

VOL 30.1 | OCTOBER 2021

TECHNOTES

JOURNAL

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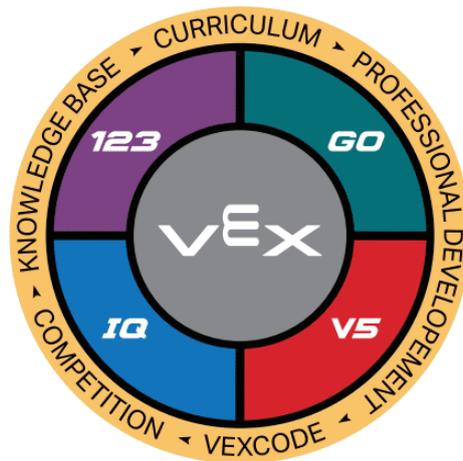


Key Stage 2

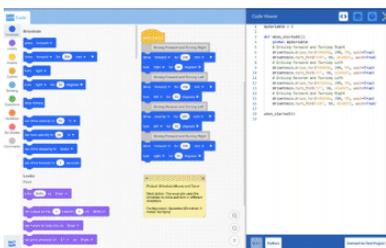
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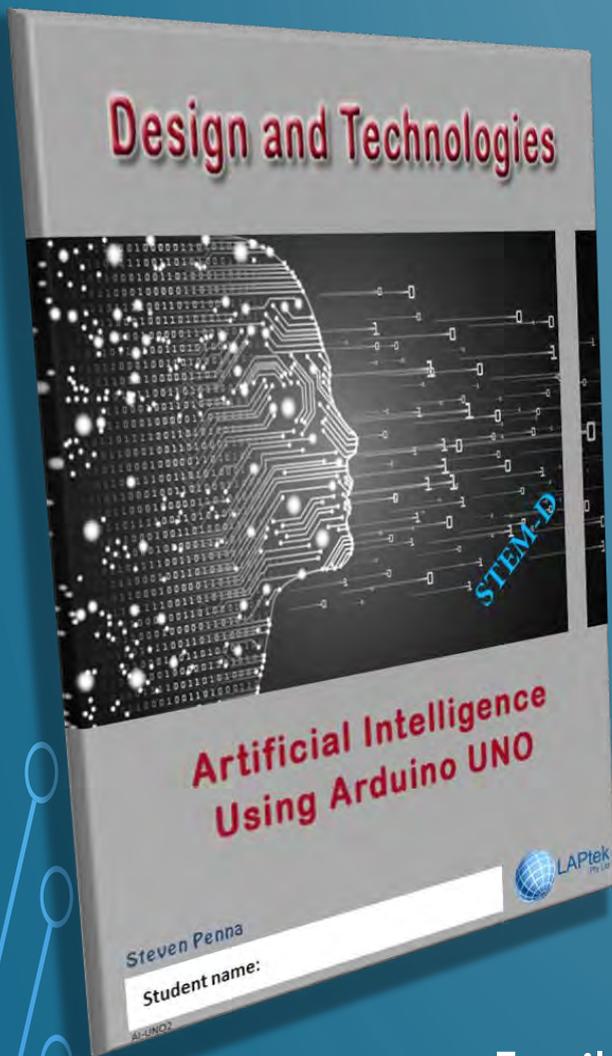
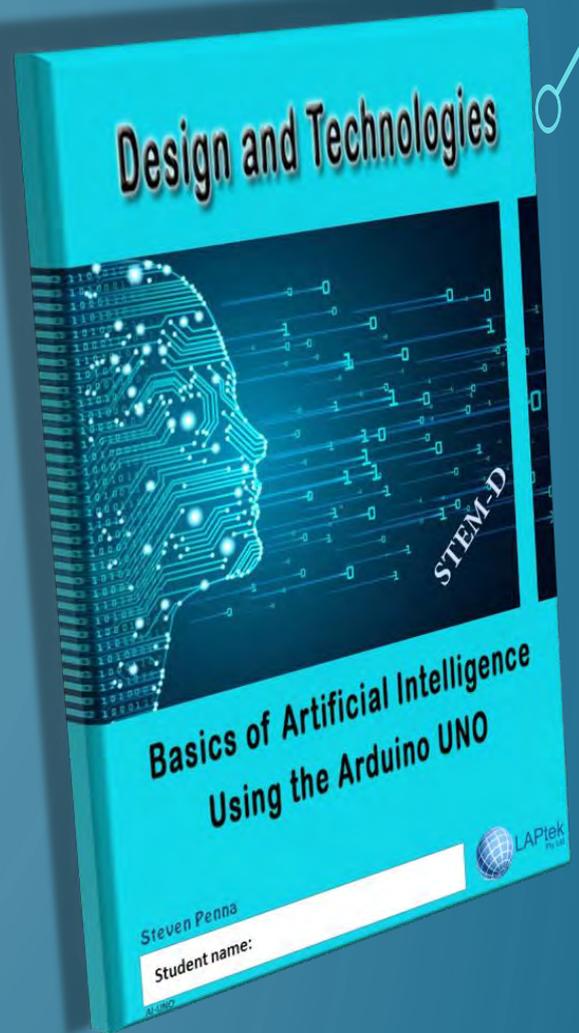
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Technotes

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Cover photo: Billanook College teacher Jamie Pointon (left) with student, Rori Van Huizen (right) photographed with her SAT production work, Silver Nymph Jewellery at the opening of Top Designs 2021. Photo by Nicole Cleary, courtesy of the VCAA.

DATTA Vic acknowledges Aboriginal and Torres Strait Islander people, who are the Traditional Owners and ongoing custodians of the land on which we work.



President's Welcome



Welcome to *Technotes* 2021. The theme for this edition is **Creating Connections**. The articles illustrate that when schools connect with the wider community, school programs can be enhanced, leading to greater breadth of student experiences and learning.

Andy Ding explains his training, experience and approaches to **teaching students with diverse learning needs** at Berendale School and his involvement in professional development activities.

Karen Evered tells us about the **STEAM program** at Boronia Heights Primary School including the approaches taken in the program, the resources used and her involvement in sharing best practice with other teachers.

An Industrial Designer, Desiree Riny and Design and Technologies teacher Brenton O'Callaghan, explain their involvement in the **Creative Workers in Schools** program at Homestead Senior Secondary College.

In the article '**Innovation and Design Makerspace** at Sacred Heart College Geelong' Siobhan Kavenagh, a Product Design and Technology teacher explains the role of the college's makerspace, the curriculum approaches taken and the college's involvement in the Geelong Design Week when students created an exciting Growroom project.

From time to time, a school may wish to review its curriculum. It was a great experience to be involved in this process as a mentor from a partnership school to assist the teachers at Hampton Park Secondary College. Tony D'Auria explains how his school went about a **curriculum review** to make learning programs more appealing and engaging for students.

Remember the difficult year of lockdowns and online learning that were such an integral part of the 2020 school year? It's quite amazing what our **Top Designs** students were able to achieve. We learn about the SAT experience of four of the students (and their teachers) whose VCE Product Design and Technology and Systems Engineering work was selected for the Top Designs Exhibition 2021 at Melbourne Museum.

There are a number of enrichment programs that our students can participate in. Eloise Breskvar and Felicia Pinchen-Hogg from the Australian Centre for Contemporary Art tell us about the innovative **STEM in Art** program they conduct.

The **Wool4School** education program and design competition has been conducted for a number of years in secondary colleges. Find out more about this exciting program in this article.

We interview Ben Liu about the Biomimicry **Designed by Nature** program at Royal Botanic Gardens Victoria. There's also a book review about biomimicry called *The Shark's Paintbrush: Biomimicry and how Nature is Inspiring Innovation*. Fascinating stuff!

Three Design and Technologies teachers, Peter Murphy, Kristen Hebden and Sam Caddey tell us about **taking on further studies** and how they and the education community can benefit from their research.

You can also read about the inspiring educators who received the **2020 DATTA Vic Awards**. Congratulations to the recipients and thanks to those who nominated their colleagues for these awards.

A huge thank you to all the contributors to *Technotes* 2021 including Laura Murphy for her guidance and support in helping to bring this issue of *Technotes* to fruition. We greatly appreciate Emma Fritsch's proof reading and suggestions. Thank you also to Lorraine Tran, our *Technotes* content manager and editor, and Kim Daly for graphic design work on the journal.

We hope you enjoy the articles in *Technotes* 2021. If you have any ideas for articles for future editions that you'd like to share with your colleagues, we'd love to hear about them! Please contact Laura at DATTA Vic if you'd like more information.

Happy reading, good health and all the best for the remainder of 2021.

Travis Burroughs
DATTA Vic President

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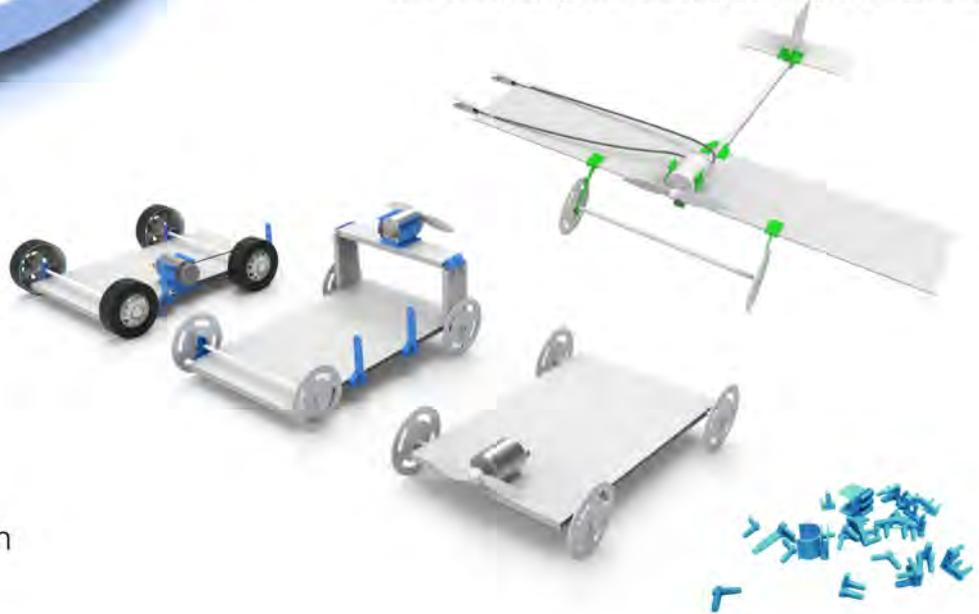
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Kevin Robertson, St John Paul II College



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STEM Education for Students with Diverse Learning Needs at Berendale School

Hau Ong (Andy) Ding

Andy is a Special Education, Art and STEM teacher at Berendale School. He completed a Master's Degree in Teaching at Monash University in 2015. His interests in education lie within leading an inclusive learning community. Andy is committed to building staff capacity and driving evidence-based strategies to foster a culture of inclusivity and excellence for students with disabilities. He was recently awarded the Bank First Award 2021 for the Master of Specialist Educational Needs graduate (Deakin University) who achieved a combination of both high academic results together with outstanding results in teaching practice.

He is currently studying for a Graduate Certificate in Organisational Coaching at Swinburne University of Technology. In addition, Andy is a registered Community Work Professional with Australian Community Workers Association (ACWA) and an accredited Engagement Specialist from International Association for Public Participation (IAP2) Australasia.

In this interview, Andy explains his training, experience and approaches to teaching students at Berendale School and his involvement in professional development activities.

Can you please explain your interest in, and any training you had to prepare you for teaching students with Diverse Learning Needs?

I have had many positive experiences that inspire me to teach students with diverse learning needs. The most transformative experience was in my undergraduate study at Monash University. I studied disabilities and then interned at numerous organisations, where I had many opportunities to work and interact with people with a disability. I learned to engage with people with a disability from a strength-based perspective and see the strengths of their abilities.

I became a teacher with an ambition to foster a school culture where students with diverse learning needs can thrive and reach their full potential.

This experience has also led me to recognise that children and young people with a disability are often misunderstood. I wanted to make a difference. I became a teacher with an ambition to foster a school culture where students with diverse learning needs can thrive and reach their full potential.

I value ongoing professional development. In 2017, I attended Deakin University and have since completed my Masters in Inclusive and Special Education. This achievement has been a significant milestone in my teaching career, during which I developed the confidence to explore varied ideas and strategies in an ongoing effort to engage students with diverse learning needs to participate in successful learning experiences.



Can you tell us a little about Berendale, the school where you teach?

Berendale School is a government specialist school for secondary aged students with a mild to moderate intellectual disability. The school is located in Hampton East in the Bayside Peninsula Region. We have about 105 students from years 7 to 12.

We have a wide range of facilities that allows us to offer an enriching STEM Program for our students. We have built a dedicated space in the Technology Suite for STEM learning. Within this space, our students have access to computers, robots, 3D printer, 3D scanner, laser cutter, vacuum forming device, lighting and filmmaking equipment and green screen technologies.

We also have other learning spaces including a commercial Trade Kitchen, Food Technology Kitchen, Bush Tucker Garden, Science Room, Machine Workshop and Woodworking Shed to facilitate and support STEM learning across the school. STEM learning is visible in every part of our school community.

It would be interesting to know about the STEM programs you conduct at Berendale School. Can you please outline some of the programs/activities and how students have responded to these programs/activities?

My school's vision for STEM learning is to encourage our students to embrace the use of new and advancing technologies as they become more available and accessible in their community and future workplaces.

Every student has a 45-minute lesson of STEM and Digital Technology every week. They engage in a broad range of STEM projects, such as robotics, advanced manufacturing, multimedia and ICT skills. Students learn to use and interact with different devices whilst developing their skills and confidence to apply them in various real-world scenarios.

A favourite student project was designing and making superhero keyrings for every staff member in the school in 2019. The students drew and transformed their teachers into superheroes. They gave their teachers superpowers based on their personality and interests. Some teachers could fly whilst others could climb walls and shoot lasers! They used drawings as inspiration to build personalised superhero keyrings on Tinkercad and printed them on our new 3D printer. The keyrings were presented to the staff on National Teacher's Day. The students felt proud of their achievement. It was a fantastic project that contributed to everyone feeling a sense of pride and connectedness in the school community.

We also provide an afterschool program, Tech Club to extend our students' learning and interests in STEM learning. During these sessions, students participate in various STEM competitions and work together to resolve challenges in a social environment. Some highlights were being the first special school in Victoria to participate in the robotic competition, RoboCup Junior Competition in 2019. In 2020, we won a Finalist Award in the Focus on Ability Short Film Festival for their animated sensory film about the natural environment.

Above: Andy Ding, STEM teacher at Berendale School explains the use of the 3D printer to a student. Image supplied by Berendale School.



You've been involved with DATTA Vic in a webinar series on Inclusive STEM for Students with Diverse Learning Needs. Can you please tell us about the webinars and what was covered in them?

The idea for the webinar series originated in 2019, from a discussion with the DATTA Victoria's Executive Officer, Laura Murphy. We saw a gap in professional learning opportunities for Inclusive STEM Education. So we set ourselves a challenge and invited Kevin Daly from Digital Learning and Teaching Victoria (DLTV) to co-host the program. With the funding from the *Google Educator Grants*, we are proud to have planned and presented a four-part webinar series for teachers and educators to inquire and celebrate best practices in STEM Education for students with diverse learning needs.

We had a line-up of experienced and knowledgeable speakers to share their work in Inclusive STEM Education. They were invited from both mainstream and specialist schools, universities and learning communities across Victoria. For instance, we had Dr Matthew Harrison from the University of Melbourne, who presented his research on the benefits of providing a video games program for students with autism. The following week, we attended a virtual tour of the school garden at Croxton Specialist School and learned about how they have built and used the learning space to support students with an intellectual disability. I also had the wonderful opportunity to interview the speakers and asked them to unpack and discuss their ideas and approaches for STEM learning.

The webinar series extended beyond the scope of disability inclusion in STEM Education. It also explored strategies to engage students who are at-risk of school disengagement. We had Glenn Barrow from FLO Connect and Mark Risicato from St Joseph's Flexible Learning Centre, who shared their innovative STEM projects for young people who have disengaged from school.

The webinar series was recorded and is now available for viewing on FUSE. I encourage teachers and educators to access this useful resource.

- Session 1 – <https://fuse.education.vic.gov.au/?5Y2F9M>
- Session 2 – <https://fuse.education.vic.gov.au/?T7GHJD>
- Session 3 – <https://fuse.education.vic.gov.au/?4G4RWY>
- Session 4 – <https://fuse.education.vic.gov.au/?DNT4FM>

Do you have any particular advice about how best to cater for students with Diverse Learning Needs, especially in regard to delivering STEM programs?

First and foremost it is absolutely important to take the time to understand your students and their learning profile. Thereafter, inquire and provide instructions and strategies that cater to their individual needs, strengths, interests, preferences and aspirations.

In the webinar series, I listed a number of practical tips and strategies that I have used to design a chocolate making project for my year 10 students. These tips and strategies enabled students with an intellectual disability to access, engage and find success in the STEM project. Out of these 10 strategies, my favourite strategy was chunking the project into multiple lessons, where I explicitly planned and taught one skill in each lesson. This came from learning that many of my students experienced challenges with working memory and slow processing speed. However, I found that their strengths in learning new technologies and interests in the topic could sustain their engagement in the project. Having chunked the project, my students could access adequate time to understand new information and develop their skills and confidence to use new devices.

It is important to note that one method of instruction or strategy does not cater to all students. Developing a sound understanding of my students has provided me the opportunities to personalise their learning in STEM. I have provided ample opportunities for my students to articulate their ideas with me. When a student asked and wanted to design a basketball-shaped chocolate, we worked together to research and find a way to design it on a computer. I also challenge my students to extend their learning. I have asked powerful questions and provided sufficient time for some students to consider and explore alternative ideas. When they come up with a new idea, I have collaborated with them to incorporate it into their final design. When it failed, the mistakes and failures became a part of the learning experience, during which my students were able to gain valuable feedback and insights for their next project. Personalising learning is a great way to make STEM projects relevant and meaningful for students with diverse learning needs.

We can learn from each other and build our knowledge and resources to improve our work in engaging and supporting our students to access STEM Education.

In terms of our Technotes 2021 theme Creating Connections, can you please comment on the benefits of sharing your knowledge with colleagues (for both you and other teaching colleagues)?

I believe every teacher and educator has expertise, knowledge and skills in teaching STEM to students with diverse learning needs. We all have students with diverse learning needs in our classrooms, and many of us have put in the effort and achieved some great results with our students. The next step for us is to share and explore our practice with colleagues. We can learn from each other and build our knowledge and resources to improve our work in engaging and supporting our students to access STEM Education.

