled with a teaching regime that is less tolerant of differences and is fast-paced. Creative thinking techniques must be explicitly taught if students are to move from creating routine solutions to simple problems to non-routine solutions to complex problems. This does not happen just by osmosis. The Harvard Graduate School of Education's See / Think /Wonder thinking routine is used in many schools, and it provides a simple, but effective construct for students to question routine behaviours.

Systems thinking

Systems thinking is very important as we live in a global society and economy supported by networked information systems. Systems thinking involves taking a holistic approach to identifying and solving problems where the parts and components of systems are interrelated (VCAA, 2017c). It is important to understand that in a networked society and economy, the output produced from one system might become the input into another system, hence the accuracy and security of transmitted data and information is very important. It is also vital to consider the users of the systems, making sure that the solution is useful and user-friendly, and that the users feel confident that the data they provide to a system is secure. For example, there is a strong interconnectedness between a banking system and Centrelink—if incorrect data is supplied to Centrelink, then it is possible that direct debits into a bank account will also be wrong. Where appropriate, these types of considerations should influence the design of a solution, such as security measures, the ability to validate the reasonableness of data, and the options provided in the solution to opt-in or opt-out of services.

Curriculum connections

This curriculum requires space within a school's timetable, and there are many competing demands for spots on this timetable. School leaders must consider how best to preserve the integrity of the curriculum as well as make meaningful connections to other learning areas so efficiencies and effectiveness outcomes are achieved. Authenticity of problem-solving is core to this curriculum, so where ever possible, students should be attempting to create digital solutions to real problems.

Types of connections

When scouring the Victorian Curriculum consider if there are connections based on:

- common concepts, such as methods of inquiry and design
- common words, such as 'create' and 'ethics'
- contexts, such as settings or applications that provide a meaningful environment for student learning, such as exploring eating habits (Health and Physical Education) and migration data in History.

Conceptual connections

Conceptual connections usually share common words and a common intent. There is a core of common knowledge and skills between relevant learning areas; however, there are differences that reflect the nature of each learning area. When commonalities are identified, then efficiencies should be gained because the core knowledge and skills do not have to be taught for each learning area. However, what is important is that the teaching and learning is nuanced to accommodate each learning area's perspective. Similarities and differences are shown in Table 2, which compares the types of inquiry for History and Science.

Table 2: Similarities and differences between the types of inquiry in History and Science

Learning Area	Inquiry processes				
History	Questioning	Researching	Analysing	Evaluating and Reflecting	Communicating
Science	Questioning and predicting	Planning and conducting	Processing and analysing	Evaluating	Communicating

Word connections

Some learning areas share common words in the content descriptions that have a shared intent. In other instances a word may not be common; however, it has a common intention. Table 3 identifies some common and non-common words that share similar intents. In these instances, teaching and learning programs can embrace these connections and minimise the duplication of teaching efforts and potential student disengagement.

These connections provide opportunities for students to use real data for a real purpose that leads to real learning.

Conclusion

The Digital Technologies curriculum is a rich source for teaching and learning programs that challenge students to be flexible and systematic thinkers. There are aspects of the curriculum that will also challenge teachers, and this is acknowledged through the increasingly available online resources, such as those published on ESA's Digital Technologies Hub and the Victorian Curriculum's website, as well as professional learning programs. The challenges are not insurmountable so start implementing the curriculum even if you start small. You and your students will be rewarded.

Table 3: Making connections based on words with shared intents at Levels 3 and 4

	Digital Technologies	Media Arts	Science
Content description	Collect, access and present different types of data using simple software to create information and solve problems	Use media technologies to create time and space through the manipulation of images, sounds and text when telling stories	Represent and communicate observations, ideas and findings to show patterns and relationships using formal and informal scientific language
Common word; same intent	Create • information • solutions	Create • stories	
Non-common word; same intent			Represent and communicate: • ideas • findings (create)
Non-common words; same intent	Simple software	Media technologies	
	Types of data	Images, sounds and text	

Context connections

In many instances there are settings or environments in other learning areas that suit the development and application of Digi Tech knowledge and skills. For example, for the Data and information strand at Levels 5 and 6 there are many meaningful opportunities for units of work that have connections to other learning areas such as:

- Economics and business, where students could collect data about the types of resources found in the school and make conclusions about the effects on the environment and sustainability
- Science, where students could record, represent and analyse the melting and freezing times of different types of liquids
- Geography, where students could collect data about specific countries, representing the data in graphic form looking for patterns and drawing conclusions.

