

Science and Mathematics Specialist Centre



Annual Report 2020

Quantum Victoria



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Education
and Training

TION

The Science and Mathematics Specialist Centres provide access for Victorian schools to high quality learning programs through on-site, online, and out-reach delivery modes. The Centres have an equity focus on rural/regional and disadvantaged metropolitan government schools. The Annual Report provides succinct information about the Centre's performance and planning in 2020.

FROM THE PRINCIPAL

Twenty-twenty proved to be a year of excitement and innovation for Quantum Victoria, and readers will find this Annual Report references significant levels of engagement and achievement for the centre.

It was also a year when the director and its educators had to pivot their work in response to the growing COVID-19 pandemic, a challenge that would have de-railed lesser organisations and individuals. Instead Soula (supported admirably by Scott, Latha and David as her extended leadership group) and her team worked to meet the challenge head-on. The centre flexed existing programs to meet new synchronous and asynchronous learning opportunities increased community partnerships and stridently worked towards key improvement strategies as part of the wider college's school strategic plan. In many cases, for example the development of the QPF Framework, they completed significant impactful teaching and learning work well ahead of what might have been expected given the tumultuous year. For a newcomer to the Mathematics and Science Specialist Centre space, 2020 appeared a year of expansion for Quantum Victoria.

Reflection of the year also brings me to consider the deep level of planning I was able to do alongside Soula and her team in preparation for 2021. And the detail on page 9 speaks to an incredibly broad range of aspirations for the centre and the college both.

Once again, I recommend Quantum Victoria, its programs and the wonderful staff to all Victorian Schools.

Andrew Robertson

College Principal, Charles La Trobe College

FROM THE DIRECTOR

The Centre's delivery of onsite student programs and teacher professional learning was brought to a halt in March after the first COVID-19 lockdown. The QV team undertook the necessary professional learning and worked diligently in a short time frame to develop **asynchronous (self-delivered)** and **synchronous (virtual and real time) outreach** in support of remote learning across Years F – 12 for students and teachers throughout Victoria. The result was a suite of **71 synchronous** and **asynchronous modules** aligned to the onsite programs.

85,745 students from **357** schools across Victoria, engaged in Quantum Victoria programs throughout 2020, an incredible result given the unprecedented challenges.

Additional 2020 Initiatives included:

- Development of the 4-year **QV Data Strategic Plan (DSP)**.
- Initial development of the **QV Data Literacy Cycle**.
- Development of the **Pre and Post Quiz Auditing tool** to evaluate and modify existing quiz questions and to construct new questions aligned to the onsite program focus areas and the associated Victorian Curriculum or VCAA Study Design links.
- Internal professional learning on the construction of diagnostic and multiple-choice questions for pre and post quizzes for the onsite programs.
- Commence scoping of the **upgrade of the QV website** and the **QV Portal** to reflect the additional modes of program delivery and to incorporate the booking system, pre and post quizzes and exit and follow up surveys.
- Development of the **Quantum Program Framework (QPF) template**, for consistent documentation of all QV onsite programs, aligned to the Framework for Improving Student Outcomes (FISO).
- Planning and scoping of the **Synchronous Learning Space**; upgrading the existing QV Boardroom and adjacent teaching and learning space, to enable the delivery of **hybrid teaching models**.
- **Peer Observation** to inform practice in the delivery of synchronous and onsite programs using the **Quantum Education Practice (QEP) Reflective** tool.

2020 was the Centre's most successful year in terms of student participation. We will take our learning and continue to explore and implement innovative approaches and practices to the teaching and learning of **Science, Technology, Engineering and Mathematics**.

Soula Bennett

Director, Quantum Victoria

2020 PROGRAMS

ONSITE

PRIMARY (F-6)	SECONDARY (7-12)
Exploring the Senses (F-2)	Lego Robotics (7-8)
Forces in Action (1-2)	The Giant STEM Investigation (7-8)
QV Bean Story (1-2)	3D Modelling & Design (7-10)
Minibeasts (3-4)	Programming with Arduinos (7-10)
Makey Makey (3-4)	Quantum Forensic Investigation (9-10)
Lego Robotics (5-6)	Quantum Cyber Investigation (7-10)
Minecraft (5-6)	Materials of the Future (9-10)
	The Art of Chemistry (10 – VCE Chem Unit 2)
	Derive of the Dead (General Maths Unit 1)
	Derive of the Dead (Math Methods Units 2&3)
	The Physics of Angry Birds (Physics Units 1&3)
	Nature through Maths (Further Maths Unit 3)