As an avid networker, I recognise the value of social connection when we meet with our colleagues to share our experiences. There are many cases where there is only one STEM teacher working in a school, and it can be an isolating journey to build a STEM Program for their entire school community. Therefore, it is important to reach out and connect with other teachers and educators who share similar interests and commitment to provide the best STEM Program for students.

For me, the benefit of sharing my knowledge and expertise with my colleagues is to build a Community of Practice. As STEM teachers and educators, we lead and advocate for high quality STEM Education Programs and activities for students with diverse learning needs. Seeing that there were over fifty teachers and educators who registered and attended the webinar series, I know that my effort and courage to network with others, has contributed towards the broader goals of ensuring that every child and young person regardless of their background and abilities, can access STEM learning and develop the skills that they need for their future.

Creating connection to STEM learning at school creates connection to life outside the classroom.

For more information about STEM and Digital Technology at Berendale School go to berendale.vic.edu.au/teaching-learning/specialist-programs/stem-and-digital-technology

Opposite left: Andy with students using Tinkercad in the Technology Suite for STEM Learning.

Opposite right: Andy with a student exploring the use of a 3D scanner. Images supplied by Berendale School.



Collaborating and sharing best practice in STEAM education at Boronia Heights Primary School

Karen Evered

Karen is the STEAM Leader and teacher at Boronia Heights Primary School.

In this article, Karen tells us about the STEAM program at the school including the approaches taken and the resources used and her involvement in sharing best practice with other teachers.

Can you please describe the STEAM program at Boronia Heights primary school? Do you have specific classrooms that are used for delivering STEAM? What year levels at the school do STEAM?

The STEAM program at Boronia Heights Primary School began in 2019. We had never had a cross curricular program like this in the school, so when I was approached to lead this program, I began to attend a wide range of professional development in late 2018 in preparation for the program to commence at the start of 2019.

We were lucky to have an old multipurpose room renovated and customised to accommodate our STEAM lab. In the STEAM lab we have three full kitchens, several storerooms, science prep room and a range of learning spaces for the children including high benches, low tables, wet area and a carpeted area in front of a large screen TV.

The STEAM program is delivered as a specialist class across all levels from Foundation to year 6. In 2019 and 2020 the students had 80-minute lessons once a fortnight. In 2021 our timetable changed, so the students now have STEAM for a 60-minute lesson once a week, but only for six months. So in semester 1, I teach Prep – year 2, then in semester 2, I teach years 3–6.

As I have an applied science degree as well as my teaching degree, I wanted to ensure that the program was authentic STEAM not just science lessons. After attending the STEAM Innovations conference at Deakin University and completing a *Using Technology Better* course in STEAM instruction, I began to put together a two-year curriculum focusing on science and engineering guided by the Technologies Curriculum (Design and Technologies and Digital Technologies). I wanted to ensure that the lessons and projects were authentic STEAM by using design briefs and ensuring that each design challenge began with either a problem, need or opportunity. I then incorporated the content of each of the relevant learning areas needed to solve the problem.

The core values of my STEAM program are underpinned by 21st-century skills or future skills as they are now known. I believe that being able to teach these transferable skills to my students is more important than the students being able to recall a bunch of science facts on a test. The core values of STEAM at Boronia Heights are: collaboration, creativity, curiosity, compassion, critical thinking and communication.

These core values and a problem-based learning approach are the focus when I begin my planning. I attempt to find an engaging project or challenge, then work through the science, design and technologies and maths curricula to incorporate aspects of those learning areas for each year level.

The core values of STEAM at Boronia Heights are: collaboration, creativity, curiosity, compassion, critical thinking and communication.

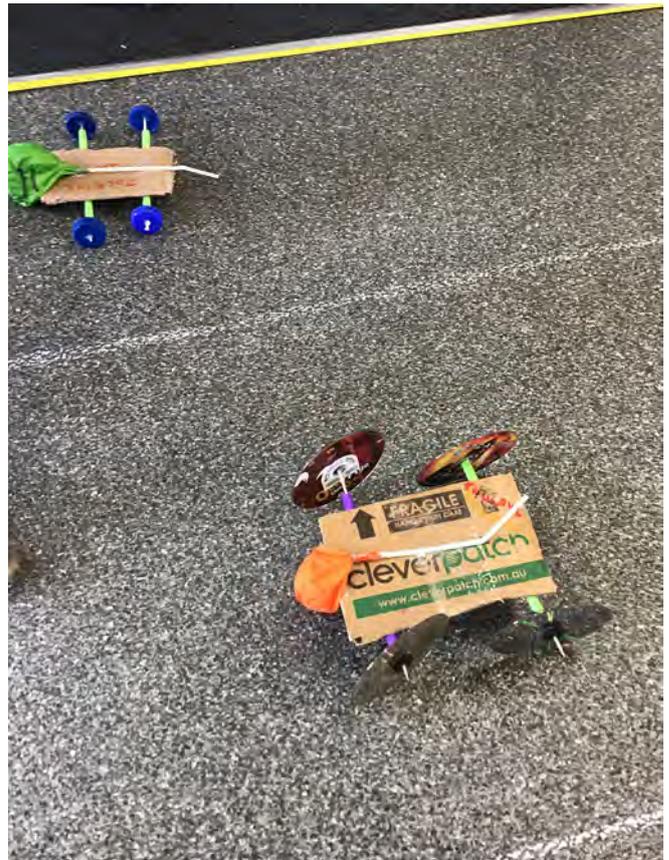
At my school I assess the students on the Science Curriculum and the Design and Technologies Curriculum. As there are so many elements to the Science Curriculum and the Design and Technologies Curriculum this can be quite a daunting task. Across the three years that I've been teaching STEAM, I have refined my assessment to focus on the future learning skills, rather than purely the content of each task. As these skills cross over so many tasks and topics, it makes my assessment more efficient and more relevant to the overarching reason for teaching STEAM.



Can you please tell us about any specific resources needed to conduct the program? Does the STEAM program have a specific focus?

I began the program with a basic range of classroom resources such as paper, pencils, textas, scissors and some simple science equipment which I gathered from classrooms and storerooms around the school. I have a class set of chrome books which are used for a range of tasks. The students all have a STEAM journal for design tasks and related work. I chose a book which has pages that are half lined and half blank (for drawing). I have continued to build the resources as I have needed them.

In my three years of experience in the STEAM lab, the resources I use the most are recycled materials and masking tape – lots and lots of masking tape! We use a lot of cardboard, cardboard boxes, plastic bottles, bottle tops, corks and glue. One of the most valuable companies for resources I have found as a STEAM teacher is Resource Rescue Inc. (discountcraftsupplies.com.au) in Bayswater. This company is a non-profit organisation that collects a range of factory offcuts, rejects or no-longer-used materials from businesses and companies which can then be purchased by schools, kindergartens and scout groups for use in hands-on construction. I love to see children have the opportunity to use their imaginations so having a wide range of materials on hand is a definite must! The children constantly surprise me in the ways they use different materials.



Although I am lucky enough to have a range of robotics that I have built up over three years, I don't see this as being essential. The technology part of STEM can also be simple technology such as pulley systems, levers and all simple machines. Technology doesn't require a range of expensive robots which become obsolete very quickly. Having said that, I am lucky enough to have a range of robots including Bee-Bots, Edison, Spheros and the LEGO EV3 robots.

Above left: Collaborative tasks to design and create a 9-hole mini golf course. This is one of the 9 holes produced by year 4 students.

Above top: Year 3 students engaged in building and coding LEGO EV3 robots.

Above bottom: Air-filled balloon vehicle race by year 2 Boronia Heights Primary students. Images supplied by Boronia Heights Primary School. Student faces blurred on request of Boronia Heights Primary School.

How do you incorporate the areas of STEAM (Science, Technology, Engineering, Arts and Maths) into your programs?

As there are so many curriculum areas to incorporate into my program in one hour a week sessions, I use a problem-based learning approach. I find a problem, a need or an opportunity and present the students with a design brief. In that design brief I incorporate relevant elements of science, technology, engineering, arts or maths. This could incorporate specific areas of the sciences such as chemical science along with some biological science. Each unit or design task will combine these areas so that students gain some background knowledge in the sciences along with engineering within some sort of design task.

When teaching the design tasks, I expose the children to all the elements of the design process. I don't expect students to be able to recite the design process, however when they use each step of the process they become familiar with and can follow this process. As maths is a focus in the classroom, I don't include lessons that focus specifically on maths in my program. The maths I tend to use the most is applied maths including measurement, angles and speed – any maths that naturally occurs in our design tasks.

What methods do you use to create connections and share best practice in STEAM education with schools in your area?

As the only STEAM teacher in my school, I felt very overwhelmed to begin with. The power of collegiate discussion is definitely underrated! That's when I started seeking out teachers in similar roles at other schools. I spoke to a few teachers when I did professional development sessions which is good to begin with. Then I realised it would be highly beneficial to contact other teachers in my immediate area.

Early in 2020 I initiated the Knox STEAM network. I created a flyer which my principal took to her principal network meeting. I organised a meeting at my school and invited any other STEAM, STEM or science teachers to come along and share some ideas of how they were instigating this curriculum in their school. The meeting was very productive and we've received very positive feedback. Unfortunately, COVID-19 hit just after our first meeting. Having made some initial connections, we had one or two online WebEx sessions during lockdown but as was the problem with every school in Victoria, the role of teaching online for an extended period of time was all-consuming in itself. Therefore, the network had to take a back seat. This year we have relaunched the network and I've had really great responses from the schools who participated.

I've made several new contacts which is the whole purpose of setting up this network. Some great ideas have come out through each meeting. I've also created a Facebook group. The reason for this is because during remote learning I found that I was often heading to Facebook to find resources for my STEAM lessons. Many of these groups are based in America which is fine, but I wanted to have more local contacts and local knowledge. That's when I decided to start the Knox STEAM Network Facebook page. This has been really successful; we have several members who regularly contribute knowledge and share ideas. It is a very quick way to get responses to questions you may have from other educators in similar roles. In the short time since creating this network at the beginning 2020, I believe it has definitely been worthwhile.

Do you have any advice for teachers who may wish to participate in sharing best practice in STEAM education?

For those of you who want to share best practice in STEAM education, my advice would be to contact other schools in your network or your state who do STEAM and begin to organise a STEAM network of your own. This is a great way of sharing knowledge and being able to meet up in person with people who have experience with local resources. Facebook has also been an excellent source of expertise and ideas. STEAM and STEM is being taught all around the world and this has been a great way to share websites. Teachers are very generous people by nature and if you ask a question you are assured of getting a range of answers to help you with planning resources and general STEAM knowledge and passion.

For those of you who want to share best practice in STEAM education, my advice would be to contact other schools in your network or your state who do STEAM and begin to organise a STEAM network of your own.

Do you have any closing comments you'd like to share?

Throughout my journey as a STEAM leader, I have increased the variety of activities that I do. One strong recommendation I have is that once you feel comfortable and confident in your STEAM space within your own school, branch out and join activities being run for school groups or by other schools. There are so many business partnerships that can be established such as the *CSIRO Professionals in Schools* program (www.csiro.au/en/Education/Programs/STEM-Professionals-in-Schools), the *Model Solar Vehicle Challenge* (www.modelsolar.org.au), *FIRST LEGO League – Australia* (firstaustralia.org/programs/first-lego-league) and so many more things to get your children engaged and involved in STEAM outside the classroom.

Innovation and Design Makerspace at Sacred Heart College Geelong

Siobhan Kavenagh



Siobhan is a Product Design and Technology (specialising in textiles), Makerspace and Art teacher at Sacred Heart College (SHC), where she has taught for six and a half years. Prior to becoming a teacher, Siobhan worked in various fields including design and completed studies at a number of institutions including La Trobe University, Melbourne Institute of Fashion, RMIT and Charles Darwin University.

Siobhan explains the role of the Sacred Heart College Makerspace, the curriculum approaches taken and the college's involvement in the Geelong Design Week, where students created an exciting Growroom project.



Development of the makerspace at Sacred Heart College

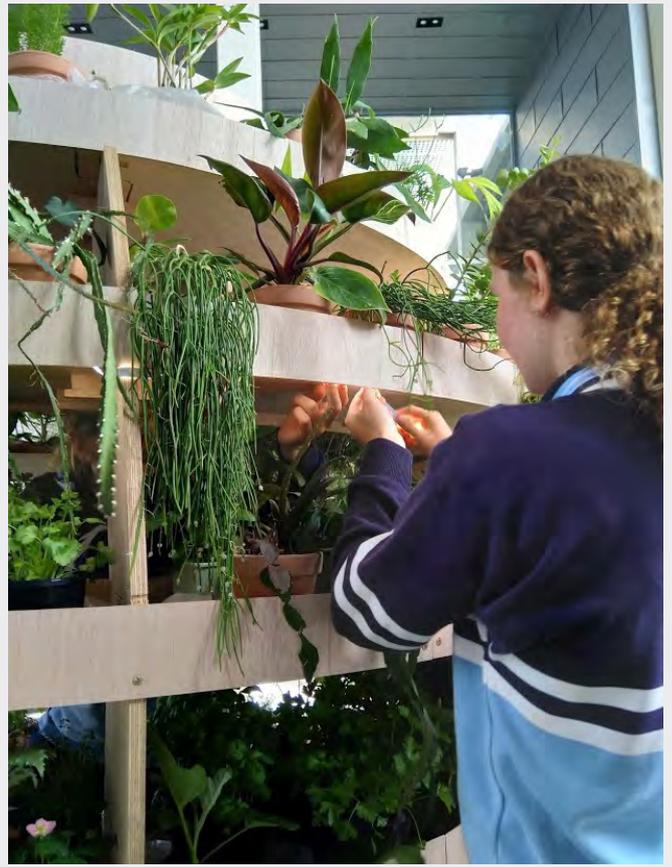
Sacred Heart College Geelong was established in 1860 as a Catholic Secondary School for the education of girls in the Mercy tradition. The makerspace is part of our new STEAM facility – the Innovation Precinct – which was officially opened in 2019 when our first makerspace specific subject was introduced to year 8, 9 and 10 students. Since then, the demand for the facilities and resources in the makerspace has grown exponentially to the point where we now employ a full time Makerspace Manager – Dani Hoogland. The Manager assists in numerous classes, is responsible for makerspace logistics and training of staff and students in how to use both design software and machinery.



Top: Students interpret the build plans and start the build.

Middle: SHC students working collaboratively.

Bottom: Building the platform. Images courtesy of Siobhan Kavenagh.



An important part of the school ethos is educating girls to make a difference in our rapidly changing world. The curriculum developed with a makerspace focus encourages students in technological astuteness, adaptable curiosity and student directed learning. There is a strong emphasis on creative thinking, innovation and collaborative learning. Students learn how to apply design thinking through learning how to use CAD software, safely operate machinery and both hand and power tools. They are actively encouraged to build prototypes to iron out design problems before embarking on final designs. I think the key attribute of makerspace learning is the soft skills students learn in the process of designing and making. It is soft skills like clearly articulating ideas, problem solving, collaborating on projects (big or small), risk taking, being able to critically analyse areas for improvement and having the time to try again that will equip the students for our future world. In developing the space, we visited makerspaces and researched best practices in design thinking for learning. We have also been fortunate to employ industry experts as mentors within the space to assist with student learning.

Involvement in the Geelong Design Week

The collaborative design challenge for my year 9–10 iTinker/Wood students in term 1 was to build a Growroom as an anchor installation for Geelong Design Week. The Growroom is the brainchild of Ikea's Research and Design Lab, Space 10 (space10.com). The Growroom acts as an 'urban farming pavilion that looks into how cities can feed themselves through food-producing architecture'. This concept resonated with students and sat within the Geelong Design Week theme *Unexpected*. Initially students worked in small groups to develop design ideas around lighting, seating, platform development and plant suitability. Each lesson, different students would be given the task of project managing the build, which took around three weeks. From a teaching perspective it was rewarding to see the students working so cohesively, listening and problem solving with minimal input from either Dani or myself. At the end of semester 1 when evaluating their work, students reflected that collaborating on the Growroom united the class and gave them confidence to support each other during their term 2 self-directed task. An added and unforeseen bonus for me!

The Geelong Design Week event was held at the school on Thursday 18 March from 4–8pm with visitors greeted by our school robot Nao who had been programmed by our Systems Engineering students. All visitors were invited to listen to presentations from industry experts in the areas of automotive and architectural design and were encouraged to participate in a variety of creative and design-based student led workshops which included a Bioplastic making; an introduction to Arduino circuitry with simple code; Mould Making and Tinkering using the equipment in the makerspace and a Zaishu Printing workshop. Thanks to the generosity of Industrial Designer Matthew Butler who allowed us to use his Zaishu stool design for this workshop. Guest speakers provided a thought-provoking insight into automotive and architectural design and its future.

Makerspace facilities, resources and use

The makerspace houses two laser cutters, 3D printers and a vacuum former as well as power and hand tools. There are a few tables but we made the decision not to have stools as we wanted to encourage movement throughout the space. The room is connected to a Product Design and Technology room by a wet area. The space is designed for tinkering across all subject areas and in all year levels at the school. Students who have been timetabled into makerspace subjects move freely between the two areas dependent on whether they are designing or making. Students and staff not timetabled into the makerspace are able to book a time to use the space with the Makerspace Manager where they are trained in OH&S and machine usage and are assisted in realising their ideas. The space is also available to students at lunch times and for a Wednesday after school program called the Bradbury Club. This innovative group enables students from Sacred Heart College, our brother school St Joseph's College and industry partners to engage in long-term problem-solving projects.

As mentioned above students and staff are encouraged to access the makerspace and use the resources within it to help develop their design ideas irrespective of subjects. The space assists in developing an interdisciplinary approach to learning through use of its resources to realise ideas in hands on meaningful ways.

Opposite top left: Students enjoy the sensory experience of the Growroom during plant installation. Image courtesy of Eva Baker.

Opposite top right: Attaching the LED lights towards the end of the project.

Opposite bottom left: Finessing from the inside of the Growroom. Images courtesy of Siobhan Kavenagh.

Opposite bottom right: The finished Growroom – a sensory experience – in the atrium at SHC ready for opening night. Image courtesy of Dani Hoogland.

Currently, we have three specific semester-length folio subjects timetabled into the makerspace in 2021. As these subjects are electives, it has been very important to develop curriculum which both engages and challenges students, gives them choice and a degree of independence in their learning. I have given a basic outline of each of the subject areas, which have been timetabled into the makerspace this year. But as with all my classes I find it beneficial to meet my students and discuss ideas before I plan too much, so that a program can be developed to suit their needs and interests.