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‘Problems of Practice’ in Digital Resource Design

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Much time and reflection go into the consideration to how we curate resources to develop a compendium on a theme for use with our students. As teachers, we often appear to work intuitively in developing what looks like a good resource and deciding what will work in our classrooms. However, these decisions are often informed by previous experience of what has and has not worked with particular students and hence the sense of working intuitively may not be a realistic description of such work. In this paper we will outline approaches to uncovering 'the implicit' in our pedagogical work. Specifically, we will consider a problem of practice encountered as the team of authors curated and designed digital resources.

The problem of practice

The problem was how can we develop our appreciation for multiple perspectives when designing humanities focused digital resources for upper primary school students to embrace multicultural Australian paradigms? In considering this problem, we will need to think about what is implicit in what we are doing and how does this implicit thinking become explicit in a collaborative digital setting. In these collaborative contexts what is implicit for one designer may not be implicit for another and it is not until it is made explicit that an appreciation for differing perspectives is possible. In exploring these ideas, we initiated a self-study approach in uncovering our assumptions implicit in our pedagogical approach to designing resources for student use in classrooms.

The 'problem of practice' we encountered is suitable for a collaborative self-study focusing on reframing pedagogy (Fletcher & Bullock, 2015; Mena & Russell, 2017). It is important to understand that 'problem' in this sense is not considered a deficit but is “linked to the notion of a curious or puzzling situation or dilemma, tension, issue, or concern. It is something that causes one to stop and pay more careful attention to a given situation” (Loughran, 2004, p. 25). It can be interpreted as an instance of “wonderment” (Samaras, 2011, p. 7) that led to a more well formulated focus for self-study.

This problem of practice was encountered when using the collaborative platform Popplet to storyboard our design for digital resources that would later be developed as a series of interconnected websites on Weebly. The use and agency of Popplet ideas organiser and the Weebly website platform in this scenario will be explored here, however this article primarily serves to provocate the idea of self-study in problems of practice in digital resource curation and design in a way that is informative for teachers and resource developers.

Our digital resources brief

The author team are working on developing digital resources for year 5 and 6 humanities integrated curriculum. The intention is to provide a coherent set of digital resources based principally on a pedagogy promoting enjoyment of learning or 'critical enjoyment' (Redmond, 2013). Although the pedagogy of 'critical enjoyment' coined by Redmond (2013) originates in media literacy education, it can be applied across other curriculum areas. Redmond (2013) explains that, “critical enjoyment is transferrable to other content areas when teachers provide opportunities for learners to harness their own intellectual curiosity and derive satisfaction from learning via curricula that connect to and integrate multiple media texts” (p. 115). Given that enjoyment, critical thinking and the use of multimodal texts is cited numerous times (see Table 1) across the entire Victorian Curriculum (Victorian Curriculum and Assessment Authority, 2017). 'Critical enjoyment' provides a pedagogical approach that incorporates the affective and cognitive domains in learning experiences and hence encourages intrinsic motivational factors to enhance learning.

Table 1: Number of times enjoyment, critical thinking and multimodal texts are cited in the Victorian Curriculum (at 5 November 2017)

Term	Broad search result[1]	Exact match[2]
Enjoyment	97	97
Critical thinking	374	18
Multimodal texts	1971	160

1. Result includes boolean AND OR results
2. Result returned when the terms are in quotation marks

Informed by this pedagogy of critical enjoyment, we will address a number of Victorian Curriculum history content descriptors in the resource, including for example:

- The effects of a significant development or event on a colony (VCHHK090) and
- Significant contributions of individuals and groups, including Aboriginal and Torres Strait Islander peoples and migrants, to changing Australian society (VCHHK096)

(Victorian Curriculum and Assessment Authority, 2015a)

There is a deliberate juxtaposition of these two content descriptors here, chosen from a number of intended outcomes our resources will be based upon. Such descriptors reveal the need for integration of multiple paradigms. Aboriginal and Torres Strait Islander Histories and Cultures is a national priority reflected in the cross-curriculum capabilities of the Australian Curriculum (Australian Curriculum, Assessment and Reporting Authority, n.d.) however, these are embedded within the curriculum areas of the Victorian Curriculum (Victorian Curriculum and Assessment Authority, 2015b). Additionally, integration of ethical and intercultural capabilities is a fundamental inclusion.