OUTREACH – ASYNCHRONOUS & SYNCHRONOUS

PRIMARY	SECONDARY 7-10	VCE
Exploring the Senses (F-2) Asynch Module	Cyber Security (7-8) Online & Asynch Module	The Art of Chemistry (Unit 2 AOS 1&2)
Forces in Action (1-2) Asynch Module	Lego Robotics (7-8) Asynch Module	Derive of the Dead General Maths (Unit 1&2)
QV Bean Story (1-2) Asynch Module	The Giant STEM Investigation (7-8) Online & Asynch Module	Biology (Unit 3 AOS 1) 6 Online Modules
Minibeasts (3-4) Asynch Module	Kinecting Sports & Mathematics (7-8) Online & Asynch Module	Biology (Unit 3 AOS 1) Online Revision Course
Makey Makey (3-4) Asynch Module	3D Modelling & Design (7-10) Asynch Module	Biology (Unit 3 AOS 2) 3 Online Modules
Quantum Electricity Online (3-4) Asynch Module	3D Modelling & Design Synchronous: 2 Sessions TinkerCAD (7-8)	Biology (Unit 3 AOS 2) Online Revision Course
Cyber Security (5-6) Online & Asynch Module	3D Modelling & Design Synchronous: 2 Sessions Fusion 360 (7-10)	Physics (Unit 3 AOS 1) 3 Online Modules
Lego Robotics (5-6) Asynch Module	Programming with Arduinos (7-10) Online & Asynch Module	Physics (Unit 3 AOS 2) 2 Online Modules
Minecraft (5-6) Asynch Module	Quantum Forensic Investigation (9-10) Online Asynch	Physics (Unit 3 AOS 3) 4 Online Modules
Kinecting Sports & Mathematics (5-6) Online & Asynch Module	Materials of the Future (9-10) Online & Asynch Module	Further Maths (Unit 3 AOS 1) 5 Online Modules
3D Modelling & Design TinkerCAD (5-6) Synchronous: 2 Sessions & Asynch Module	3D Modelling & Design TinkerCAD (7-8) Synchronous: 2 Sessions & Asynch Module	Further Maths (Unit 3 AOS 2) 4 Online Modules
	3D Modelling & Design FUSION 360 (7-10) Synchronous: 2 Sessions & Asynch Module	
	Programming with Arduinos TinkerCAD Circuits (9-10) Synchronous 2 Sessions & Online Asynch	

STUDENT STATE WIDE EVENTS

EVENT	YEAR LEVEL	STUDENT PARTICIPATION
QV Melbourne Grand Prix Experience – 12 th March	F-12	204
RMIT/QV STEM Pathways – 10 Synchronous Workshops	9-12	560
RMIT/NASA/QV Synchronous and Asynchronous – Women in STEM 31 st Aug – 11 th Sept	9-12	913

VISITING TEACHER PROFESSIONAL LEARNING

EVENT	DATE	YEAR LEVEL
Presentation @ STAV VCE Biology, Chemistry & Physics Conferences	11 th - 14 th February	VCE Units 2, 3 & 4
STEM Project Based Learning PL @ Quantum Victoria	18 th February	Primary/Secondary
App Inventor Primary Teacher PL @ Quantum Victoria	20 th February	Primary Years
App Inventor Secondary Teacher PL @ Quantum Victoria	21 st February	Secondary Years
DET STARRS Workshops x2 – 3D Modelling & Design	1 st & 3 rd Sept	Primary/Secondary Years

QV STAFF PROFESSIONAL LEARNING

EVENT	DATE	PROGRAM or FOCUS AREA
Indigenous awareness for program development with Aunty Zeta	Feb - September	Minecraft
Professional Reading – What Expert Teachers Do	6 th , 13 th & 25 th Feb	Pedagogy & Practice
STEM PBL Professional Reading		Pedagogy & Practice
Development of the Data Literacy Strategy at QV with External Consultant (Ian Philips)	28 th Feb 4 th Mar	Data & Practice
Knowing Understanding Being & Doing (KUBD) Strategy	3 rd Mar	F-12 Onsite Program Structure
Professional learning – development & uploading programs on QV Portal	16 th – 20 th Mar	Pedagogy & Practice
Delivering programs through a virtual platform – development of Prim/Sec synchronous sessions	27 th Apr – 8 th May	3D Printing & Modelling Years 4-10
QEP Peer Observation – Synchronous Session delivery	11 th May – 27 th Nov	Pedagogy & Practice
Team Teaching @ Quantum Victoria	4 th Dec	Pedagogy & Practice