In year 8 we offer an introductory subject called iTinker. Students learn safe work practices, develop basic skills using the makerspace equipment and experience a more playful way of learning through making. Students are actively encouraged to be curious, learn to trial ideas, see failure as an opportunity to re-evaluate and improve designs. Time is purposefully built into the curriculum to allow for this. Students are given the opportunity to develop their own projects with the purpose of more meaningful and engaged learning. The focus is always on the process and not the end product.

iTinker/Wood, a middle school subject, enables students to explore a variety of materials using a combination of traditional woodworking techniques and new technologies. For the past two years students have spent a term working on a collaborative project (the Growroom in 2021) and a term for a self-directed project of their own choosing. The variety of projects is varied depending on individual skill and interest level. This year simple silversmithing was introduced in response to student interest.

This year a new subject, Design Innovation, was established. This subject challenged students to look beyond the ordinary, develop their curiosity, experiment with different materials and techniques and to use this knowledge and skill to design and develop an innovative product. So far students have developed knowledge and skill in the areas of fibre optics, bioplastics, building an RFID scanner, leather design and costuming. It is rewarding to see curiosity win over initial tentativeness as confidence builds.

Students are given the opportunity to develop their own projects with the purpose of more meaningful and engaged learning. The focus is always on the process and not the end product.

I think the most important things I have learnt so far in developing curriculum for makerspace learning is to keep projects open ended, to nurture curiosity and problem solving through play and risk taking and to ensure students are choosing projects based on areas of interest which will sustain them when they hit roadblocks in the design process. Students often seek permission for ideas and start with 'Can I do...?' The response which I find works best for me at the moment is 'Yes but how will you do...?' This shifts the responsibility back onto the student giving them more autonomy in their design process. Students excel when given the freedom to choose their ideas, make mistakes without fear of failing and the opportunity to rectify these so that they understand it is the process not the end result which is where the most learning is achieved.

A note from the editor

Read more about Growrooms at 'Green dreams in The Growroom' on IKEA Today (ikea.today/green-dreams-growroom) and view examples at 'Inside The Growroom by IKEA' on Completehome (www.completehome.com.au/outdoors/inside-growroom-ikea.html)



Creative Workers in Schools program at Homestead Senior Secondary College

Desiree Riny and Brenton O'Callaghan,
Homestead Senior Secondary College



In this article, Industrial Designer, Desiree Riny and Design and Technologies teacher with responsibility for Art/Careers and Pathways, Brenton O'Callaghan, explain their involvement in the Creative Workers in Schools (CWIS) program. Student participants in the program also provide their feedback.

About the program

Creative Workers in Schools supports both metropolitan and regional creative workers to undertake a six-month paid residency in a Victorian government primary or secondary school. The program started in term 1, 2021 and is delivered by Regional Arts Victoria in partnership with the Department of Education and Training and Creative Victoria through the support of the Victorian Government's Working for Victoria initiative. During the residency, the creative worker receives training and mentorship and works with teachers and students to design and deliver a creative project to support learning from Foundation to year 10 in line with the Victorian Curriculum.

Source: 'Creative Workers in Schools' on Creative Victoria (<https://creative.vic.gov.au/grants-and-support/programs/creative-workers-in-schools>)

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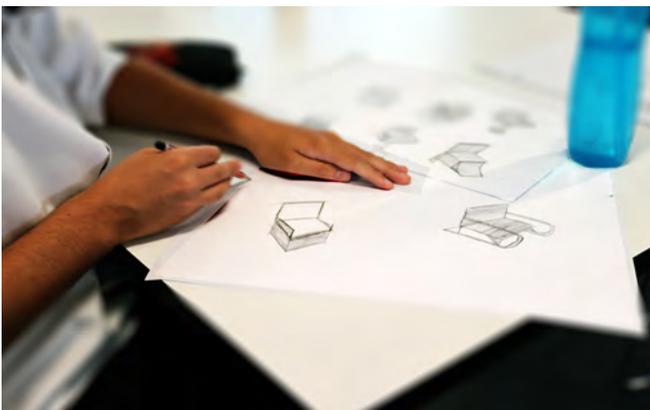
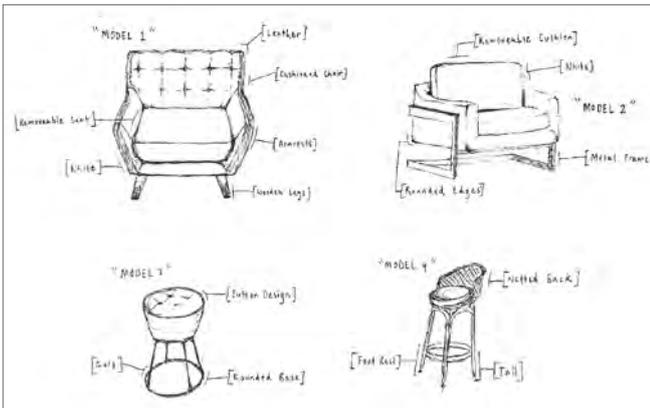
The Industrial Designer's experience of Creative Workers in Schools

I was selected to be one of 150 artists and designers to undertake a new six-month *Creative Workers in Schools* program – which would be mentored through my design practices. It certainly has been an amazing gig so far, with countless opportunities to develop my design process and co-design with so many interesting people – other creative artists, students, teachers, mentors, and the wonderful staff of Regional Arts Victoria (RAV).

To learn that I was the only industrial designer amongst the group was certainly surprising but also exciting because it meant that I could be the first to pave a new way for other industrial designers from industry to be given the opportunity to share their knowledge and contribute to secondary education.

I was personally paired with Homestead Senior Secondary College. Homestead Senior Secondary College has only been operating for a year and their arts and design department has been significantly impacted by COVID-19. Due to the lockdown, as you can imagine, students' learning about design and art was impacted and limited due to lack of face-to-face teaching. With this in mind, I wanted to use my design practice to allow students to explore design and art through a very collaborative design process. Not only did I want to encourage the students to take the design lead but be at the centre of the design process – allowing them to be the designers and to take control of what their creative project looks like, whilst being mentored through a designer from industry and their amazing teacher Brenton!

Above: Desiree within the school's workshop fabricating flat pack chairs using heavy machinery. Image supplied by Desiree Riny and Brenton O'Callaghan, courtesy of Homestead Senior Secondary College and *Creative Workers in Schools*.



So what did we decide to work on? Here's some background to the design brief.

Homestead Senior Secondary College is a new school and is looking to create a café within the school for the students and local community. Currently there is limited seating in the area, and we used this opportunity for the students to have some creative input into the cafe and asked them to design chairs for the space. The requirements were that the chair was created from a flat pack design, based on geometric shapes and had to be similar in size to a classroom chair.

The students so far have been very successful in learning various design thinking processes including rapid prototyping of their chairs from the two-point perspective, producing isometric drawings and participating in a 'Shark Tank' pitch amongst their peers.

From the Shark Tank pitch, we selected a few designs that are now in the process of being fabricated by me and Brenton in their new design and technologies workshop. Just from the first couple of months of being in this role, seeing the students light up and so engaged with this project has been amazing. It has encouraged me in my design practices and processes. The teacher and designer roles are completely different; however, I'm finding myself wearing both caps. It's been the most extraordinary thing to experience and learn how to adapt, especially learning when to take a step back and allow students to just have fun and be as creative as possible.

It's been the perfect opportunity for me to share my industry experience and engage students within the field of industrial design – to show them what it is like to be a designer in the real world and allow them to learn how workers in industry apply design thinking and practices to generate solutions for authentic needs and problems.

The teacher's experience of CWiS

Essentially my role was being the conduit between Desiree and her skills, and the students having the opportunity to learn from her. From the beginning, working with Desiree was a collaboration on ideas, and the possibilities were endless. It was a matter for me to make those ideas possible in a classroom setting and decide how they would fit within the curriculum. With the design class that I had, it was fairly easy to fit the ideas within the curriculum and within the allocated time.

From here it was necessary to give Desiree a lesson-by-lesson timeline of the activities that the students would do in each class. We worked together on the tasks, as there were some industry specific skills that she wanted to provide the students the opportunity to learn about, such as computer-aided design (CAD), model making and a pitch presentation. During the lessons it felt a lot like team teaching, as Desiree worked and moved around the classroom assisting students with the tasks as much as I did.

Personally, the benefits of the program were many. I learnt skills that are used in the industrial design field that I can now implement in my classes, such as model making. Desiree has inspired me to complete some online classes in CAD which I can use in the classroom and teach to students. I have a better understanding of the design process and the practices professionals use in the industry, which will benefit my future design students. I now have a unit of work for the industrial design field, and a professional that I can call upon for advice.

I have a better understanding of the design process and the practices professionals use in the industry, which will benefit my future design students.

The benefits for the students were that there are many female students looking to continue with design as they move into VCE. The students were engaged as they worked on a real-life design problem and were able to see that the decisions they made reflected on a real-world audience and product. The students on a number of occasions were taken out of their comfort zones, and it was great to see them accept the challenges and grow into their role as designers.

Student feedback on the program

'I really enjoyed the fact she willingly spoke to students, treated everyone with equal and fair respect and brought up some rather fun and unique conversations. I also enjoyed the input she provided and advice she gave, showing she really cared about the work we were given and about us achieving our best while also promoting the wonderful world of design.'

'I just want to say a big thank you for letting me have this opportunity!'

'I didn't think of design as a career but now after having a good teacher I'm considering it.'

'Whenever Brenton was working with another student, Desiree was happy to help. Desiree gave some insight on future occupations regarding what design studies could lead to.'

'I would like to try the cardboard scale models again, because that was pretty fun, and it gave good feedback about the chair designs and functions.'

'Every piece of furniture like chairs and couches go through the same design process we used, so I learnt that a single chair design can take a lot longer than I thought.'

A note from the editor

Desiree describes herself as an industrial designer based in Melbourne who uses a combination of technical, digital and additive manufacturing skills to design and fabricate innovative products and services within the medical, social and furnishing industries. She is the founder of DIY Lower-limb Prosthetic.

For further information about Desiree and the projects she has worked on please go to www.desireeriny.com

Opposite top: 1:5 scaled chair prototypes, using recycled cardboard, to demonstrate size, form and shape of their chosen chairs.

Opposite middle: Students researched and developed many chair concepts, which later were refined into a single concept.

Opposite bottom: Student drawing a two-point perspective drawing of their chosen chair. Images supplied by Desiree Riny and Brenton O'Callaghan, courtesy of Homestead Senior Secondary College and *Creative Workers in Schools*.



Above left: User-testing 1:1 scaled chair prototype out of 25mm cardboard, to refine the height of the arms and back rest.

Above top: A student assists Desiree and Brenton with joinery gluing of a flatpack chair.

Above bottom: One of the 14 fully assembled flat pack chairs that was solely hand crafted and fabricated by Desiree within her six-month residency. Images supplied by Desiree Riny and Brenton O'Callaghan, courtesy of Homestead Senior Secondary College and *Creative Workers in Schools*.

Reviewing the curriculum at Hampton Park Secondary College

Antonio (Tony) D'Auria
with Travis Burroughs

Tony D'Auria is a Technology teacher at Hampton Park Secondary College (HPSC). Travis Burroughs, is Director of Student Led Programs and STEM Consultant at Templestowe College, President of in2robotics and DATTA Vic.

Tony explains how, with the help of Travis, a teacher of a partnership school and member of the Future Schools Alliance (Templestowe College), Hampton Park Secondary College is taking a new approach to the teaching and learning program and development of a new STEAM facility.

Background

Prior to 2019, Hampton Park Secondary College (HPSC) would have been considered quite traditional in terms of its curriculum, pedagogy and overall approach to education. It had become apparent, however, that student engagement was an issue. There was low student satisfaction with subject choices and opportunities. Poor engagement and participation were having a negative impact on overall student learning and growth. The staff also felt that change was needed to improve curriculum, pedagogy and student engagement.

Our current principal, Mr Wayne Haworth, was selected to oversee and implement the changes required to transform Hampton Park Secondary College. Our new school vision sums it up well.

'At Hampton Park Secondary College, we are rich in diversity, and through empowering and engaging students, we remain wholehearted in our pursuit of excellence.'



Overhauling teaching and learning

One of the major changes that we faced as a school was changing the structure of teaching and learning within Hampton Park Secondary College. This meant overhauling not only subjects available to students, but also how the lessons are taught and conducted. It was decided that our college needed to go from the traditional school model, that is where students choose their subjects at their year level, to what is called the Vertical Teaching and Learning Model incorporating Project Based Learning (PBL).

Above: A year 11 product design student creating a prototype using laser cutting technology. Image by Tony D'Auria courtesy of Hampton Park Secondary College.



Vertical Teaching and Learning Model

The Vertical Teaching and Learning Model is based on groups of mixed aged pupils (taken from two or three year levels) being taught together for the common good. It is meant to help schools offer a wider range of subjects and allows students to be streamed according to their ability. Vertical teaching has its origins in the vertical tutoring system where students from all year groups are brought together for pastoral sessions.

Project Based Learning

PBL involves a dynamic student-centred approach that enables students to acquire a deeper knowledge through active exploration of real-world challenges and problems. Incorporating PBL allows for more flexible, differentiated teaching and learning that gives students the freedom to work independently or collaborate either in person or virtually. Performance tasks work well especially when students do not all have access to the same materials. As a school we felt that these changes would allow for greater student choice and enable them to choose subjects they want to do instead of being forced to do them. This in turn will (hopefully) improve student participation and satisfaction and lead to better outcomes for both students and the school as a whole.

Change takes time

Change to a school curriculum/program doesn't happen overnight. In order to make major changes to a school curriculum/program the school council, teachers, students and the school community have to work together to make it happen. Our principal and leadership team have been overseeing and guiding the staff to implement changes within the school. As Design and Technologies teachers, we are used to PBL. Let's face it – PBL is something we already incorporate in our teaching program. However, for teachers who are used to a traditional teaching and learning model it may not be so easy for them to switch to a vertical model incorporating PBL or they may not even know how to incorporate PBL into their curricula. Over the past two years our staff have been doing extensive professional development on both the Vertical Teaching Model and PBL. Our principle has brought in experts on PBL and curriculum design, who have helped staff navigate through all the changes, pitfalls and the dos and don'ts of the new model for teaching and learning at our school.

Revamping the technology curriculum

Another major change that is currently underway is the revamping of the Technologies curriculum. The technology domain meets on a regular basis to collaborate and revamp our Technologies curriculum. Changes we've made include updating technology subjects. We've had to decide what subjects to eliminate and/or merge, propose new technologies subjects such as VCE Systems Engineering and Robotics to create student pathways within the technology program and create curriculum documents using the PBL model. We started these changes in 2019, however things came to a standstill in 2020 due to COVID-19. We have been slowly implementing them throughout the 2021 school year. Even though we feel that we have been able to implement these changes, they are a work in progress because we know that major and broad changes take time. We will be further implementing changes in 2022 with the aim to have them completed and implemented by the 2023 school year.

The importance of partnerships in the change process

Early on in our domain meetings we felt that it was important for us to reach out to other schools who have been through similar changes. We also felt that a partnership with other schools could be a good way to collaborate with other schools and even share resources. One of those partnerships we formed was with Templestowe College. As Templestowe College has been through similar changes our principal thought a partnership with Templestowe College would offer us opportunities. As well as being able to collaborate and share pedagogy ideas, the partnership with Templestowe College has allowed us to seek advice, assistance and feedback while we are implementing our changes.

Early on in our Technology domain meetings at HPSC we felt it would be a good idea to reach out to someone who has extensive experience in this learning area. Our principal reached out to one of our partnership contacts at Templestowe College, Travis Burroughs, the current president of DATTA Vic and a STEM Learning Specialist who has extensive skills and knowledge in technology teaching. Travis initially came on board to help us with our new Science, Technology, Engineering, Arts and Mathematics (STEAM) Centre. However since then, he has been coming to our school once a fortnight to assist us with improving our technology curriculum and pedagogy. (Read Travis's comments about the partnership experience below.)

This partnership has proven invaluable, as it allowed us to see what elements of the teaching and learning program have worked well at Templestowe College. We have also learnt what elements of their program have not worked so well to allow us the opportunity to make informed decisions about the program we will implement at HPSC.

We are committed to working in partnerships not only with parents in our community but also with schools such as Templestowe College. It is only through genuine partnerships that we as a school are able to achieve the best outcomes for our students.

Facilities upgrade

The major changes to our teaching and learning program at HPSC meant that we had to upgrade our facilities. Let's face it, why go through all these changes if the facilities are not suitable? As STEAM is a key part of the curriculum at our college, one of the major changes to our facilities is the redevelopment of the technology wing. Set to be completed in 2022 the new STEAM Centre is designed to be a more flexible teaching and learning space. This will allow students and teachers to work collaboratively and utilise state-of-the-art technologies such as 3D printing, laser cutting, CNC milling and machining, textiles/fashion design, robotics and even jewellery making.

Benefits

Granted – all this change hasn't been easy! As a teacher, being part of these changes at HPSC has allowed me to continue to perfect and improve my pedagogy. It has allowed me to collaborate not only with my fellow staff members, but also with teachers from our partner schools. It's allowed me to gain a deeper understanding of technology teaching and learning.

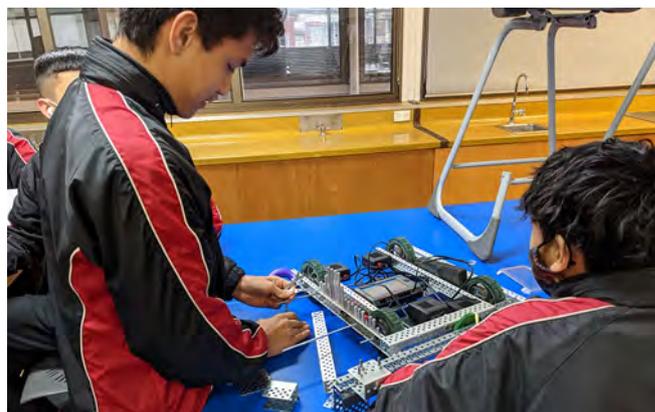
From Travis Burroughs, partnership teacher at Templestowe College

The Templestowe College Experience

What is now called the Future Schools Alliance (<https://futureschools.education>) started as a last-ditch effort to resurrect Templestowe College from the brink of collapse due to low student enrolments. In 2009 the student numbers and engagement had deteriorated to a point where the school was no longer viable. The Department of Education, in a last-ditch effort to save the school, appointed a new principal, Peter Hutton. Peter saw that traditional education had failed the school and then opted to try a new approach. The new approach turned the school's philosophies in on themselves to focus on what the students wanted to learn and not on arbitrary VCE results.

Eventually the new system led to the removal of year levels and students learning at their own point of need in classes that they lead. Twelve years later, the school is under new leadership, but the philosophy continues on. Templestowe is now a thriving school with over 1200 students from around the eastern suburbs and despite the lack of focus on VCE has managed to have a steady increase in VCE results since 2009. Once students' voices are heard, a school can start to improve, but if not, schools are stuck in a vicious circle of trying to improve student outcomes from arbitrary data.