One of our implicit assumptions in designing the digital resources is that the final product will be a combination of multimodal viewing texts, including interactives and aligned activities to engage students in the development of their learning. This can be described as integrating new literacies (Forzani & Leu, 2012; Rosaen & Terpstra, 2012) in the humanities curriculum that recognises literacy learning as a socially situated activity (Rosaen & Terpstra, 2012; Wenger, 1998). Rosaen and Terpstra (2012) explored their own practice in their work engaging teachers in understanding and teaching new literacies through collaborative self-study. Self-study with a focus on practice was seen as an opportunity in "uncovering pedagogical tension, challenges and successes" (p. 39). To uncover our pedagogical challenge, we have documented our collaborative approach to digital resource design.

Our collaborative resource design approach

We have already developed practices around embedding the use of technology as a sociocultural element. We extended our practice in the resource planning phase from using google docs to the Popplet platform (see Figure 1).

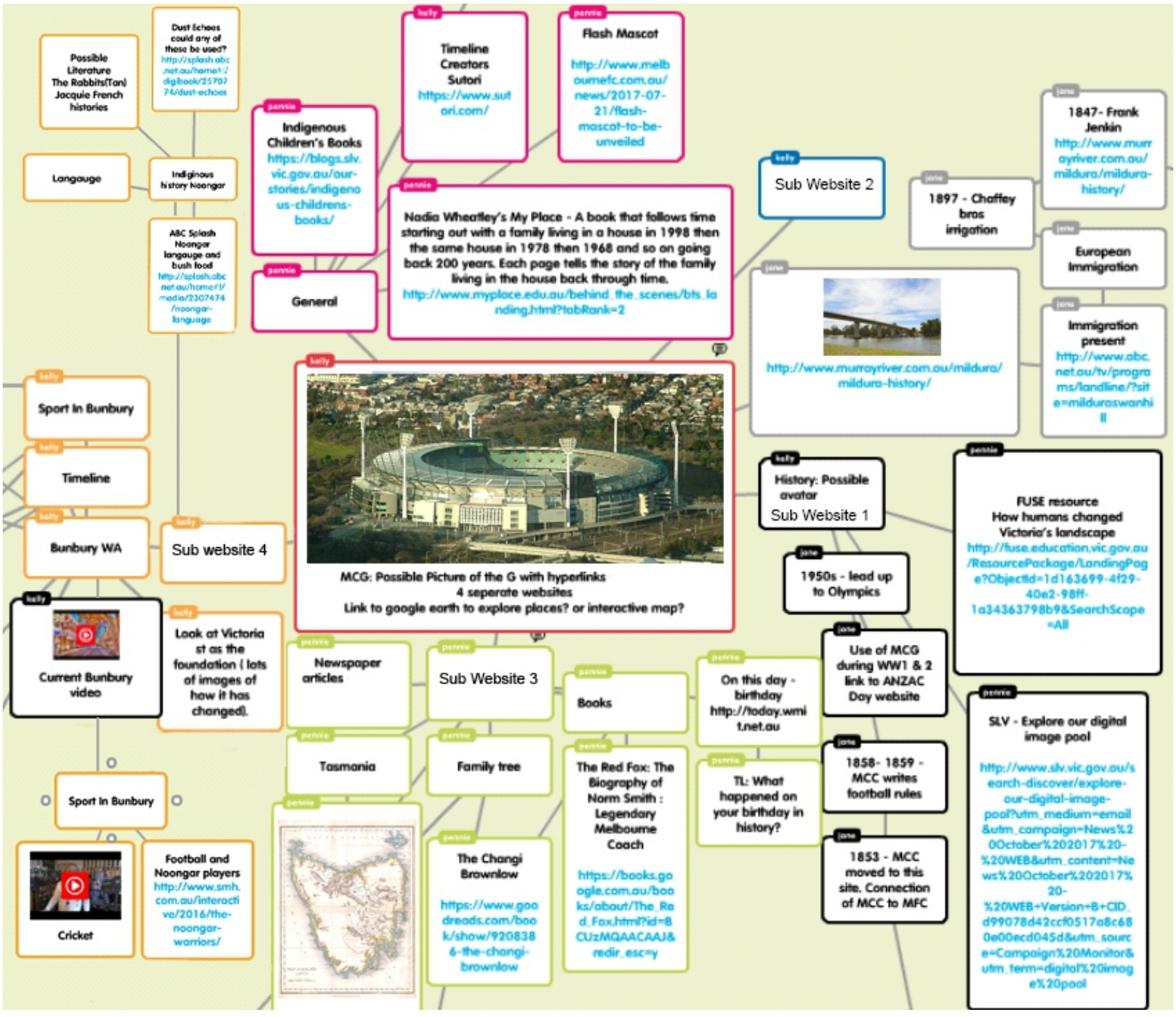
Although the team was working face-to-face, the Popplet platform was a distance reducing medium, affording a shared digital space that was an important catalysis in design considerations.