PRE-SERVICE TEACHER PLACEMENT – La Trobe University

PST	DATE	YEAR LEVEL
MTeach: Phys/Science	7 th Oct – 12 th Nov	Prim/Sec Synchronous Sessions & onsite programs
MTeach: Biol/Science	7 th Sept – 16 th Oct	Prim/Sec Synchronous Sessions
BEd: Biol/Science	31 st Aug – 30 th Oct	Prim/Sec Synchronous Sessions

2020 Focus Areas:

Student

- Development of Primary & Secondary Asynchronous Outreach including; booklets, editable e-Booklets and online modules to complement onsite programs
- Development of Primary & Secondary Synchronous Outreach & accompanying Asynchronous Modules
- Development of Asynchronous Online Portal Modules:
 - **VCE:** Physics, Biology, Further Maths and Chemistry
 - **7-10:** Quantum Forensic Investigation, Kinecting Sports and Mathematics, Programming with Arduinos, The Giant STEM Investigation, Quantum Forensic Investigation, Materials of the Future, 3D Printing and Modelling (TinkerCAD & Fusion 360)
 - **F-6:** Kinecting Sports and Mathematics, 3D Printing & Design (TinkerCAD), Quantum Electricity, Forces in Action, QV Bean Story, Minibeasts, Makey Makey, Minecraft, Exploring the Senses
- **Student Synchronous and Asynchronous State-wide Events:**
 - App Inventor: Primary and Secondary (3 events)
 - RMIT/QV Year 9-10 Synchronous and Asynchronous Workshops in Non-Traditional STEM Vocational Education Pathways (10 workshops)
 - RMIT/NASA/QV Year 9-12 Women in STEM

Teacher

- STEM Project Based Learning (PBL)
- STEM in Context through 3D Printing & Modelling
- PMSS Professional Learning Workshop
- Presenting at external conferences including; STAV VCE Biology, Chemistry and Physics

IMPACT

Quantum Victoria engaged with **85,745 primary and secondary students from 357 schools across Victoria in 2020**, the largest student participation to date and an incredible achievement given the unprecedented circumstances. Graph 1 below illustrates the increased student participation and the impact of the mode of delivery on student engagement since the Centre's first year of operation. The implementation of the scalable outreach model that commenced in 2018, became the primary mode of engagement in 2020.