The Future Schools Alliance, now led by Templestowe College's former principle, encompasses over 60 schools from around Australia, all of which are putting the student's voice first. I have been involved with HPSC helping them along their journey for the past two years. It is astonishing to see the changes that have occurred in that time! Students are taking ownership of their learning and leading the school. I look forward to seeing how the school grows over the next few years.



As well as being able to collaborate and share pedagogy ideas, the partnership with Templestowe College has allowed us to seek advice, assistance and feedback while we are implementing our changes.

Opposite: Robotics students developing a robotic system and creating a test program.

Above top: Robotics students testing their robotic system.

Above bottom: Robotics students creating a VEX robotics system including writing a coding sequence. Images by Tony D'Auria courtesy of Hampton Park Secondary College.



Lower price for our new model!

Both models remain the same in relation to function except the box is now being manufactured from M.D.F. not aluminium. **A huge reduction in price and weight.**



What does the U.R.G. do? Any standard router fits between two pieces of aluminium angle that are fixed to an M.D.F. box and the timber being machined is clamped in three self-centring vices. It is used in conjunction with a router to machine grooves. A booklet is included outlining its scope and new project ideas.

Why a Universal Router Guide would be useful in your workshop.

Safety The guide allows a router to cut grooves by manipulating the router, not pushing the timber over an exposed cutter where a router is inverted in a table.

Vices The expense of the guide is due to the high quality self-centring vices.

On guard The guide is a part of a computerised testing platform so anybody can familiarise themselves with any WH&S issues that may arise.

Project ideas The video and website demonstrate original joining techniques and many new project ideas that can be created by the use of the guide.

Routers Any size router fits the guide.

Review! Visit our website to read the *Australian Woodsmith* magazine review from Issue 158.



Visit our website for demo videos

www.universalrouterguide.com.au demonstrates why your workshop would benefit from a Universal Router guide.

Redesign model prices:

Large model: was \$3500 now **\$2700**
Small model: was \$2500 now **\$1700**

Ideal for schools

For more information contact Steve Somerfield on 0435 045 522 or email info@universalrouterguide.com.au | www.universalrouterguide.com.au

Testimonials from Users of the Universal Router Guide

I have a furniture background and have always had tools and equipment available to produce custom pieces to a high standard. The U.R.G. has been a necessary teaching aid within my faculty, with the need to purchase a second guide for an adjoining workshop. It is safe and manageable for students from year 9 and upwards. Thanks Steve for designing such a useful piece of equipment for student success!

Brad Arnold (teacher), Illawarra Sports High Wollongong

I purchased a Universal Router Guide for my school as I was looking at a way for producing mortises more safely and quicker. The U.R.G. is linked to classroom management as students are not lining up for a machine. The U.R.G. is another piece of technology that makes my job easier. When using the U.R.G. the cutter is pointing away from the student and they hold the router while the timber is fixed in the vices. There is no chance of an inexperienced students' fingers touching the router bit as the students are pushing a router not a piece of timber. I enjoy using the U.R.G. and feel confident that my students are safe. I have also been using it with V.E.T. building construction to make new benches for the classroom.

Thomas Freeland (teacher), Cranbrook High school

We have two Universal Router Guides at the college that get used side by side with other pieces of technology to make various timber projects. We appreciate the fact that students are able to set up the guide and use it safely and independently.

Andrew Edmondson (Head teacher), Edmund Rice College Wollongong

Having implemented the Universal Router Guide at my previous high school in 2020, I noticed that students' projects were coming together faster. I could trust students to use it with minimal supervision by me and it's simple to set up and 100% safe. It was also useful as I use it as a secondary mortising machine and inlays and flutes can be machined on any size leg. Having moved schools recently I don't have a U.R.G. at my current school and it is these processes stated that are taking my students much longer and the quality in their work has diminished.

Nick Sands (teacher), Kirrawee High School

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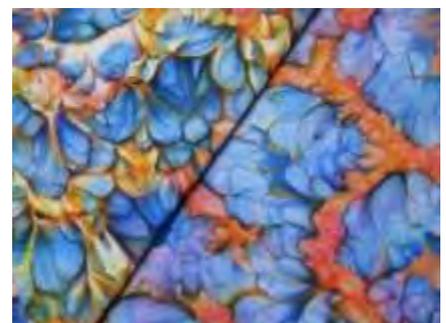
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Top Designs Exhibition 2021



This year's Top Designs Exhibition at Melbourne Museum demonstrated the tenacity and creativity of students who overcame the many obstacles they faced during the 2020 lockdowns due to the coronavirus pandemic. Here we find out more about the work in the exhibition from the students and their teachers.

VCE Product Design and Technology – Maori-inspired clothing

Student: Jenna Franks

Teacher: Phillipa Loton

School: Bacchus Marsh Grammar

From the student...

Description of the product

I developed my design brief to give New Zealand citizens living abroad a way to feel connected to their culture. As a Kiwi myself, I am proud of my nationality and often wish I had a way to express this in my everyday attire. The design includes modern interpretations of traditional elements of Maori culture to ensure it is representative and without cultural appropriation, whilst appealing to a wide contemporary audience.

I mainly constructed the garments from linen and linen blends, as it is a modern representation of the traditionally used flax. The necklace was made of ply wood and paua veneer. I also included materials such as greenstone, elastic and PLA filament.

The outfit consists of three separate pieces and an accessory, intended to be able to be worn both separately or together.

- The red bandeau top contains a centre zipper with a bone koru zipper tag and decorative top stitching either side. It has wide elastic banded sides to both create negative space and to make the garment more size inclusive. The straps are adjustable and detachable to allow the end-user to customise the top; the strap adjusters were 3D printed using PLA filament due to the restricted access to stores during COVID-19 lockdowns in 2020.
- The white hooded t-shirt features two Maori inspired screen prints; the smaller front print is an altered graphic of the artwork on the 10 cents piece, while the other is inspired by the traditional *kowhaiwhai* pattern.
- The skirt is reversible to increase its versatility, with skirt side one being beige and black and skirt side two being entirely black, both featuring a red tie waistband. The wrap style was chosen as it is relatively size inclusive and a pocket with a greenstone closure is also featured to increase functionality.
- The wooden and paua necklace is also reversible, with a plain wooden side and a blue/green paua side; both sides were laser cut after extensive testing.

Experiences while working on the SAT folio and product

I enjoyed learning more about Maori culture as it was not something I had looked into before, having lived in Australia most of my life.

A high point was definitely the research trip I was lucky enough to go on with my mum before COVID-19 hit; we went to the North Island of New Zealand and visited Rotorua and Wellington to learn more about elements of traditional Maori culture and find inspiration as to how this could be interpreted to appeal to a contemporary, modern audience. The lows would definitely have to be being stuck at home during the lockdowns and not having access to all the school's resources or even being able to talk face-to-face to my classmates.

Current and future plans

I am currently studying at the University of Melbourne, completing a Bachelor of Science and hoping to become a secondary school maths, science (and possibly product design) teacher.

I am currently working at my old high school as a VCE intern so I am able to use my knowledge to help the current students. Aside from this, the biggest take away from completing my folio was the importance of time management as the process is long and slow and cannot be rushed or left to the last minute.

Advice for current VCE students particularly those doing Units 3 and 4 Product Design and Technology

I would strongly encourage students to develop a design brief related to an area they are interested in as it will motivate them to produce work of a high standard. It will make the process of creating the folio more interesting.



Opposite: Jenna modelling the red bandeau top, reversible wrap around skirt and wooden and paua necklace she designed and produced for her SAT.

Above top: Jenna modelling her white hooded t-shirt that features two Maori inspired screen prints, reversible black wrap around skirt and wooden and paua necklace.

Above bottom: Jenna with her two outfits displayed at the 2021 Top Designs Exhibition. Photos by Nicole Cleary, courtesy of the VCAA.

From the teacher...

Suggestions to share with other teachers regarding how they can best support their students when working on the SAT

Primarily, it helps to know students well so they can be supported to work with their strengths. Also, I think it is important to take time early in the Product design process to develop a design brief that allows for students to prioritise innovation. This does take longer and requires a few drafts of the brief, however it supports students to move beyond their first idea. Additionally, encouraging students to conduct their own primary research as much as possible supports the creative process.

Learning from experience – doing things differently

This year I am finding that students may have missed out on some skill development last year as they had significantly less time in class to build and practise skills. Some of their other skills, such as CAD or using Canva for online folios are more advanced so this year we are tapping into skills they do have. Also we are using creative activities, such as using images to prompt a series of three minute sketches, as a means of practising creativity through drawing to engage students in hand drawing.

Hurdles the student had to overcome when doing the SAT

Jenna was working from home for about two terms during 2020 and for the majority of the product construction process. She had to think laterally in terms of getting supplies delivered to her home or look for alternative suppliers online. Jenna communicated well with teachers who could then assist with posting items to her house or using a 3D printer at school for her. Her persistence and positive attitude helped enormously. As a group, students faced connectivity issues depending on where they live, difficulty accessing sewing equipment, difficulty communicating with me online about how to construct their products, and challenges working independently without social support from peers. Overall they were amazingly resilient and just kept going.

The SAT allows students to project manage a long-term research and practical project and requires development of all the associated skills. It requires them to problem solve, be creative, manage their time independently, be flexible and anticipate difficulties.

How the experience of working on the SAT will help the student in the future

The SAT allows students to project manage a long-term research and practical project and requires development of all the associated skills. It requires them to problem solve, be creative, manage their time independently, be flexible and anticipate difficulties. There are not many opportunities at school for students to take control of such an extended project and the skills resulting from the SAT can be applied to many other contexts in future.



VCE Product Design and Technology – Silver Nymph Jewellery Line

Student: Rori Van Huizen

Teacher: Jamie Pointon

School: Billanook College

From the student...

Description of the product

My product is a relatively classical range of jewellery made from sterling silver, Tasmanian blackwood, and resin pigmented with blue, green, and purple pearlescent pigment powders and detailed with acrylic gold ink. I combined more natural, smooth shapes with angles of resin cut through them for the stones as I thought it created a nice contrast in the pieces. To complete my jewellery, I had to use many different woodworking techniques as I cut out all the pieces and angles by hand from the wood which primarily included the use of a jeweller's piercing saw. I also had to learn the correct technique for silver soldering as that was a large part of the construction of my project.

My main material area would probably have been metal, specifically sterling silver as it made most of the foundations for my jewellery, however I also worked quite heavily with wood and resin as these made the actual stones of my jewellery.

My end user was the owner of a small boutique in the Dandenong Ranges. She required a line of jewellery that was different to the current styles in her boutique to bring in new customers and attract the eyes of tourists. However, the line still had to fit the overall aesthetic of her boutique and had to be a coherent line. I chose to use wood and resin for my stones because these materials remind me of the area around her boutique.

Experiences while working on the SAT folio and product

Whilst working through the design process I enjoyed creating all of the visualisations and the mood board the most and just playing around with the aesthetic that I wanted in my design.

The low point was not being able to access the workshop as much as I would have liked due to COVID-19 lockdown restrictions; other than that, there was not much of a low point for me as I genuinely enjoyed the entire unit.

Current and future plans

Currently I am studying a double degree of science and engineering at Monash University. I am thinking of majoring in materials engineering and biology.

VCE Product Design and Technology did help me to prepare for the organisation and planning aspects of my course. Having to plan out a whole design process will significantly help me in my proposed future in engineering.

The practical part of VCE Product Design and Technology does not really contribute to the study I am currently doing, however the design process and theory about sustainability and materials is helping me quite considerably in my studies as it ties into my sustainable design engineering unit that I am currently taking.

Above: Rori's eye-catching range of jewellery designed and produced for the VCE Product Design and Technology SAT. Photo by Nicole Cleary, courtesy of the VCAA.



Advice for current VCE students particularly those doing Units 3 and 4 Product Design and Technology

Keep on top of your folio and if you need to do something in your folio sit down without distractions, focus, and power through it; it will take you less time to do than you think. The more you procrastinate the more you will get behind and the more stressed out you'll become. Also, when you study sustainability try to retain as much of the information as you can as it applies in all aspects of life and in all career fields.

From the teacher...

Suggestions to share with other teachers regarding how they can best support their students when working on the SAT

Let the student's passion drive the process; just be there to support their ideas and guide them in the right direction. The most helpful thing you can do as a teacher is to encourage a student's creative side through discussing possibilities and ideas with them but without making decisions for them. If a student comes up with a workable creative idea then you/they are already halfway there and the critical thinking will follow.

While it's important to include all the product design factors to work towards an excellent result in the SAT, I've found the two most worthy of a student's initial attention are user-centred design and innovation and creativity, as it's these that will individualise a project and effectively set it aside from the rest. There is no doubt that time management is absolutely critical in completing the SAT and if students, with your help, are able to quickly identify the importance of effective time planning and management then they will be well placed to succeed.

Hurdles the student had to overcome when doing the SAT

The nature of Rori's intricate, unique production work did, at times, isolate her from the group. Not having other students working in her field (jewellery making) effectively created a situation where other than technology staff, Rori didn't have anybody else to discuss her ideas with to gain feedback. Rori therefore sought out the assistance/advice of an industry specialist who she contacted and spent time with. She learnt from him by viewing and experiencing his operations. Access to equipment was also an issue, especially during periods of lockdown, however some careful planning and alterations to work schedules meant Rori was always working as productively as possible at any given time.

Clearly 2020 threw up some very real challenges in completion of the SAT requirements. Not being able to be physically present with students as a group to discuss and develop ideas and possibilities was difficult. However, the working from home scenario was a positive for those students who were able to really focus their attention towards the design and development stages in order to produce the best possible design options, scheduled production plans, risk assessment etc. I feel this situation truly brought the best out of a number of students and ensured that whatever on-site time was available to us could be exclusively production focused.



The most helpful thing you can do as a teacher is to encourage a student's creative side through discussing possibilities and ideas with them but without making decisions for them.

How the experience of working on the SAT will help the student in the future

Rori is quite possibly one of the most determined, committed, and self motivated students I've ever worked with. I'd like to think that the experience of working through an entire academic year on a single project, having to manage the many different aspects, has added to her skill set and therefore helped in some way towards setting her up for ongoing successful project management.

Problem solving is always a major element of successful SAT completion (even more so during 2020) and for Rori to have had to identify issues throughout her SAT completion process and envisage viable ways of overcoming problems has hopefully provided some real time problem solving experiences that she may reflect upon in her future work.



Above: Jamie Pointon (left) with his student, Rori Van Huizen (right) at the opening of Top Designs 2021. Photo by Nicole Cleary, courtesy of the VCAA.



VCE Systems Engineering – Autonomous Underwater Vehicle (AUV)

Student: Moses Huf-Tirfe

Teacher: Michael Antony

School: Footscray High School

From the student...

Description of the product

The problem my Systems Engineering project solves is the cost/adaptability barriers that are present in the current underwater observation market. In response to this problem, my Systems Engineering product roughly needed to cost in the low hundreds, contain ample room for additional hardware as well as use simple scalable software. It had to be smaller than most similar technologies, so it's easier to deploy.

This AUV can autonomously travel to predetermined locations using GPS technology. It can collect data on aquatic environmental conditions, that is, collect samples from underwater environments to help monitor their health. It can automatically stabilise itself along the X-axis by detecting the roll instability, then actuating the hydroplanes to create a counter roll. The AUV can also dive and surface by filling and purging the contents of the external ballast tanks. The solar panel charges the battery when the AUV has surfaced.

The following components and materials were used to produce the AUV: MPU6050 gyroscope, Arduino nano, NPN MOSFET, 5V solar panel, servo motors, 12V submersible impeller pump, DC motor, 12V battery, protoboard, PVC tubing, ABS plastic for 3D printing, acrylic plastic for laser cutting, plywood, acrylic and enamel paints, hot glue, super glue, solder and hook up wires.

The completed AUV has three tubes, two used as ballast tanks, the other as the fuselage that contains everything from the electronics to the observation equipment.

Experiences while working on the SAT folio and product

I enjoyed the work I did relating to simulating materials performance. In spite of it not being something I'm greatly intrigued by, I enjoyed it because it allowed me to cut down on assumptions in the design of the system which is a satisfying aspect of the design process.

The high point was reaching a breakthrough with the gyroscope and the hydroplanes, as it took potentially hundreds of hours of research and trial and error. For it all to amount to a great result was a pleasing highlight. The low point was engaging in challenging discussions with my teacher that would occur over various engineering decisions as well as on the presentation of the folio and project.

I learnt the most from working with Arduinos. It was a platform that I've never had to use before yet it was incredibly versatile when it came to the development of the AUV. Yet it was quite challenging because there was such a wide variety of issues that could occur, from hardware to software to bootloaders to simple grammatical errors. The largest challenge created by COVID-19 was the loss of practicals; this ultimately led to me putting a focus on the development of the software side as well as placing a greater focus on simulations for certain materials and creating a more intricate CAD design.

Above: The AUV project designed and made by Moses Huf-Tirfe displayed at Top Designs. Photo by Nicole Cleary, courtesy of the VCAA.

Current and future plans

I'm currently studying an engineering and commerce double degree at Monash University. I've also continued working with the aerospace start-up I co-founded called Eutopia Aerospace*, as we gear up to develop larger engines and expand our market reach. There are also several promising industries I'm looking forward to potentially having a presence in such as energy storage, blockchain and even agriculture.

Systems Engineering allowed me to get a lot more hands on time with distinct electronic components and to have a solid practical knowledge behind what I'm learning at university which is very valuable.

Advice for current VCE students particularly those doing Units 3 and 4 Systems Engineering

Your folio doesn't need to be a doctoral dissertation.

You can be whatever you want to be so long as you are good at it and employers are hiring in your field of interest and expertise.

Systems Engineering allowed me to get a lot more hands on time with distinct electronic components and to have a solid practical knowledge behind what I'm learning at university which is very valuable.

From the teacher...

Suggestions to share with other teachers regarding how they can best support their students when working on the SAT

Students should have a clear idea of teacher expectations and VCAA requirements, the former being more stringent than the latter if students aspire to have their work displayed in the Top Designs exhibition. Depending on the type of workshop students work in, specific rules must be followed because I believe safety is of utmost importance. My advice to teachers is not to allow students (including VCE Systems Engineering students) in workshops to work on their own. An accident can happen in any workshop at any time.

I ensure that each student has the Daily Activity Log filled in and signed before leaving class.

I suggest that teachers present to the students two or three working models from past years, along with folios, the marking scheme used, and the marks allocated against each criterion. This helps students to understand the VCAA expectations, the rationale behind the mark distribution as well as the marking process. It's a really useful exercise for students to be given the opportunity to assess at least one project from the previous year. I have 12 projects from previous years on display that I maintain in good working condition and have used these for this purpose and to inspire the current students.