There are legal and ethical practices to consider when designing and curating digital resources for classroom use. Our decisions relating to representations of people and the potential impact of such representations is an ethical aspect of our design practice that needs to be continually examined throughout the process. The legal considerations are also important when designing for open access resources to be situated on the web. We have an obligation to adhere to copyright in our planning. We not only want to teach intercultural and ethical understanding through these resources, but subsequently embody these principles in their design.

The affordance of the use of colour in Popplet informed later decisions to use colour to theme the series of websites that would host the final product. We discussed using the state and territories colours the materials related to. We could also now consider the implications for this. How did the state colours come about?

After briefly researching this it was discovered that some states have officially adopted colour as part of their insignia such as Queensland (The State of Queensland, 2017) and South Australia (Government of South Australia, 2017) and others have not. Some state and territory colours are known through popular use. For example, in Tasmania there are no official colours, however, the Government has recorded the recognised State sporting colours as bottle green, yellow and maroon (Tasmanian Government, n.d.). The Australian Capital Territory recognises blue, gold and white as the official colours (ACT Government, 2017) drawing on the city colours blue

Figure 1: A modified snapshot of the Popplet supporting collaborative curriculum development (content moved from original position so it can be seen better in the screen shot). The original layout of earlier version can be seen in Figure 2. (All images within this figure are in the public domain)



and white as represented in the Coat of Arms as well as blue and gold, as the traditional sporting colours. Blue and gold for sporting use was taken from the Australian Coat of Arms. The ACT Government report that, "The choice of colours maintains existing traditions, reflects a link with natural history and preserves heraldic tradition and practice" (ACT Government, 2017). This is one example that indicated the importance of making explicit the 'implicit' to understand the implications of such decisions.

The kinds of questions that arise though such collaboration and reflection are: What are the implicit pedagogies at work when we make these kinds of decisions? Who do we represent? What do we reinforce socially and culturally when these resources are used in classrooms? Are the implicit pedagogies aligned with our intended pedagogies? If implicit pedagogies are uncovered does this transparency give rise to adopting these as explicit pedagogies if they are aligned with the intentions, or does it provide an opportunity to rethink decisions and representations in artefacts?

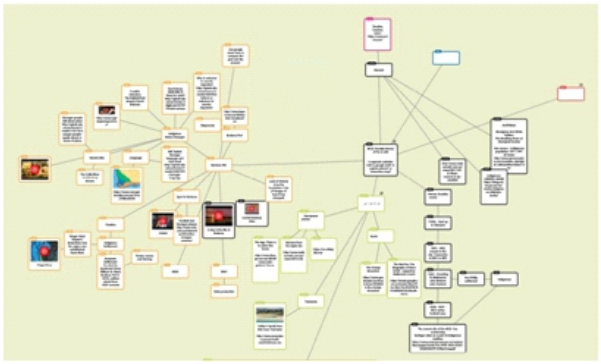
We also needed to consider the role of technology. The distinction between technology as "a social and cultural practice" and technology as a tool has been explored by

Hoban (2004, p. 1039) in a review of three self-study research case studies. Do we consider Popplet and Weebly as sociocultural actors in our design process having agency (Latour, 2005)? Collaboration using technology such as Popplet and Weebly can "alter in unexpected and significant ways the activity itself as well as those involved in it" (Borgmann, 1984; Norman 1993, in Araya, 1997, p. 61). It was intended that Popplet would support our collaborative work so our practice could be seen as a response to the use of Popplet if not a result (this concept is also discussed in the reprint of Henderson, 2011 in this issue; Wenger, 1998).

Self-study journal reflections

In this section our written reflections about our experience are presented and discussed. The screenshot of the Popplet (Figure 2) depicts an earlier version of our collaborative planning than Figure 1.