Graph 1: Student Participation 2013 - 2020

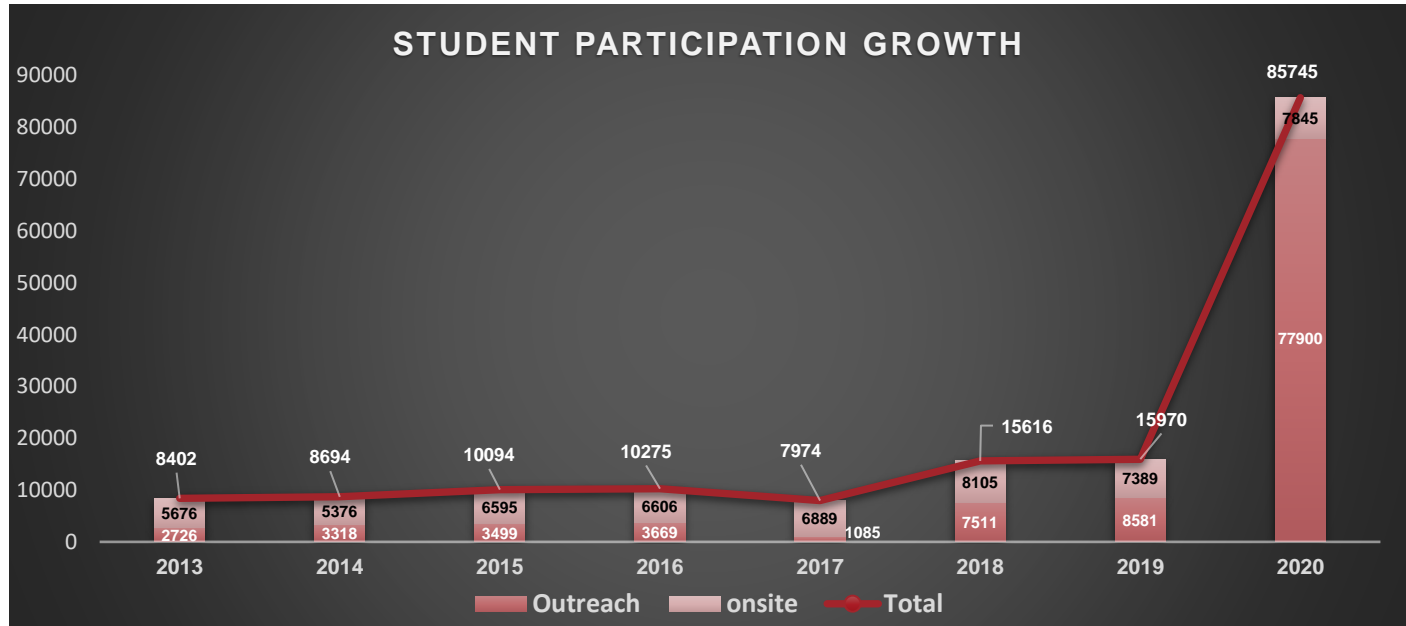


Table 1: Student Participation Data 2016 – 2020

Type		2016	2017	2018	2019	2020
Total Student Participation		10,275	7,974	15,616	15,970	85,745
School location	Metropolitan	65%	54%	55%	46%	60%
	Rural	35%	46%	45%	54%	40%
Student year level	Primary	47%	44%	55%	67%	63%
	Year 7 - 10	28%	48%	40%	19%	22%
	VCE	25%	8%	5%	14%	15%
School Sector	Government	96%	94%	98%	95.8%	97.5%
	Catholic	2%	3%	1%	0.5%	0.5%
	Independent	2%	3%	1%	3.7%	2.0%
Classification	Metro Disadvantaged	50%	31%	45%	29%	21%
	Rural	34%	46%	46%	54%	38%
	Standard	16%	23%	9%	17%	41%
Delivery mode	Onsite	64%	86%	52%	46%	9%
	Outreach	36%	14%	48%	54%	91%

Table 1 illustrates an increase of 14% in the engagement of students from metropolitan government schools from the 2019 figure. This increase can be contributed to the additional QV Outreach offerings in support of remote learning, QV's capacity to engage with more students via synchronous and asynchronous modes of delivery, allowing for a greater uptake of QV programs from students in metropolitan Melbourne. There was an increase in the engagement of Secondary (7-10) and VCE students in 2020 compared to the 2019 figures and a decrease in the engagement of primary students. Outreach accounted for 91% of program delivery in 2020.

PARTNERSHIPS

The challenges associated with 2020 limited our capacity to engage with partners as we did in previous years. The table below indicates the activities associated with each partner.

Partnership	Nature
La Trobe University	Pre-Service Teacher Placement
RMIT University	School of Vocational Engineering, Health and Sciences – Synchronous & Asynchronous Workshops, Women in NASA Synchronous & Asynchronous Event
Charles La Trobe P-12 College	Host School
Melbourne Grand Prix	QV Grand Prix Experience, Interactive exhibit (Thursday 12 th March)
Science Teachers' Association of Victoria (STAV)	VCE Biology, VCE Chemistry, VCE Physics Conferences
Specialist Science and Mathematics Centres Network in Victoria	BioLAB, EarthEd, Ecolinc, GTAC, and VSSEC, a network of high quality statewide educational resources driving improved science and mathematics education outcomes in Victoria, working collaboratively to achieve this goal.
Department of Education STEM Unit	STARRS Synchronous Workshops

STAFFING

The integrity of a Specialist Centre and its ability to deliver high quality learning for student and teachers is reliant on its ability to attract, employ and retain suitably qualified and experienced staff. The Quantum Victoria staff are highly specialised and skilled practitioners of Science, Mathematics and STEM Education. Quantum Victoria is committed to preparing the future workforce by continuing to place Pre-Service teachers and employs CRTs when needed. Please refer to the 2020 staffing profile in the table below:

Classification	Positions	EFT
Principal class – AP1	Centre Director	1.0
Learning Specialist	Teaching and Learning	1.0
IT Manager ES 1-4	IT/AV Infrastructure and upgrades	1.0
Teaching Staff	4x Teachers	4.0
Education Support staff		
ES 1-2	Lab Technician/Program Facilitator	1.0
ES 1-3	Education Officer: Data Analytics	0.6
ES 1-3	Education Officer	0.8
ES 1-2	Admin Officer	1.0
Total		10.4

FINANCIAL

Quantum Victoria received the full capped annual revenue of \$1,464,599.00 in 2020. Student engagement was the highest to date, assisted by the Centre's quick response to remote learning through the development and delivery of Synchronous and Asynchronous sessions and modules. Additional funding was received from teacher professional learning (\$3,470.00), from the DET Synchronous Initiative (\$3,765.00) and revenue from student engagement from non-government and advantaged government school students (\$1,640).

The Centre delivered a modest surplus of \$40,383.23. The Chart of Accounts in Appendix 1 provides the financial report for 2020. The carry forward bank balance of \$594,767.23 will be used to update the IT/AV infrastructure, IT hardware/software and in the adoption of mixed reality technologies across 2021-2023.

2021 PLANNING

College Annual Implementation Plan (AIP)

Evaluate impact on learning through an increase of 15% of the post quiz mean score from the pre-quiz mean scores for the onsite Primary Minecraft (Year 5-6) program and the Secondary 3D Printing & Modelling (7-10) program.

QV Online Portal

Redevelopment of the website and the development of the Booking and Reporting System to streamline the current and future data capture and analysis.

IT/AV Infrastructure Update

Upgrade of QV Boardroom and adjacent teaching and learning space to accommodate flexible learning and establish the Synchronous Learning Space, alongside the commencement of the upgrade to the Centre's original network.

Data Literacy Professional Learning for the Quantum Victoria Team

Implementation of the QV Data Literacy Cycle.

SOLAR Initiative

La Trobe University *Science of Learning And Reading (SOLAR)* initiative to inform literacy strategies in the development, documentation and delivery of Minecraft and 3D Printing and Modelling.

Toyota Foundation Grant

Development of Year 3-4 'Design and Systems Thinking – Recycling through Automation' student program and STEM PBL initiative.

La Trobe University/Quantum Victoria/Cisco Cyber Security Project

QV will deliver Four Cyber Security Experiences to Year 9-10 secondary students in Victoria and Australia across a three-year period.

QV Portal Modules, Courses and Teacher resources

- Asynchronous Online Portal Modules & Courses – Completion of Physics (units 1-4), Biology, Further Maths, Programming with Arduinos (7-10), The Virus (9-10)
- Year 3-4 Design Thinking through Automation – Toyota Foundation Grant

Synchronous Outreach Development

- Programming with Arduinos
- Synchronous App Inventor State-wide Workshops for Primary and Secondary students

Student State-wide Events

- App Inventor – Primary and Secondary Events
- Discover Engineering Day in partnership with Engineers Australia
- Tall Poppy Synchronous Workshops – 1x Primary and 2x Secondary
- PrintACar Challenge – Virtual Qualifying Day at QV and a two-day PrintACar Final Carnival

Teacher Professional Learning

Charles La Trobe College

- STEM PBL – Primary La Trobe Campus (F-6): 3 workshops supported by additional planning and implementation workshops.
- MYLNS – CLTC Secondary La Trobe Campus (7-12): 'Solving Worded Problems in Mathematics for Deeper Learning: 2 workshops supported by additional planning workshops.

Statewide

- STEM State-wide Conference – STEM *Authentic Learning for the 21st Century*, a conference for Primary and Secondary Teachers and PSTs and Lab Techs, November 19th 2021