Large digital folios must be divided into three or four sections. That means if additions and corrections are made in one section, the remaining sections will remain intact. Merging all sections to form a single folio is done only when no more corrections need to be made.

Projecting a student's folio onto a large screen (TV or projector screen) assists the teacher and student to do corrections and makes formatting pages easier.

How things will be different after the pandemic

Compared to 2020 and 2021 after the pandemic lockdowns, hopefully teaching will get back to normal. When a teacher is available in school every day, there are three advantages. Firstly, whenever a student needs clarification, the teacher is available or could be visited, say, for lunch break tuition on the project options proposed by the student. Secondly, students who get free periods can simply continue on with their project and work and spend some extra hours on it. This advantage was not available during the lockdowns. Thirdly, teachers can push students to speed up the project/folio when they see students face-to-face on a daily basis.

Hurdles the student had to overcome when doing the SAT

There were a number of hurdles during 2020 due to COVID-19 school closures. Collaborative learning from peers in workshop practices/processes was not possible during lockdown times. After-school tuition on folio development was impossible. Even when school reopened for some time in 2020, clear instructions were given by the principal that all teachers must exit by 4.30pm. This was for COVID-19-related deep cleaning of the rooms.

The only option the student and the teacher had was to attend Google Meet sessions from their homes during evenings and weekends. In fact, in some ways, I felt that it was a more convenient way for personalised guidance to students while they were comfortably sitting in their homes.

My student did a lot of trials/simulations to get the Arduino program working to his expectations. One day while I was having a Google Meet session with Moses, he shouted and jumped all over the home study room in happiness. I asked him what was going on. He said after three full days of trial and error, finally he saw his program and his system communicating with each other. Using his camera, he showed me the successful simulation in action.

I remember that one Google Meet session started at 7pm and ended at 11.45pm! The dedication of both the student and the teacher was the reason for Moses' work being selected for the Top Designs exhibition.

How the experience of working on the SAT will help the student in the future

Moses was a highly motivated student who wished from day one that his project would be included in the Top Designs exhibition. In 2016, a student of this school (formerly named Footscray City College) was also represented in Top Designs. The experience I gained from marking that 2016 project helped me to teach Moses the building blocks of the folio.

I believe that if Moses is guided well by experienced teachers who can answer all his queries, he will be a successful engineer in the future. I feel the experiences he gained last year stand him in good stead as he is now studying an engineering/commerce degree course at Monash University.



**A note from the editor*

Melbourne-based start-up Eutropia Aerospace was founded by secondary school students Moses Huf-Tirfe and Hamish Drummond. This start-up plan is to combine reusable rockets with hybrid fuel to provide a more cost-effective way of getting micro-satellites into orbit. For more information and to listen to an interview with Moses, go to <https://castbox.fm/episode/Moses-Huf-Tirfe-Co-founder-%26-CEO-of-Eutropia-Aerospace-id414587-id189825435?country=us>

Above: Michael Antony, Systems Engineering teacher at Footscray High School (left) and Moses Huf-Tirfe pictured with the AUV at the opening of Top Designs. Photo supplied by Michael Antony.



VCE Systems Engineering – Racing Simulator (Car Driving Simulator)

Student: Alexander (Alex) Stevensen
Teacher: David Harmer
School: Christian College Geelong

From the student...

Description of the product

The product was created to solve the problem surrounding rehabilitation following a motor vehicle accident or a medical event and preparing a user to return to driving a vehicle.

The subsystems of my product look similar to the subsystems you would see present when driving a car i.e. a steering wheel, a steering wheel base, a brake and accelerator pedal and a gear shifter. The steering wheel incorporates a rotary encoder, motor and Arduino microcontroller for the main components. The motor supplies the force feedback for the steering wheel. For example, if you were to drive over a bump in the vehicle simulation video game, the motor would rotate the encoder to best match the bump's feeling that would be present in a real vehicle. The rotary encoder is the source of steering for the steering wheel and can be pictured like the x-axis along a Cartesian plane, where moving the wheel to the right moves the reading on the rotary encoder more in the positive x-direction and vice versa for the left-hand side. This movement is transferred to pixels so that the video game can act accordingly depending on how far the wheel is turned.

The pedals both operate in very similar ways utilising a potentiometer to function in a similar manner to the rotary encoder however just for the limited range of motion present in a pedal. The potentiometer is turned using two rectangular pieces of metal that connect to both the potentiometer and the pedal to allow for seamless movement and readings whilst the pedal is in action. The shifter subsystem operates in a very similar way to how a keyboard works on a computer. There are switches on either end of the shifter's base that when pressed by the shifter act like a key being pressed on a keyboard. This is controlled by a Teensy microcontroller that acts independently from the Arduino.

Experiences while working on the SAT folio and product

The aspect of the engineering design process I enjoyed the most was the physical building of the end product. My high point of the year would have been bringing the finished product into school to show everyone and to allow people to test and experience the final product.

I learnt the most from the constant interruptions in the school year due to COVID-19. By this, I mean that I had to adapt to the situation and had to overcome the difficulties that were present. I overcame a lot of the difficulties by being resourceful and being quite self-reliant. The most helpful advice from my Systems Engineering teacher was to be more self-reliant.

Current and future plans

I am currently studying computer science at university and I aim to go into the field of cyber security.

My Systems Engineering experience really helped to prepare me for what I am doing now as it taught me to be self-reliant which is what is often required when programming and problem solving.

The skill I developed in Systems Engineering and probably use most frequently now and in future, is how to formulate and execute a well-designed report/folio.

Advice for current VCE students particularly those doing Units 3 and 4 Systems Engineering

It's really important to invest the time doing research for a potential product that you can really enjoy making. Making something that you enjoy reduces the stress with the project and can give you a breath of fresh air that is often needed while studying in year 12.

My Systems Engineering experience really helped to prepare me for what I am doing now as it taught me to be self-reliant which is what is often required when programming and problem solving.

From the teacher...

Suggestions to share with other teachers regarding how they can best support their students when working on the SAT

As a new teacher to Systems Engineering during a year where we as teachers were so disconnected from our students, my hope was to encourage the students to keep asking questions for understanding. This would enable the students to become learners that can be self directed. In the extraordinary year that we experienced, it meant that the students had to take more control of their learning. I believe that in the future these newly graduated students will need every bit of resilience they have to achieve their dreams in life.

Learning from experience – doing things differently

Folio, folio, folio, is my focus this year. It has to be done and it is such a big part of the curriculum. In my first year, I took an authoritarian approach in terms of covering each criteria, not wanting to test the waters of creativity if you like. This year I am trying to make the folio process more engaging, allowing the students to showcase their creative minds and therefore, the criteria may not appear as such a strenuous task for the students to complete.

Hurdles the student had to overcome when doing the SAT

Alex faced many challenges last year both with the folio and the project build. Firstly having a brand new teacher to Systems was probably the most daunting thing for Alex. Being sent home to work through the pandemic lockdown period was somewhat of a disaster trying to share screens and images via email to make sure the student and teacher were on the same page with our ideas. Thankfully, Alex was able to gain confidence in what I was saying, which quickly allowed him to get on top of his folio from a very early stage and led to a great overall result. Being separated during last year was the toughest thing for all the students to deal with as there was not as much time for one-on-one teaching. If the student was not able to learn and become a self directed learner and worker, then they mostly found it very difficult to work from home.

How the experience of working on the SAT will help the student in the future

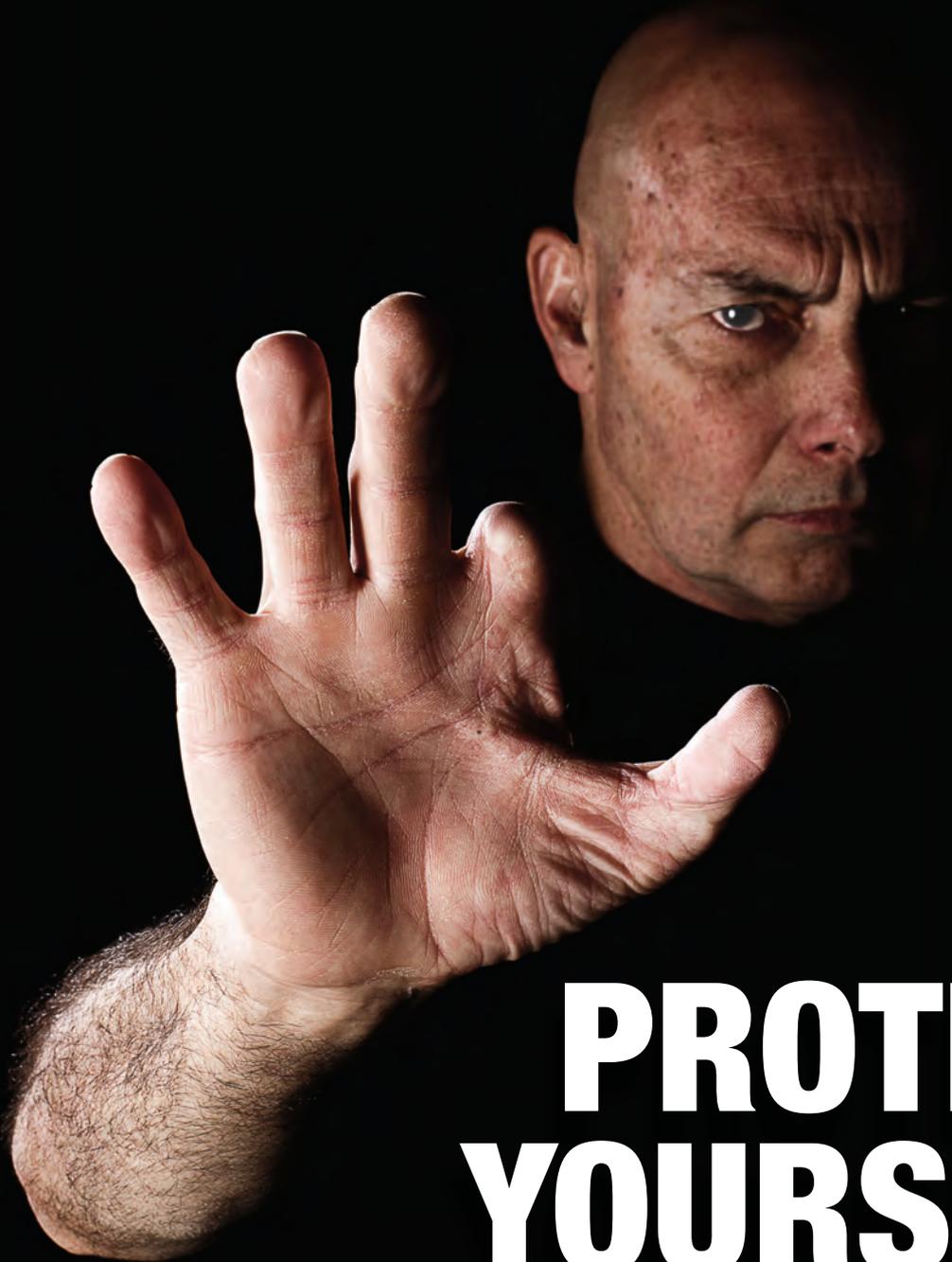
As mentioned earlier, Alex was able to become confident in the curriculum I was delivering to him, very quickly. This allowed Alex the time to get organised and set himself up for a big year. Alex understood that to be able to complete his folio well, it was not going to come from just asking questions and seeking clarification. Alex was aware that he would need to work very hard behind the scenes to ensure that he would get the work completed. Therefore, Alex showcased his attention to detail through great time management, resilience and self-belief. These are all great attributes that I am sure will see Alex excel in his university studies and occupation as he moves on from there. Well done, Alex!



Opposite: Alex Stevensen with his car driving simulator that allows the user to realistically accelerate, brake, use a manual transmission and steer a car within a video game. Image by David Harmer, Christian College Geelong.

Above top: Alex's racing simulator showing the functional parts of the system used for steering, braking, accelerating and changing gears. Photo by Nicole Cleary, courtesy of the VCAA.

Above bottom: Close up of Alex's car driving simulator. Image by David Harmer, Christian College Geelong.



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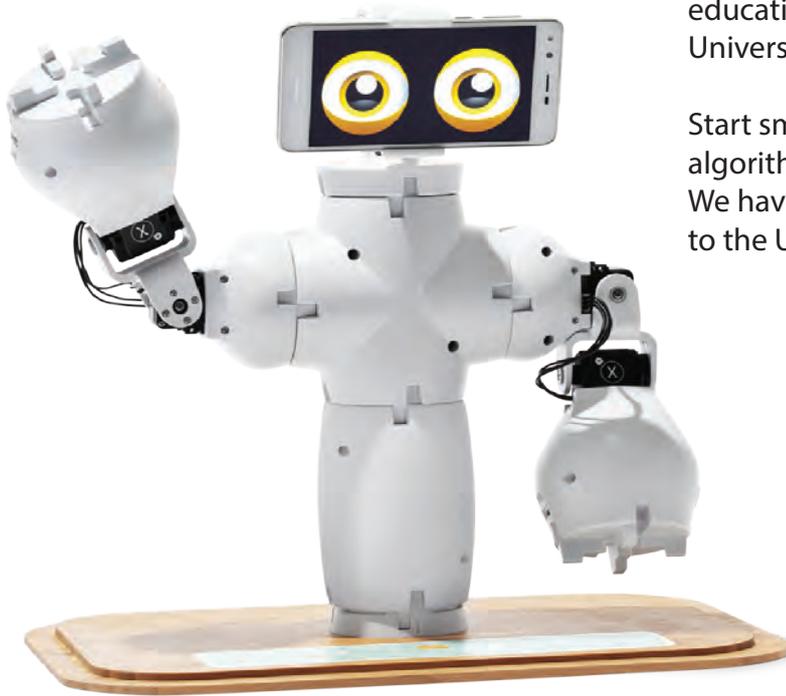
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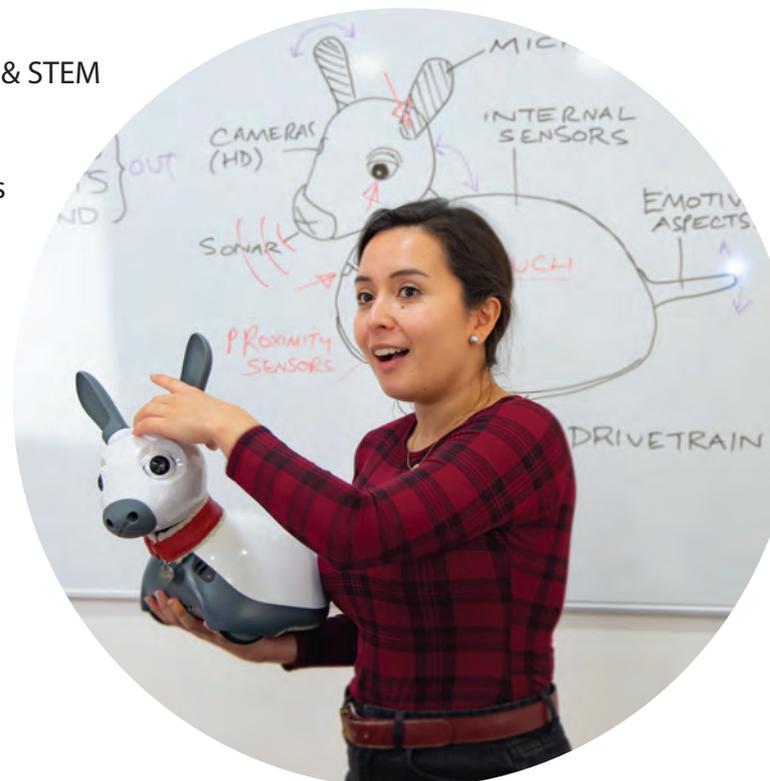


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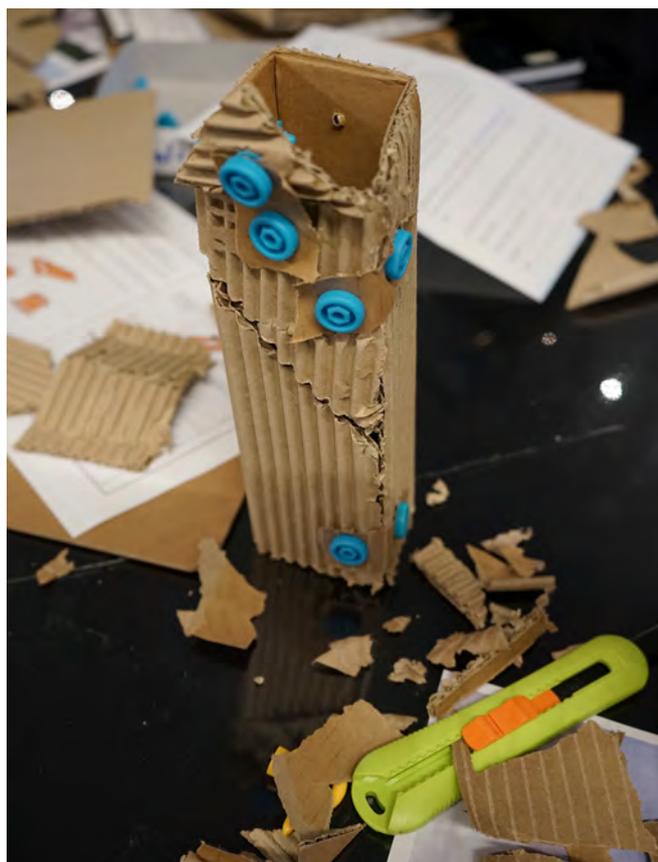
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Enrichment programs for students

STEM in Art program at the Australian Centre for Contemporary Art (ACCA)

Eloise Breskvar and Felicia Pinchen-Hogg, ACCA



Find out about the four learning programs conducted by ACCA, DATTA Vic's involvement in these programs and read feedback from teachers about the value of the STEM in Art program for their students.

Aims of the program

ACCA Education with the generous support of the Department of Industry, Science, Energy and Resources and the assistance of DATTA Vic has developed a new *STEM in Art* inquiry-based learning program. The program aims to prioritise access, inclusion, and the development of young peoples' critical and creative capacities. The program targets regional and socio-educationally disadvantaged (ICSEA) students to participate in *STEM in Art* inquiry-based education and artmaking workshops, which aim to capitalise on the rich, and often largely untapped, interconnections between creative art-making activities and the STEM focuses of design, engineering, and programming.

The ACCA *STEM in Art* program involves delivering free, hands-on gallery-based workshops at ACCA, with free transport provided for eligible students; developing high-quality, curriculum-responsive resources for teachers and students; and continued, sustainable learning through outreach of specialist ACCA educators to eligible schools to solidify and embed learning from the gallery and strengthen relationships encouraging future engagement with the program.

An important component of this program has also been the provision of free transport for regional and socio-educationally disadvantaged schools, which addresses an identified barrier for marginalised schools to participate in inner-city arts learning experiences.