Figure 2: Popplet in earlier form to demonstrate the web of ideas



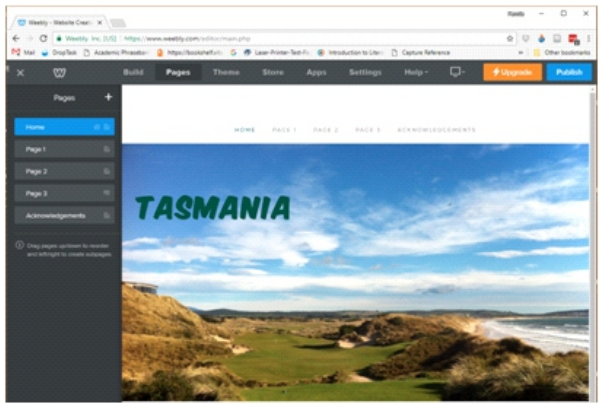
Kelly introduced the use of Popplet to the team, as a collaborative platform to represent the individual research we had been doing independently. In Kelly's reflection (see inset) she describes representing the ideas for the resources in the Popplet concept map (See Figure 2) as a 'scattergun' approach, in the sense of how the brainstorming concept map took shape. In her reflection, Kelly grapples with the idea of multiple histories and how to reconcile these as "intertwined stories which explored a richness of place".

Kelly's reflection

"As we added ideas onto the Popplet I realised that each of us had a different approach to the historical mapping and examination of place, even though we all had the same conversation. I had taken a scattergun approach to mapping and was wrestling with how I would present the information in a linear approach when the Popplet was clearly displaying the complexity and breadth of my thinking that did not align with a linear approach. I started researching European history of place and went back to an examination of indigenous settlements, but I was struggling with how to represent both the indigenous and European settlements as dual and intertwined stories which explored a richness of place without trivialising it to a series of facts."

When we began to think about how the resources might be translated to a platform of multiple websites this seemed to necessitate a hierarchical and linear presentation of materials (See Figure 3).

Figure 3: Weebly website builder denoting linear structure required



Jane observed that the structure of the resource planning that was taking shape may not be representative of the "complexity" of the "intersection across events and places" that she had in mind (See Jane's reflection inset).

Jane's reflection

"When I started imagining how this resource would support school-based learning, I found that I was thinking in terms of going backwards in time. I knew there would some intersection across events and places so thought that the complexity would be embedded in my planning. Yet, the thinking represented on Popplet showed this early planning reflected a quite linear view of time and place. Using the Popplet was a good check for my thinking and made me realise that that was not what I meant at all. I began to make connections to other events in history and over time I suspect the networking will be quite detailed.

However, the positioning of indigenous history as pre-European settlement still jumped out at me. What does it mean to draw this 'line in the sand' of historical accounts? How do we avoid falling into a Euro-centric account of early white settlement? How do I find out more about this 'silent' side of the story and then how do I represent that in a way that is able to be understood by primary -aged students? My own education paid little attention to indigenous history and morally I know this is a shortcoming that needs to be addressed. So, if I want to look at the impact of irrigation and migration on the Riverina in post-WW1 Australia, how do I learn the stories of indigenous communities to help me shape a fuller picture of this passage of time?

The Popplet was an effective tool in recording thinking and making connections. It also raised an awareness of the limitations of my own content knowledge. With so little at hand how could I embark on complex planning?"

We have already begun to challenge our perspectives on how we structure resources and what assumptions are implicit in our decisions. Specifically, when designing a resource centred around place and history, we reflected that our understandings of place might be different to indigenous understandings and connections with place.

Our collective realisation that our choice of what might appear to be a linear structure for the resource may not result in an immediate shift in structural design of the resources due to technical or knowledge constraints. However, we are embracing the challenge to reflect multiple perspectives not only in the content but also in the design of digital resources.

Pennie's reflection

"In the process of using Popplet the team readily agreed on the direction to take. It struck me that we had congruence in our pedagogical approaches. We agreed to structure resources by place and then by a backward running timeline, common to the discipline of history. I recalled from my reading that the Indigenous peoples' connection with land is spiritual and that land is for collective use of all, not something that can be owned. I wondered how we could incorporate Indigenous and multicultural paradigms of place and time? How could our design give a sense of or at the very least acknowledgement of multiple paradigms? How can I develop resources that offer authentic representation? How do I grow and shift my worldview?"

There is identity work involved in undertaking a self-study into our understanding and development of multiple perspectives when designing digital resources. An understanding of multiple perspective could well lead to a change in world-view (See Pennie's reflection inset). How can the articulation of the implicit translate into changes in the user interface design and make explicit the resulting pedagogical shift in the digital resources? These realisations have already raised implications for our practice and identity as teachers (and resource curators for teachers and as professional learning and resources providers). We hope that by undertaking self-study we may develop a critical understanding of our practices relating to the application of our pedagogies in the context of digital resource curation.

We wondered how we could incorporate these understandings in the process of the resource development and it was agreed that we would undertake a self-study project to document and facilitate our understanding or the development of our identities from our learning during the resources development. We hope that a flow on effect is resources that will assist teachers in representing multiple perspectives in the classroom.

Self-study research and cultural practices

As newcomers (Wenger, 1998) to the field of self-study we have considered that we could contribute to the literature about how self-study methodology is learned (Ritter, 2017) and propose to analyse and describe our experience in the process of our collaborative self-study. While all authors are familiar with self-study research, we have not undertaken it formally. One of the authors was involved in teaching a Master of Education unit, Self-study as professional inquiry, resulting in a desire to formalise the self-study mindset developed into a formal self-study project after supporting students with this process.

The idea to develop our mindset to reflect sensitivity to the multiple worldviews of our population and to incorporate our learning into our digital resources design was inspired when we came together to develop resources. This is a good illustration of why self-study cannot exist in isolation; and that "collaboration is fundamental to the methodology" (Hamilton & Pinnegar, 2013, p. 74). In this instance the social and cultural practice is a collaboration in a digital technology context. The self-awareness arising in our process of collaboration contributes to the "honesty, openness, and transparency of any problems surfacing" (Samaras, 2011, p. 8). This openness within the collective self-study team could lead to changed practices when engaging with others to incorporate intercultural understanding in the design of the resources. This process will continue our work in uncovering the implicit, challenging our assumptions related to our design.

For example, buildings might be iconic representations of place from our cultural-historical standpoint but how do we embrace the importance of landscape in our design?

We have begun reflecting on how our concept of place and time might be very different to other cultures and how design reflects our values and logic systems. During this process we became in engaged in one of the intercultural content descriptors we wish to embed in our resources to: Analyse how aspects of their own and others lifestyle, behaviour, attitudes and beliefs can be culturally influenced (VCICCB009, Victorian Curriculum and Assessment Authority, n.d.). By beginning this process of analysis we can understand how our practice and identity are inextricably interlinked (Wenger, 1998). Self-study as a research methodology is "a body of practices, procedures, and guidelines used by those who work in a discipline or engage in an inquiry" (Samaras & Freese, 2006, p. 56. in Samaras, 2011, p. 68).

On reflection of their review of 60 self-study research papers presented at the 2014 International Conference on Self-Study of Teacher Education Practices, Mena and Russell (2017) recommend careful attention to "collaboration, use of multiple research methods, and explanation of trustworthiness" citing these as essential characteristics of self-study "that were not always addressed adequately or carefully" (p. 105). We will contribute to this area from our undertaking of self-study by including in our journals our development of understanding of self-study as a methodology in the process. We see the undertaking of a self-study as a way to critically engage with each other as well as develop our personal professional identities.

In the next stage of development we will consider factors and design principles for technology developed by Education Services Australia and Curriculum Corporation (Gaffney, 2010) as a starting point for the team to continually critique our approach to design. We will also draw on the work of Shipp (2013) as a catalyst for expanding our strategies for inclusion of multiple perspectives in the classroom. The New Zealand Te Whāriki early childhood curriculum (Ministry of Education, 2017) is also an exemplar we can learn from. Our future work will also be informed by the Reconciliation Action Plan Action suggestions for the curriculum planning for classrooms (Gilimbaa Indigenous Creative Agency, n.d.).

We will begin our journey making a plan for research using collective self-study. This involves attention to the ethics and making decisions about the wide range of possible data collection methods. As a starting point we will potentially gather data in the form of audio recordings of our curriculum development face-to-face meetings, complete self-study researcher logs and engage with critical friends. We will be sure to include in our circle of critical friends, those with expertise in different aspects of intercultural understanding.

Concluding comments

The team of authors are engaged in the collaborative development of resources and are now embarking on a collaborative self-study project to correlate with the development of the digital resources for upper primary Humanities integrated curriculum in Victorian schools. This article has described the initiation a self-study research project to approach the problems of practice arising in digital resource curation. Due to our use of Popplet and other technologies we have the opportunity to further explore the role and agency of technology in our self-study. We hope this article inspires teachers and resource designers to consider engaging in self-study mindset or research project alongside their engagement with digital resources as part of their curriculum development.

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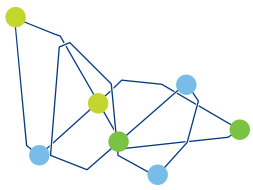

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