Four ACCA learning programs for students

ACCA's *STEM in Art* program had been developed for F–12 students and extends our four existing ACCA learning programs with a STEM focus as follows:

1. *Talk Think Make x STEM*: runs alongside two ACCA exhibition seasons each year and involves a 45-minute educator-led discussion around an exhibition and a 45-minute STEM infused art-making session. ACCA educators in collaboration with DATTA Vic have developed an art-making program that draws on a selection of STEM principles including design, engineering and programming.
2. *STEM in Public Art*: focuses on STEM by asking students to examine the design and engineering challenges unique to creating public artworks in Melbourne, involving critical and creative analysis of public artworks and a series of connected making workshops. The program utilises prominent Melbourne public artworks by female artists as a means of demonstrating the potential for girls and women to work successfully as artists who engage the principles of design and engineering and collaborate with specialist practitioners to realise ambitious, large-scale public artworks.
3. *ARTREACH x STEM*: Focuses on ACCA educators visiting regional schools to introduce *STEM in Art* concepts and introduce and extend gallery-based learning through discussion and artmaking in regional contexts. The program's multiple engagements aims to support young people to deepen understanding about artistic and creative processes, design thinking, problem solving, and the value of visual inquiry; and strengthen relationships with schools, encouraging future engagement with the program.
4. *STEM in Art Online Learning Stream*: focuses on continued and sustainable learning beyond the gallery. ACCA educators working with DATTA Vic are developing downloadable *STEM in Art* learning resources to support teachers and students to incorporate STEM principles in their visual arts classroom and highlight opportunities for interdisciplinary collaboration across multiple learning areas. Resources will be published on ACCA's Online Learning Platform, which currently hosts curriculum-responsive resources such as art files and exhibition learning kits, alongside video and audio content, e.g. artist, curator and maker interviews.

Opposite: Monolithic sculptural response to *Missile Park 2020*.

Above: Student explores corrugation in response to *Missile Park 2020* and Yhonnie Scarce's photograph of a bus shelter in Woomera, South Australia. Images courtesy of ACCA Education.



Teacher feedback about the program

Selected feedback from teachers who participated in the *STEM in Art* program for the exhibition by Yhonnie Scarce called *Missile Park*.

‘Students felt safe to speculate and interpret unseen artworks and engaged in critical discussions and could immerse themselves in the exhibition experience and the making component.’

Extract from student newsletter

‘At the Australian Centre of Contemporary Art, the students were able to explore the exhibition by Yhonnie Scarce titled *Missile Park*. The Education Officer helped us evaluate Scarce’s unique art based on her experience as a Contemporary Indigenous artist, her family history and cultural and political significance. ‘Her works included blown glass arranged in installations of corrugated iron and sculptures. Ultimately, the exhibition raises awareness of historical events and the effect it had on our Aboriginal communities; a remarkable experience like no other.’

‘Students enjoyed the STEM task and appreciated reflecting on the artist’s work to develop their own artworks.’

‘After the visit, one of my students said: “This is an amazing example of why contemporary art museums are an integral part of Melbourne.”’

‘The *Talk Think Make x STEM* session built students’ knowledge and skills across several of the fundamental concepts of contemporary art, with students gaining new insights and strategies for understanding interpretation, abstraction, how artists reference their own biography, and contemporary working methods and materials.’

‘Students loved the hands-on *STEM in Art* activity at the end of the session.’

For further information about the *STEM in Art* program at ACCA go to <https://content.acca.melbourne/uploads/2021/02/Brochure-2021-web.pdf> or contact Eloise Breskvar, Educator and Program Coordinator at eloise.breskvar@acca.melbourne or Felicia Pinchen-Hogg, Education Manager at felicia.pinchen-hogg@acca.melbourne

Above: Student sculptures (models, structures, memorials) in front of *Missile Park 2020*. Image courtesy of ACCA Education.



Biomimicry: Designed by Nature program at Royal Botanic Gardens Victoria

Ben Liu

Ben is the Creative Producer, Learning and Participation Programming and Audience Development at the Royal Botanic Gardens Victoria (RBGV). Ben studied a Bachelor of Arts (Nature Tourism) at La Trobe University and has teaching experiences in a range of educational settings.

In this interview we learn about biomimicry and the programs offered at the Royal Botanic Gardens that have strong links to sustainability, nature-connection and STEM.

What is biomimicry?

Put simply, biomimicry is *nature-inspired design* and over the past two years Royal Botanic Gardens Victoria have worked with partners, including DATTA Vic, the Department of Education and Training (DET) and Catholic Education Commission of Victoria (CECV) to develop a range of biomimicry inspired experiences for Victorian students.

From this work has emerged the keystone program *Designed by Nature* (www.rbg.vic.gov.au/learn/biomimicry), which introduces students to the discipline of biomimicry, supporting them to utilise biomimicry processes to look to the natural world for problem-solving and design inspiration.

Who is this program designed for?

The *Designed by Nature* program has been designed for upper primary and secondary students, with adaptations across the program to meet Victorian Curriculum outcomes.

Where and when is the program available?

The *Designed by Nature* program is offered at our two sites, Melbourne and Cranbourne, and can be booked each weekday during school terms. It is a full-day program spread across two sessions (AM and PM) that run from 10–2pm.

Due to the various COVID-19 lockdowns we have also adapted to be able to deliver the program online and to date more than 1000 students have participated in the program either face-to-face or online.

What are the aims of the program?

Put simply, biomimicry is nature-inspired design however as an emerging discipline it runs much deeper with strong links to sustainability, nature-connection and STEM. At RBGV we see Biomimicry as a truly cross-curricular opportunity bringing biology and design together for a more sustainable future. We also see our botanic gardens essentially as living biomimicry encyclopedias with endless opportunities to inspire student design solutions.

Through the *Designed by Nature* program students will work with a Biomimicry Educator to:

- learn about examples of bio-inspired inventions and come face-to-face with the plants and systems that influenced them
- identify the tried and tested biological strategies of nature through guided nature observation
- come up with their own nature-inspired ideas.

... biomimicry is nature-inspired design however as an emerging discipline it runs much deeper with strong links to sustainability, nature-connection and STEM.

Can you tell us a little more about the program?

The central idea of the *Designed by Nature* program is to provide a guided opportunity for students to develop and test a range of bio-inspired solutions. However, in order to do this, we firstly work with students to develop a thorough understanding of biomimicry.

Therefore, the first part of the day is spent outdoors in the gardens exploring key biomimicry themes including distinguishing between ‘learning from’ and ‘learning about’ nature, identifying functions and forms in nature as well as engaging in systems thinking using examples from nature.

Following the morning session students are then challenged to become biomimics, and practice nature-inspired engineering through a small group Design Challenge utilising one of the nature-models chosen by the RBGV Biomimicry Educator.

Back at school teachers are sent a range of specially curated digital resources for classes to explore further at school and to support them in undertaking their own nature-inspired designs.

What are the benefits to students of doing this program?

Such is the emergence of the field of biomimicry that the Jobs of the Future Report (<https://100jobsofthefuture.com>) recognised *Biomimicry Innovators* as one of the top 100 jobs of the future, identifying the importance of a new generation of innovators who seek sustainable solutions to human challenges by emulating nature's engineering processes.

We see biomimicry as an additional and important tool that students can add to their problem-solving tool kit.

Check out the student feedback below:

'I have learnt loads! Thanks you guys sooo much, it was so interesting and I love learning about nature!'

'I learnt all about the biomimicry world, you made it entertaining and it was so fun to do even through the online world. You've made me think twice about my dream career and my mum is literally watching this with me because she wanted to learn about it.'

'... that biomimicry is a brilliant way of solving problems.'

Do you have any future plans for this program or biomimicry offerings at RBGV?

At RBGV we have big dreams to expand our biomimicry education offerings, some of which include a state-wide bio-design competition for students to showcase their nature-inspired solutions, teacher professional learning opportunities and industry partnerships with leading design thinkers.

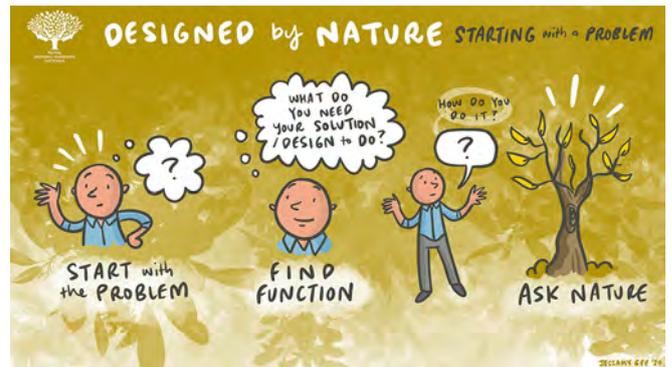
Where can teachers get more information?

Find out more by visiting our website www.rbg.vic.gov.au/learn/biomimicry or watch our introductory video at https://youtu.be/_N2h2JLycO8

The following publications are also recommended if you're interested in finding out more about biomimicry:

- Primary
 - www.booktopia.com.au/awesome-innovations-inspired-by-plants-jim-corrigan/book/9781680206074.html
 - <https://www.booktopia.com.au/design-like-nature-megan-clendenan/book/9781459824645.html>
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Royal Botanic Gardens Victoria is a proud partner of the DET Victorian Challenge and Enrichment Series which provides FREE opportunities for high-ability Victorian government school students to participate in the *Designed by Nature* biomimicry program. Find out about upcoming sessions here: www.rbg.vic.gov.au/learn/victorian-challenge-and-enrichment-series



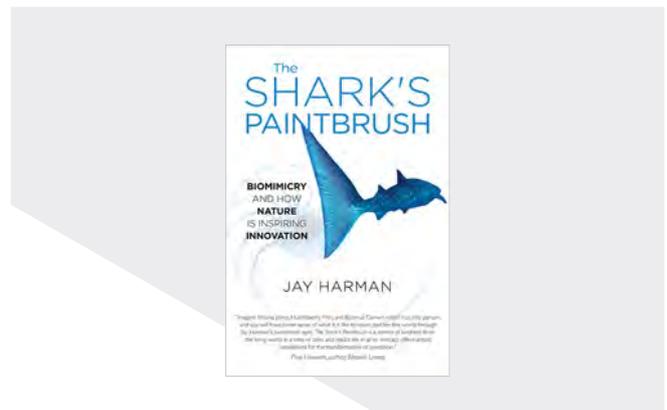
Top: Biomimicry, nature-inspired design, can provide additional problem-solving tools for design students.

Middle: Led by an expert biomimicry educator, the *Designed by Nature* biomimicry program explores a range of plant functions that can be used in design solutions.

Bottom: Learning from nature's efficient and sustainable designs is a key part of biomimicry education. Images supplied by Royal Botanic Gardens Victoria.

Book review

Lorraine Tran (reviewer)



The Shark's Paintbrush: Biomimicry and how Nature is Inspiring Innovation

Author: Jay Harman

Publisher: White Cloud Press, Oregon 2013

Details: 339 pages, with some small black and white photographs and illustrations

This is not a newly released book, however the information it provides is beyond fascinating. The author, Jay Harman, who grew up in Australia, is a naturalist, entrepreneur, and inventor. As the founder and CEO of PAX Scientific and its subsidiaries, he has designed efficient industrial equipment, including refrigeration, turbines, boats, fans, mixers and pumps – all based on biomimicry. He is credited with being among the first scientists to make biomimicry a cornerstone of modern and future engineering.

Within the first few pages, the author says that his book will clearly demonstrate that nature is the best source of answers to the technological, biological and design challenges that we face as humans (page 3). He believes that our current environmental and economic problems result from an out-of-date way of doing business whereas nature constantly evolves, survives and thrives, while not using up or endangering its base resources. There is huge potential to apply nature's lessons to design a new golden age for the earth and for humanity.

The term biomimicry was first coined in 1997 by Janine Benyus, a naturalist, educator and author of *Biomimicry, Innovation Inspired by Nature*. The word originates from the Greek *bios* meaning 'life' and *mimesis* 'to imitate'. However, humans have copied nature for millennia, with varying degrees of accuracy and understanding. A couple of examples are the design of Polynesian outrigger canoes that echo floating seed pods and Aboriginal Australian boomerangs that mimicked bird wings. One of the best known commercially successful examples of biomimicry is Velcro. George de Mestral, a hiker and inventor, looked at how burrs stuck to his sock and dog's fur and discovered the hook and loop structure under the microscope that became the basis for Velcro. Geckos hanging upside down from the ceiling have resulted in innovative adhesives and bandages.

Harman believes that by using a systematic design and problem-solving process, rather than just copying nature's shapes, scientists and engineers can profoundly apply biomimicry by precisely studying nature's strategies to survive and adapt. This involves clearly defining the challenge we're trying to solve. Then we can determine whether the problem is related to form, function, or ecosystem. Next, we can investigate what plant, animal or natural process solves a similar problem most effectively (page 7). For example, the design of a wide viewing angle camera lens was inspired by the eyes of bees which can see five-sixths or three hundred degrees around their heads. Alternatively, the exceptional strategies of a plant, animal or ecosystem are recognised and reverse engineered as in the case of the gecko above.

There are innumerable lessons humans can learn from nature. Nature builds with locally derived materials and doesn't waste materials. Nature can't afford to poison itself or create offcuts or excess. It can create and combine chemicals in such a way as to be nontoxic to its ecosystems. Green chemistry is a branch of biomimicry that uses a 'do-no-harm' principle (page 8). Nature also has methods to recycle absolutely everything it creates in a closed loop of survival on the planet. Everything is a resource and everything is recycled – one of the most fundamental components of sustainability. Harman makes a big statement at the end of the book's introduction – that by learning from nature, we can create more abundant, healthy, satisfying lives for ourselves, our children and our planet.

The Shark's Paintbrush comprises three parts. The first titled *A New Golden Age* provides a background to the development and interest in biomimicry. The second, *Biomimicry at Work* is the most interesting and investigates secrets from the sea, scales and feathers, the bee's knees, spores and seeds and wampum. Sharks, whales, dolphins, lizards, leeches, bees, butterflies, trees and seashells are just some of the thousands of species that are already teaching us about engineering, chemistry, materials science, fluid dynamics, nanotechnology, medical devices and so on. The third section looks at the *Nature of Change* and focuses on how business can apply biomimicry.

Harman makes a big statement at the end of the book's introduction – that by learning from nature, we can create more abundant, healthy, satisfying lives for ourselves, our children and our planet.

The book contains many fascinating examples of biomimicry; flight (birds), scale armour (fish, armadillos, lizards), camouflage (snow fox, leafy sea dragon, stick insects) spirals found in nature (seashells, flowers) used in architecture, fans and propellers, water-repellency (lotus leaf) (page 177) and something that's very topical at the moment, injections inspired by the proboscis of a mosquito (page 157).

In conclusion, the author has great faith in the possibilities biomimicry offers. He states:

Our deeply troubled world can be reinvented through biomimicry. Nature's trillions of solutions throw open the door to far-reaching opportunities for building a better world; rescuing our ailing environment and atmosphere; and giving rise to a powerful, new, sustainable economy.

If you're interested in using biomimicry as a theme for a STEM program, this book would provide some great background information. It contains an extensive 'notes' section as well as an index. There are a number of other resources available, including a program conducted by the Royal Botanic Gardens Victoria (see pages 44–45 in this issue of *Technotes*). The Biomimicry Institute also has education resources available at <https://biomimicry.org/education>. The institute states on its website:

'Biomimicry is revolutionizing education—offering teachers a way to inspire students of all ages by blending biology, STEM, creative problem solving, design, and systems thinking. Explore how we can help you share biomimicry with the next generation of change-makers.'

The Innovation Inspired by Nature – AskNature website (<https://asknature.org>) also has some interesting examples of biomimicry. It encourages the study of biomimicry on its website with the following:

'Introducing biomimicry into the classroom bridges the boundaries between school and real world for students. Biomimicry is an inherently interdisciplinary way of encouraging students to be observant of the complexity of the natural world and our interconnectedness to it. Rather than just learn about living things, biomimicry requires us to learn from the natural world.'

In addition, Biomimicry 3.8 – Innovation Inspired by Nature (<https://biomimicry.net>) and the Biomimicry 3.8 Blog; Synapse.bio (<https://synapse.bio>) offer some useful information and ideas. Also see Biomimicry 3.8 – YouTube (www.youtube.com/user/biomimicry38) for some great insights from the experts in biomimicry.

In closing I quote Albert Einstein: 'Look deep into nature, and then you will understand everything better.'

Opposite: Front cover of *The Shark's Paintbrush: Biomimicry and how Nature is Inspiring Innovation*. Source: White Cloud Press (www.whitecloudpress.com/product/the-sharks-paintbrush-cl).



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A Beginner's Guide to Educational Research

Peter Murphy

In the next three articles, we meet three teachers who decided to undertake further study. Why did they do it and what was the focus of their research?

Peter is a former president of the Design and Technologies Teachers' Association of Australia (DATTA Australia) and DATTA Vic and has been a leader in Design and Technologies education for over 10 years. He has worked in leadership roles in the Catholic and Government education sectors and now lectures in Technologies Education at La Trobe and Southern Cross Universities. He also lectures in Industrial Design at RMIT University. Peter has worked extensively with VCAA and Australian Curriculum, Assessment and Reporting Authority (ACARA) and now heads up Preferred Futures education consultancy. He is also the current Executive Officer for DATTA Australia.

In this article, Peter explains his interest in taking on further study and the factors behind what he decided to research. He describes the starting points in the process of conducting research and what he hopes will be the outcome of his work.

I was honoured to be the national president of the DATTA Australia committee from 2018 to 2020. During that time, we restructured the organisation in a number of ways in order to be more proactive in supporting state associations and advocating for the Design and Technologies Learning Area. The main initiatives we undertook were the creation of a national Design and Technologies Week and gathering more data and focus on the Technologies Teacher shortage.

However, it was when helping to organise and deliver our national research conference, newly rebranded as DATTArc, we collectively discovered the hidden threat to the future of our valuable learning area – an international shortage of active academics to support the continued evolution of Design and Technologies education. There are numerous factors for this drastic shortage, many unique to each country, but the universal conclusion is unavoidable. Short of some government metrics showing the importance of innovation and creativity to the future of the economy, there is no large industry or academic group out there advocating for continued, well-supported Design and Technologies education in schools. When compared to the extremely large Digital Technologies lobby, the comparison is stark, as so many wealthy multinational companies and an increasing number of academics push for greater uptake and improved implementation of much needed digital literacy.

Without action, the Design and Technologies learning area is in very real danger of becoming obsolete. And as we are the main learning area for delivery of sustainability, engineering and applied problem solving, this is a major threat for our future.

DATTA Australia's restructuring over the past four years meant that we are now in the financial position to start small but important scholarships to encourage more Design and Technologies teachers to consider further study and research to help repopulate the academic area that understands and sees the value in what we teach our students. These scholarships will hopefully be available for application by the end of 2021.

I have always been interested in teacher training, after a particularly poor personal experience at university. I felt it was time that I stepped down as president and took up the challenge of embarking upon further study myself – a journey that I have only just begun after years of consideration about how it would affect my income and my young family, who have already had to put up with my long hours of unpaid volunteer work on behalf of the learning area.

I spoke to many academics at various institutions and settled on studying for a Graduate Certificate in Educational Research at Melbourne University. I could study this part-time over one year, mostly online, and this would reduce the financial risk and impact on my family while I discovered if I was cut out for further research.

The goal of this Grad Cert is to teach you the basics of educational research and then help you develop a PhD proposal that you can then use to secure research approval at the university of your choosing. Having studied a Bachelor of Arts in Industrial Design in Scotland 20 years ago, I was more comfortable with crafting prototypes than searching databases for journal articles and referencing them accurately in whatever style that was required in 2021.

The initial subject I was enrolled in was Education Research Methodology. This required me to attend 6 x 5-hour intensive online weekend sessions consisting of lectures and tutorials (group discussions and activities). These sessions were fantastic and had a variety of newly graduated and mature age students who had a range of backgrounds and research interests. They also broke down the world of research into very manageable and practical chunks that I could get to grips with more easily than I originally thought possible. In fact, I think my practical approach to the research activities stood me in much better stead than some other students who had to unlearn previous practices.

The first stage in conducting research, and arguably the hardest, is to come up with a good research question. For our first activity our word limit was 1500 words (about the length of this article) which is actually very constrictive given the amount of factors we had to cover.

I initially wanted to tackle the issue of Technologies Teacher training and to investigate issues like climate change and the evolving nature of the design industry, but that was too broad for this initial task. After some consultation with my tutor, we settled on the topic of the barriers to teaching sustainability in schools and after many, many iterations I settled on this question:

‘How do teachers’ beliefs on climate change affect how they teach ‘Sustainability’ in Design and Technologies years 7–10 in Victorian secondary schools?’

As you can see the question is quite constrained and precise, hopefully meaning that the subsequent research that I would theoretically conduct at some stage later would be achievable. I will save my broader interest in design education and teacher training for potential future study. Many of my fellow students struggled to create a concise question, some of them were close to 100 words long, so I was pleased not to be alone in that struggle.

Once the question was crafted, I had to explain the reason for the proposed research and justify why it was important to find out what I could about this issue. What value would this knowledge have for the learning area, the education profession and indeed society? This was not too much of a problem as I knew it was an issue that many of my colleagues struggle with. Initial Technologies teacher education has not focused on sustainability until recent years, meaning many teachers in schools are relying on their own notions of what climate change and sustainability were, which I proposed would influence their teaching of this pressing global issue. One that students of all ages care about deeply.

I then conducted a literature review; this was the part I was most afraid of, having never been an enthusiastic academic reader. However, when it was explained to me that the majority of relevant journal articles would have only been published in the last 20 years, I quickly became familiar with some of the main articles and writers in this sadly shrinking field of study. There was a lot more to dig into in the sustainability education area and that of how our preconceived notions of issues would impact our actions around them.

Once COVID-19 lockdown restrictions eased, I headed into the university library, but I discovered that many of the books on the shelves were published more than 20 years ago, and not related to my intended area of study. So my research took place almost entirely online using the library search tools and databases. Finding articles was no problem. Finding the time to read, categorise and prioritise them took a bit more effort, but it was an enjoyable pursuit and one that filled me with more confidence each day.

Once I had established that there was a gap in the knowledge represented in the articles I had chosen to read on this issue, the next step was to identify my world view, research approach and recognised theory which I would use to structure my proposed research. This may sound more difficult than it really is. Essentially, I had to choose whether I wanted to conduct *qualitative* or *quantitative* research. Having a clear idea that I would need to interview people to find out about their beliefs on climate change and their subsequent practices I opted for a qualitative approach using semi-structured interviews as my main method of gathering my research. During my literature review I came across a well-established theory named *Ajzen’s Theory of Planned Behaviour* which essentially deals with exactly what I was looking for. It considers various types of influences that could impact upon intentions to behave, or in this case to teach, in a particular way. I had found the right tool for the job – always a relief!

I then had to justify my approach to finding volunteer teachers and conducting the interviews that I needed, quickly realising transcription of real interviews is a very laborious and time-consuming process. I proposed approaching three schools in different sectors and settings to conduct interviews with up to three teachers at each location. In my second assignment I had to delve more deeply into any ethical issues around my proposal, of which there are many. Chief among which was to ensure anonymity and that the volunteer teachers would experience no negative consequences as a result of taking part in my proposed research. I feel I have only begun to scratch the surface of ethical research issues and indeed gaining approval from any institution's Ethics Committee is a large but essential hurdle that researchers of all experience levels can struggle with throughout their careers.

My main aim is to help the learning area to grow in value as we help to develop students who are capable of creating innovative solutions to the problems that the whole world is facing.

Now that this article is going beyond the word limit of my first assignment I should again state that I am just at the beginning of my research journey, but it is one that I am really enjoying and hope to continue. Two different universities have shown interest in supporting me as I transition to a possible PhD and I feel I am becoming confident enough to progress into the world of understanding, advocating and hopefully improving Design and Technologies initial teacher education and practice in schools. My main aim is to help the learning area to grow in value as we help to develop students who are capable of creating innovative solutions to the problems that the whole world is facing.

I would also like to encourage you to join me on this long but important journey. A now retired academic once told me that writing a PhD is much like building a beautiful piece of furniture. 'It's always more work than you thought it would be, but the work ethic and enjoyment are the same'.

If you've ever considered using your experience as a Design and Technologies educator to help the next generation beyond the students in your classes and your personal circumstances are favourable, then go for it!

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Makerspaces creating opportunities for STEM futures – research into student’s academic self-concept development

Kristen Hebden

Kristen graduated from the University of Melbourne with a Bachelor’s Degree in Mechanical Engineering/Science in 2002 and completed her Graduate Diploma in Secondary Education and Teaching at La Trobe University in 2014. She is currently a Design Learning coach (part time) at Ivanhoe Girls’ Grammar and PhD candidate at Swinburne University researching makerspaces in high schools. Previously she was the Lead Teacher in STEM technologies and Digital Fabrication at Lauriston Girls’ School. She would like to inspire future generations and encourage a more diverse participation in STEM.

Kristen outlines the research she is doing into how students’ academic self-concept develops when they work in a makerspace. Her research involves taking student surveys, conducting focus groups and teacher interviews to determine the impact of makerspaces compared to traditional design and technologies spaces and the programs conducted in each.

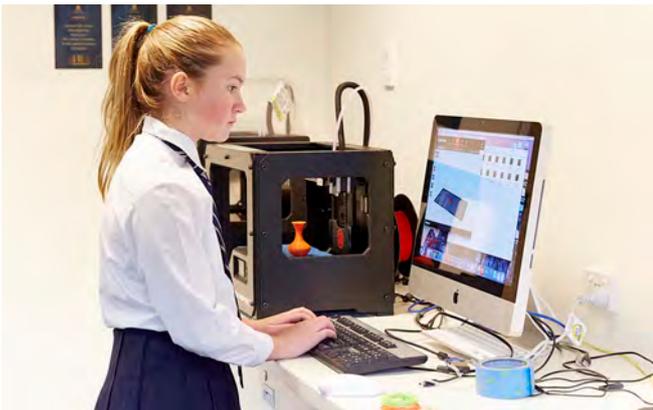
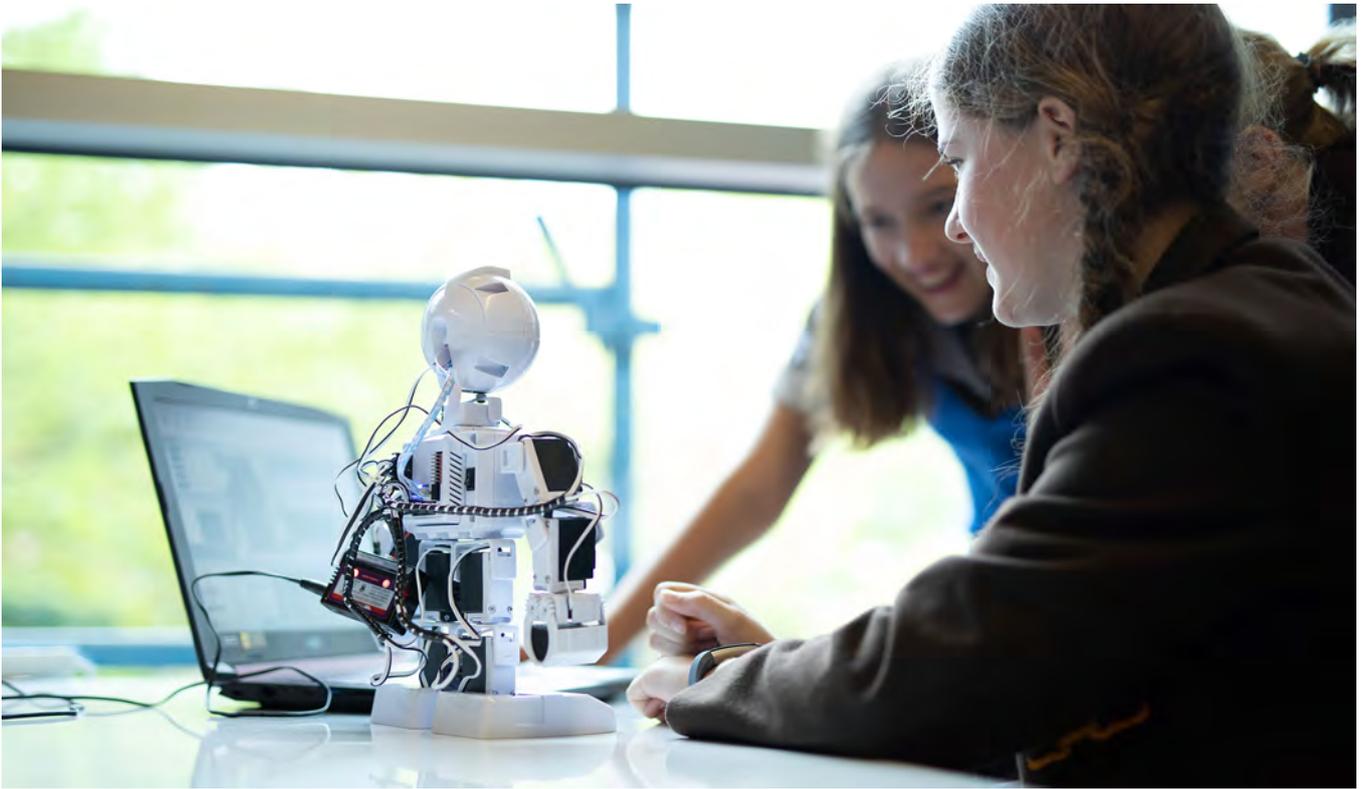
I started my teaching career as a Physics and Maths teacher, but with my engineering experience I quickly moved towards Maker Education. When I was an engineer, I realised very quickly the barriers between disciplines that existed in school did not exist in industry, and the ability to utilise knowledge and skills from a variety of disciplines was valued. I have been lucky in my teaching career to be at schools that had a vision of creating opportunities for students to experience problem-based projects that utilised knowledge and skills from a variety of disciplines. I have had the privilege of visiting many different schools, talking with educators around Australia about the programs they are delivering. Teachers are amazingly creative and give me such hope for the future of education.

STEM is a term originally used because Science, Technology, Engineering and Maths disciplines shared certain ways of working, and also shared an image issue and declining participation. In schools, the acronym STEM is now used to refer to multidiscipline or interdisciplinary projects. With all the funding associated with ‘STEM’ and the siloed nature of disciplines in schools, there has been a push to include other subjects in the acronym to better represent the projects that are being done (STEAM, STREAM, STREAMER, STEMM, STEMME ...). This can be confusing for students and parents and has the potential of reinforcing the barriers between the disciplines rather than reducing them.

An alternative to the acronym debate in education is to focus on Making. The Maker movement began in 2010 and quickly became a feature of education in North America and Europe. For a variety of reasons, the maker movement has grown slower in Australia. Making as a term is very inclusive, and each maker community shapes what it looks like, but it can include everything from physically making a thing, coding or digitally making something, making music or even making a process. Makerspaces in schools can be full of technology – 3D printers, electronics, robots, laser cutters and sewing machines. This mash up of technology can break down traditional gender barriers, discipline barriers and increase creativity. Even though we tend to focus on the technology that is in a makerspace, it is the different pedagogy used and collaborative community that is the key defining feature of a makerspace.

I am researching how students’ academic self-concept (their perception of who they are) develops when they work in a makerspace. Students will often self-describe themselves according to what subject areas they are good at, or not good at – an ‘artsy’ person, or not a ‘Maths’ student. This is their academic self-concept. These academic self-concepts feed directly into how the students see their future, and the number of career areas they can see themselves doing. When teaching I saw how student’s self-concept impacted their learning, motivation, aspirations and ultimately their future. Since makerspaces have emerged, I have seen many students’ self-concept change to include more positive associations. This was particularly true when I visited schools in the USA where their maker movement in education is more established than in Australia.

I started my PhD because I wanted to find out what it was about makerspaces that let students change their academic self-concept. School organisation is an exercise in compromise. There is constant competition in schools for time and resources. I wanted to be able to help schools in Australia prioritise the most impactful characteristics when setting up their maker program. The literature has highlighted five possible characteristics including the interdisciplinary nature of the space, the lack of externally imposed curriculum and the student agency this allows, the time to tinker and play, and the way in which failure is harnessed in the iterative process.



My research will use student surveys to explore how a student's academic self-concept changes from the start to the end of a semester when taking a subject set in a makerspace. I will then use focus groups to understand what students thought impacted them, and interview teachers to understand the characteristics of the makerspace program the students completed. I am hoping to have a variety of schools participate, including regional and metropolitan schools, independent, catholic and government schools, so that the findings will be applicable to many Victorian schools.

Before I was able to plan my research, I needed to understand what makerspaces looked like in Victoria. I conducted a survey at the end of 2019/start of 2020 looking at the different spaces for making that were in schools. I found that schools had multiple spaces, and that the newer spaces for making (makerspaces, STEM/STEAM rooms, Fablabs, etc) were distinctly different to traditional spaces for making (Design and Technology rooms and Art rooms). The newer spaces for making were generally staffed by teachers from a greater variety of disciplines, used by a greater variety of subjects, used outside of timetabled classes more often, and had a greater range of equipment.

COVID-19 has delayed the data collection for the main part of my study. It is difficult to study how a school space impacts students when they are not in the space! Due to this delay, I have gone part time with my study. This has allowed me to have a lovely balance that wasn't there when I was full time teaching or full time studying. Being able to adjust my teaching practice as I read the latest research findings from around the world has allowed me to learn faster and understand more deeply as both a teacher and researcher. If you are thinking about undertaking further study, I highly recommend it. However, having to balance the immediate demands of school with the long-term deadlines of my PhD is challenging, and the understanding from my school has been important in making it work for me.

I am hoping to do my pilot study semester 2, 2021 and the main data collection in semester 1, 2022. If you have a makerspace with a timetabled subject, and would like to participate in my study, please email me on khebden@swin.edu.au

Top: Ivanhoe Girls' Grammar School students using robotics in their makerspace. Image courtesy of Ivanhoe Girls' Grammar School.

Bottom: A Lauriston Girls' School student uses 3D printer software. Image courtesy of Lauriston Girls' School.



Researching the importance of Communities of Practice

Samantha (Sam) Caddey as told to
Lorraine Tran

Sam has been studying part time and also teaches Art/Design and Textiles full time. She is the Arts Learning Area Leader at Sacred Heart College in Kyneton.

In this article, Sam explains her interest in educational research and what she discovered from her investigation into a VCE teachers' social media page as a Community of Practice.

Sam went to high school at Toorak College, Mt Eliza in Victoria as a boarding student and graduated in 2001. Whilst travelling for a year she did a short art course at Edinburgh University in Scotland and realised how much her brain needs academic stimulation. She undertook a Bachelor of Art and Design at Australian Catholic University (ACU) in Fitzroy, Melbourne, and also completed an exchange program for a year at St Martin's College in Lancaster, UK. She then completed the Diploma of Education (Visual Arts) at Melbourne University.

After graduating, Sam was offered a job at Hanoi International School in Vietnam, teaching art and design and ran the Mekong River International School Cultural Exchange Program which enabled her to travel, teach art and design, and live adventurously at the same time! She moved back to Melbourne in 2011 and started work at St Margaret's School, and enrolled in the Master of Education program in 2011. When Sam started further study, she undertook a number of subjects. She loved learning about what was going on in the world of education. After taking a break for a few years, she re-enrolled to finish her course.

Sam studies part time and teaches Art/Design and Textiles full time and is also the Arts Learning Area Leader at Sacred Heart College in Kyneton. If that doesn't keep her busy enough, she runs teacher in-person and online professional development (PD) and attends and teaches life drawing classes. Sam was awarded DATTA Vic's Secondary Educator of the Year in 2019.

Sam says she is passionate about the importance of arts and design education and thinks it is vital for well-rounded human beings. She aims to be the best practitioner and advocate for the arts that she can be. She enjoys meeting other passionate educators, learning about the different lenses to view teaching, education, and the education system, and learning about how best she can be an advocate for arts education as well as a great classroom practitioner and Arts Learning Area Leader. In the future, she hopes to move into other areas of school leadership but wants to retain her strong ties to the arts and design. In the classroom, she aims to engage students, work with big ideas – like sustainability, user centred design and design thinking, and enjoys planning projects that students can really get their teeth into.

She enjoys meeting other passionate educators, learning about the different lenses to view teaching, education, and the education system, and learning about how best she can be an advocate for arts education as well as a great classroom practitioner and Arts Learning Area Leader.

Sam was granted some study leave whilst studying. Because she was working full time, she advises that studying one subject is manageable, but two would be 'pushing it'. Time management is really important when you're studying. Sam believes that doing further study contributes to making you a better teacher. She feels that further study encourages you to analyse your thinking. Although Sam sees the value of academic learning, she sometimes wishes her study had more emphasis on hands-on learning for example, she wanted to use design thinking as a research method but most universities still focus strongly on traditional research methods.

As part of her research for her Masters of Education (by coursework), Sam focused on an area she is passionate about. Her research considered whether the VCE Product Design & Textiles/Fashion for Teachers Facebook group was a Community of Arts Practice (CoAP). Sam used empathy mapping, visual mapping of CoP behaviours and posts, reflective stakeholder mapping and figuring and used a design thinking process (gathering information, analysing information and visual and written outcomes) in her research. She visually represented CoP participants and stakeholders.



Sam made some interesting observations such as:

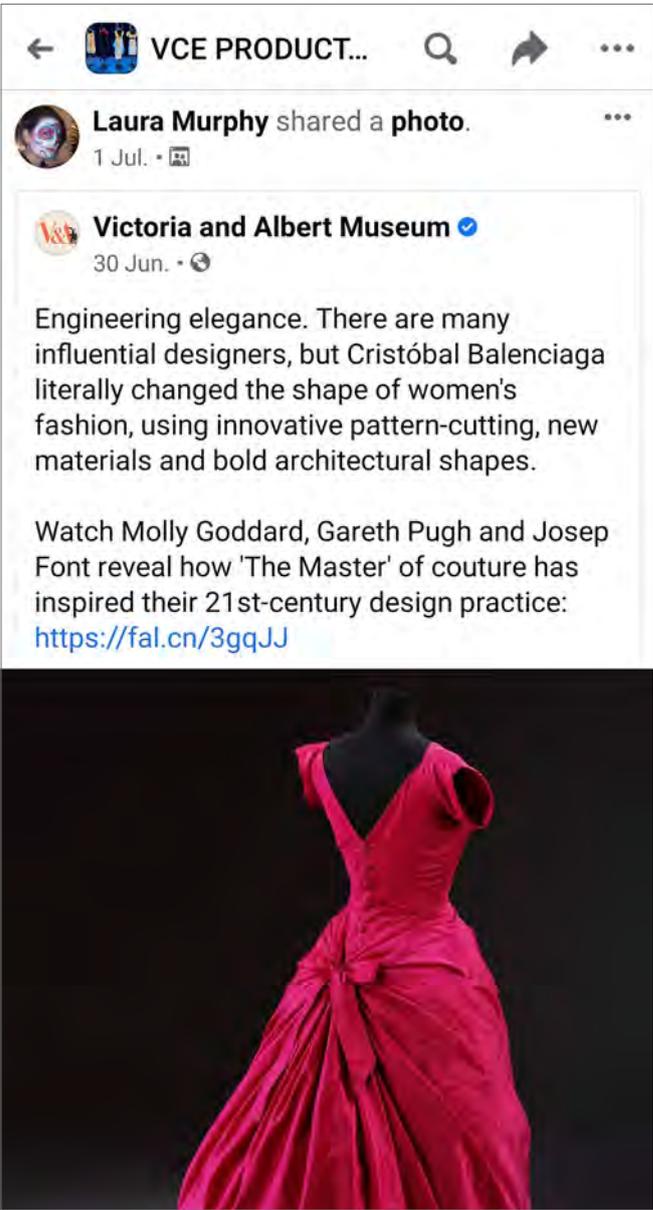
‘The group is more likely to be active, when there is a need or necessity, for example when remote teaching happened in 2020 due to COVID-19, there was a flurry of activity and sharing of resources and support for one and other. It should be noted that new teachers to the subject area explain that the group fills a need for support when starting out in this area, are confidently active participants and find participation vital for their success.’

‘DATTA Vic is widely supportive of the group and often mentioned in posts. Laura M is one of the most prolific participants in the group, is the Education officer for DATTA Vic and has interest in supporting teachers of PDT to flourish and thrive. The wider stakeholders are actually the domains of Fashion, Art, Design, Technology, Craft and Education. Although not one more dominant organisation. These broader areas have a vested interest in teachers being supported in their practice, so that the domains can thrive.’

Sam profiled five participants in the Facebook group in her research. She states:

‘Understanding where each member believes their practice lies in relation to art, design, craft and technology is a complex task, because each member of the CoP comes to the practice with different backgrounds, entry points into the profession and experiences. Understanding what each believes the practice of teaching is, is also influenced by the school they work in, and the institutional decisions and beliefs about what the teaching practice is.’

Above left: As part of her research, Sam focused on the benefits to users of the VCE Product Design & Textiles/Fashion for Teachers Facebook group as a Community of Practice (CoP).
 Above right: Screenshot of a post on the Facebook group. Source: Facebook (www.facebook.com/groups/2091765174218560)



Conclusions drawn from this research included that the Facebook group is a CoP, but inconclusive as to whether it is an arts practice or otherwise. From her own perspective, Sam has found the group to be an invaluable resource; relevant, supportive and serving more of an educative purpose than any other group she has been part of. The usefulness of the group to each participant could depend on such factors as: if the member is based in a country school (feeling isolated); is a relatively new teacher; needing to grasp the nature of the different areas of textiles/fashion and the pressure they are under.

When asked if Sam had any final thoughts she wished to share for this article, she said ‘As teachers, our work is really important in the lives of our students and important to the world. Teachers need to support each other and by doing so, this will help us all.’

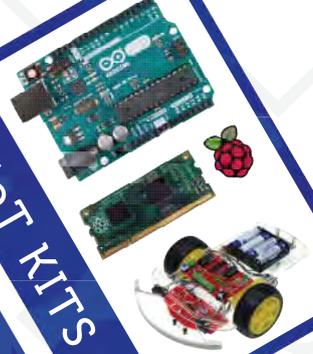
A note from the editor
 Thanks to Sam for sharing parts of her life and research with us. We wish her all the best in any further studies she undertakes and in fulfilling her career plans.



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DATTA Vic Awards

Congratulations to the teachers who received the 2020 DATTA Vic Awards.

DATTA Vic makes awards available annually in the following categories:

- *Foster Adem Leadership in Technologies Education*
- *Secondary Educator of the Year*
- *Primary Educator of the Year*
- *New to Teaching.*

In 2020, DATTA Vic also included two Special Community Awards.

Each award winner receives a framed certification and a gift voucher.

In this article, the award recipients and/or their referees explain their achievements.

Foster Adem Award for Leadership in Technologies Education

Colin Chapman, Victorian Curriculum and Assessment Authority (VCAA) and Caroline Chisholm Catholic College

Nominated by Christopher Simpson, Braemar College, Woodend

Approach to engaging students

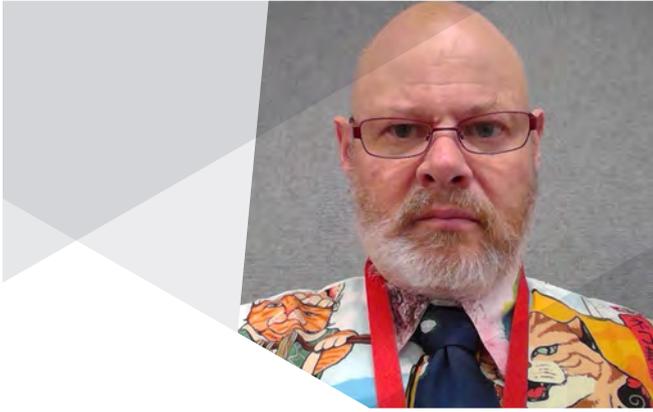
Colin is an innovative teacher who is not frightened of trying to show that it is OK to make mistakes. He has great success with his Systems Engineering students at VCE level, allowing them the freedom to explore their ideas and concepts. He has shown this approach in his Wolfram courses and that experimentation is a valid form of learning for people of all ages.

Innovative approaches to Technologies education

Colin uses experimentation to get the students to create long lasting knowledge about the principles in the VCE Systems Engineering course. Having access to a large workshop allows Colin and his students to use a wide variety of techniques to create their systems, and gives them a lot of exposure to industry practices. He believes in real work education for real world situations.

Promotion of the Design and Technologies Learning Area in the wider school community

Through running courses in Wolfram software and seminars for new and returning teachers, Colin has been able to open up technology to a much wider audience. This is especially true of his multi-discipline background where he can reach a wider range of teachers who may not have considered themselves in a technology teaching role.



Other relevant information

This year (2020) has been an unusual year to say the least. The rapid changes made to the study design for Systems Engineering has been pivotal in ensuring success for students. Colin, along with Leanne Compton from the VCAA, has been instrumental in ensuring the changes made to the study design allowed for a continuation of student work and a focus on setting realistic goals. Having a strong industry and research background allowed him to propose a revised study design that allowed for the successful completion of projects while keeping the integrity of the assessment process in place. This was no mean feat. He allowed teachers the flexibility to use their own judgement of their students but still align the work to outcomes that were consistent with previous years. I believe he has shown exceptional leadership in doing this because he has not lost sight of what the subject is trying to achieve (real world thinkers and doers) and that every young person has the ability to succeed in their study. This took into account what each student could feasibly do in a non-school environment. I think he is thoroughly deserving of the nomination of the Foster Adem Leadership in Technology Education Award.

Also nominated by Monique Dalli, Caroline Chisholm
Catholic College

Approach to engaging students

Colin knows his students and his curriculum, by knowing his curriculum (back to front!) he can/does teach a variety of different ways to show, explain and demonstrate concepts. This is evident through the multiple entry points that he creates for students. He finds creative ways to relate and engage. This creates opportunities for students to understand concepts deeply and doesn't discriminate against learners that require additional numeracy, literacy or language support.

This year, Colin's teaching of junior systems has had an impact on our learning area by developing and mentoring staff at the college to be Systems Engineering teachers.

Innovative approaches to Technologies education

Colin is always at the forefront of emerging technology, current news and Information and Communication Technologies. During remote teaching he led staff in making useful videos. These were a highlight because of their raw nature – they weren't showy or highly polished edited slick films – they were recorded by demand and to directly meet the needs of students. This response to students' needs meant that we had a high uptake on the use of recorded instructional videos (created by staff) because Colin's approach was accessible, it had the inference on the video/content providing multi-modal opportunities of learning as opposed to slick production.

Promotion of the Design and Technologies Learning Area in the wider school community

Colin is an ambassador for VCE Systems Engineering with a practical approach to assessment. This practical approach has influenced VCAA, DATTA Vic, and our College Teaching and Learning Teams. His broad understanding of assessment and his championing of 'evidence of learning' rather than summative assessment practices has had a huge and broad impact on VCAA study designs during COVID-19 and adaptations of our assessment processes at the college.

In 2020 Colin was influential to the changes in the study design in VCE Systems Engineering at a state level. Colin is giving of his time and energy. He will often work with small teams of staff at the college, then work with teachers across the state in Systems Engineering.

Other relevant information

Colin values professional learning. He gives much of his time and himself to the growth of our profession through VCAA and DATTA Vic Professional Learning events as well as the mentoring of staff, Victorian Institute of Teaching and pre-service teachers. As well as being very giving of his own time, he is always demonstrating that there is more to learn. This makes him a leader in Design and Technologies education.

Above: Colin Chapman, recipient of the Foster Adem Award for Leadership in Technologies Education. Image supplied.



Secondary Educator of the Year

Seven Vinton, Oberon High School

Nominated by Paul D’Orio, Geelong Tech School

Approach to engaging students

As an educator, Seven is a STEAM champion within his school, Geelong and the wider community. He works tirelessly to provide students with real life engaging learning opportunities. Seven has worked closely with the Geelong Tech School to co-develop programs and provide his students access to real life, industry-based programs using emerging technology. Seven allows students to explore and discover new concepts and creates a learning environment which allows them to develop their technical skills and key capabilities.

Innovative approaches to Technologies education

Seven is a leader in the Digital and Design and Technologies curriculum area and most recently, developed a statewide design challenge calling on students to design and prototype a mask for health care workers responding to the COVID-19 pandemic. This challenge provided students the opportunity to learn about 3D design, laser cutting and the use of different materials. Although technology skills are important, as an educator, Seven is focused on ensuring students are able to make the connection between these skills and their future application.

In 2019, Seven’s students took part in the local entrepreneurial program delivered by Upstart, the Geelong City Council and Geelong Tech School. He guided his students to design and prototype an Internet of Things (IoT) device to monitor the condition of local waterways. Students were able to pitch and present their prototype to a panel of local industry representatives.

Over the past three years, he has worked with the Geelong Tech School to co-develop programs in drones and electronics accessible to all students across Geelong. He volunteers time to support the development of these programs to further embed technology education into the wider community. In addition to program development, Seven has also delivered a number of professional development workshops for local teachers in Arduinos. At Oberon High School, Seven continues to provide opportunities for his students during lunchtimes. Students are able to use technology in unstructured time to explore their own areas of interest.

Promotion of the Design and Technologies Learning Area in the wider school community

As a Design and Technologies Educator, Seven has spent considerable time to promote these subject areas within his local community. Most recently, Seven organised for the Geelong Tech School to run incursion programs within his school, exposing students and his colleagues to a range of programs using design and emerging technologies. In addition to this, he worked with the Geelong Tech School staff to develop professional development sessions in CAD, 3D printing and laser cutting for Oberon High School staff.

The Face Mask Competition in collaboration with DATTA Vic and the Geelong Tech School is another example of his work in promoting Design and Technologies within the wider community. Seven has also developed a Systems Engineering Community of Practice which has enabled systems teachers across the region to discuss the curriculum, moderate work and seek technical advice. Seven continues to work with the local council and local ministers to promote the programs students are involved in within the local community.

Other relevant information

On behalf of the leadership team at the Geelong Tech School, we cannot speak highly enough of the contribution Seven provides to his school, the Geelong Tech School and the wider community. He is an inspiring educator who works tirelessly to create opportunities for his students and colleagues. In addition to his technical expertise, Seven has been a fantastic mentor for young teachers particularly at the Geelong Tech School. Any school would be very lucky to have a teacher like Seven Vinton.

A note from the editor

Seven wrote an article in the 2020 *Technotes* journal on Providing STEM Opportunities for Young People at Oberon High School. In this article, he outlined the years 7–12 engineering program at Oberon High School that focuses on critical and logical thinking using digital technology.

New to Teaching Award

Olivia Carr, Wallan Secondary College

Nominated by Rachel De Prinse, Wallan Secondary College

Approach to engaging students

Olivia approaches teaching with care and compassion. When faced with a difficult student, Olivia will go out of her way to find something that can pique their interest. She has a knack for connecting with students in a genuine way, which allows her to easily build rapport with even the most difficult students. The students see the effort that she puts into her work, and they respond well to this.

Innovative approaches to Technologies education

Olivia's main area of focus is the textiles industry. Due to the practical nature of this subject, Olivia was concerned about a drop in engagement during the online learning period and the move to theory-based work. To combat this, Olivia made take-home packs for each one of her junior students; embroidery and felting kits for her juniors, hoodie materials and patterns for her middle-school students, and extra materials for those who wanted an extension activity. When students weren't able to pick these up, Olivia hand delivered these kits so the students wouldn't miss out on their chance to be engaged in the textiles learning area. Olivia even managed to source some raw wool to send home to the students so they were able to see the journey it takes to create fibre in industry. I am constantly amazed at the lengths Olivia will go in order to keep her students interested in the textiles industry.

Promotion of the Design and Technologies Learning Area in the wider school community

Even though she is only in her first year of teaching, Olivia rose to the challenge of being the only textiles teacher in the whole school. She re-worked the entire curriculum so it played to her strengths, and has shared her skills with the school community by holding basket weaving workshops with the staff association, and by creating mask making workshops with underprivileged students who weren't able to have access to masks on their own.

During online learning, Olivia created demonstration videos and uploaded these to Microsoft Teams so that students and their families could be involved in small textiles-related activities. She has re-worked the entire textiles curriculum at the school to bring it up to date and make it more relevant to the students in our area. As a regional school, we have many students who live in an agricultural area so Olivia has focused her curriculum on food and fibre production, and how this can be done in a sustainable way. With our students also having a lower literacy and numeracy level, Olivia has tailored the curriculum to provide as many opportunities as possible to incorporate practical activities.

Other relevant information

Olivia is a first-year teacher but is already teaching VCE Product Design and Technology with a textiles focus. She takes feedback on board and uses this to improve her teaching. I have never seen a graduate teacher adapt so well to the challenges of her new teaching role as she has.



Special Community Awards

In 2020, DATTA Vic established a new Community Award to recognise our members who have gone that extra mile to support their communities – particularly during such a difficult year. We have two recipients of this award:

Kerry Horbowsky from Saint Ignatius College Drysdale, nominated by Justin Coffey and Nathan Patterson, and **Elizabeth Keep** from Peninsula Grammar, nominated by Felicity McNamara.

'Kerry has been innovative in setting up a Facebook group for textiles teachers that's been going for over a year. Kerry provides so much help and advice to teachers who join. She posts at all hours, so I know she spends a lot of time doing this. She has got together with a teacher from Braemar College to set up two more groups – one for Design and Technologies and one for Systems Engineering, and they are already going great! She's put in so much time and effort to create this really effective Community of Practice – and just at a time when teachers really need that kind of network.'

'After the 2019–2020 summer bush fires, **Elizabeth** wanted to make a practical difference to the affected communities with a coordinated response from design and technologies teachers and students across the state. As well as helping the affected communities this gave the students at her school and others a tangible way they could feel they were helping others. Elizabeth coordinated with the wildlife organisations as to their needs for the nesting boxes, then gathered all the necessary information to pass on to school. She then contacted many schools and got them on board to build these boxes. There were many projects that were completed across many schools – all thanks to Elizabeth's coordination and efforts.'

Opposite: Seven Vinton, Secondary Educator of the Year.

Above: Olivia Carr, recipient of the New to Teaching Award. Images supplied.

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How do I know that I am right?
Why do I believe this?
Am I making assumptions?
Am I biased?

How does this impact how I think and how I behave?
Can I put my feelings aside and just think about the facts?
Can I put my bias aside and be open-minded to new ideas?

TEACHING THE CAPABILITIES
through Design & Technologies

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“
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“
Students are actively engaged in creating designed solutions for personal, local and global issues for a sustainable future.”

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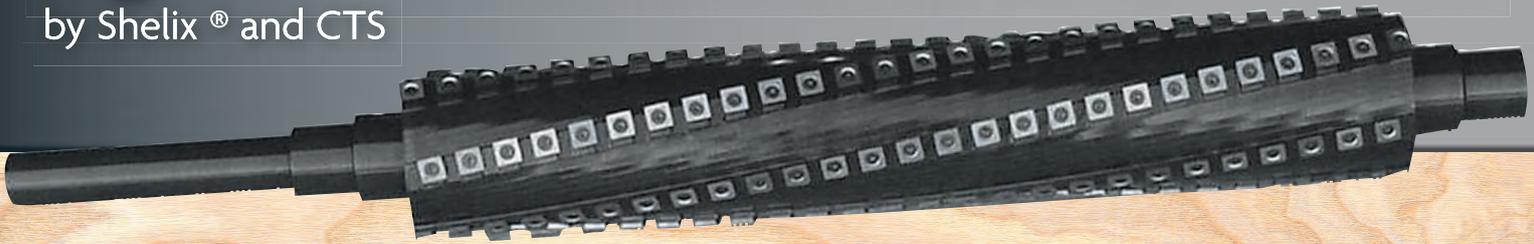
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