QV Teacher Professional Learning

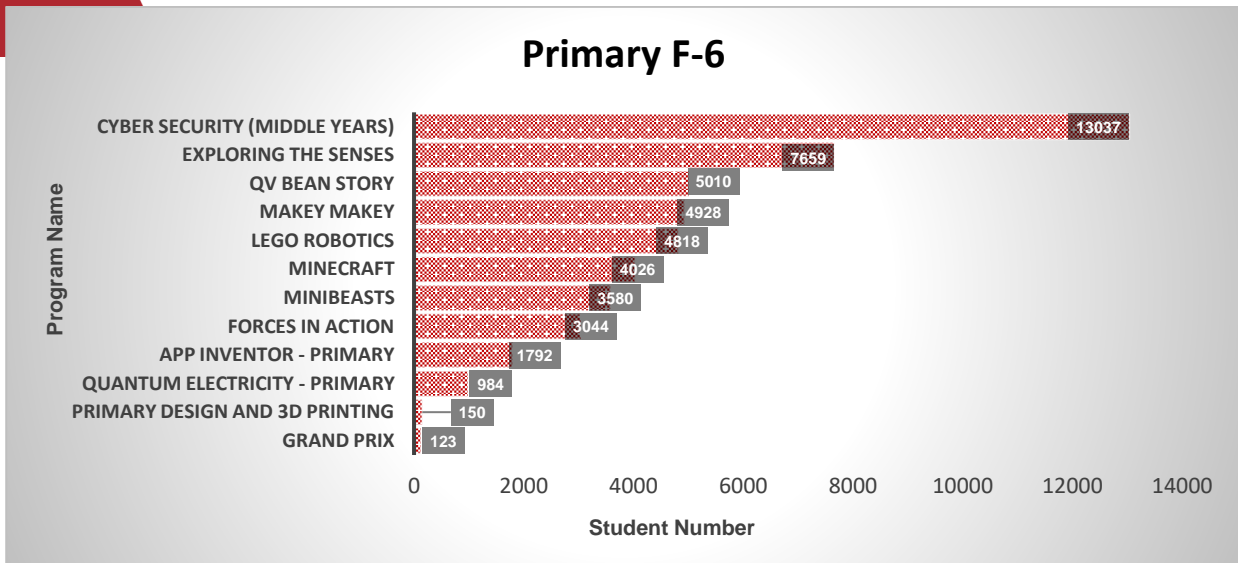
- Data Analytics Day – QV Data Literacy Cycle
- Synchronous Learning Space Training Day
- Hosting and facilitating Virtual Events
- Video Editing
- Augmented Reality training
- Portal authoring and editing

Pre-Service Teachers

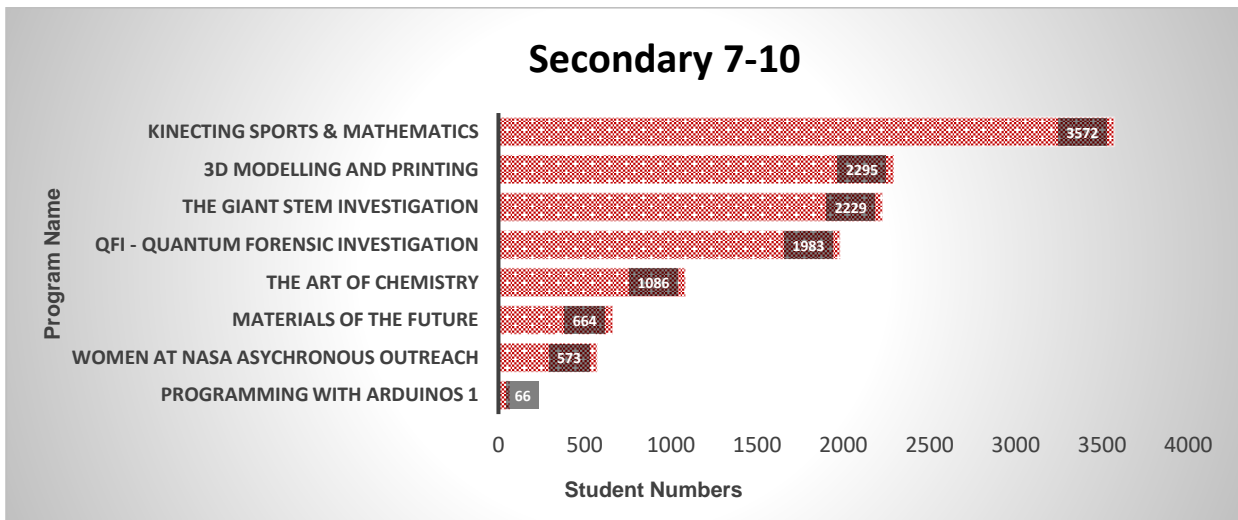
- Placement of Pre-Service Primary and Science/Maths Secondary candidates in partnership with La Trobe University

APPENDIX 2: ASYNCHRONOUS STUDENT ENGAGEMENT

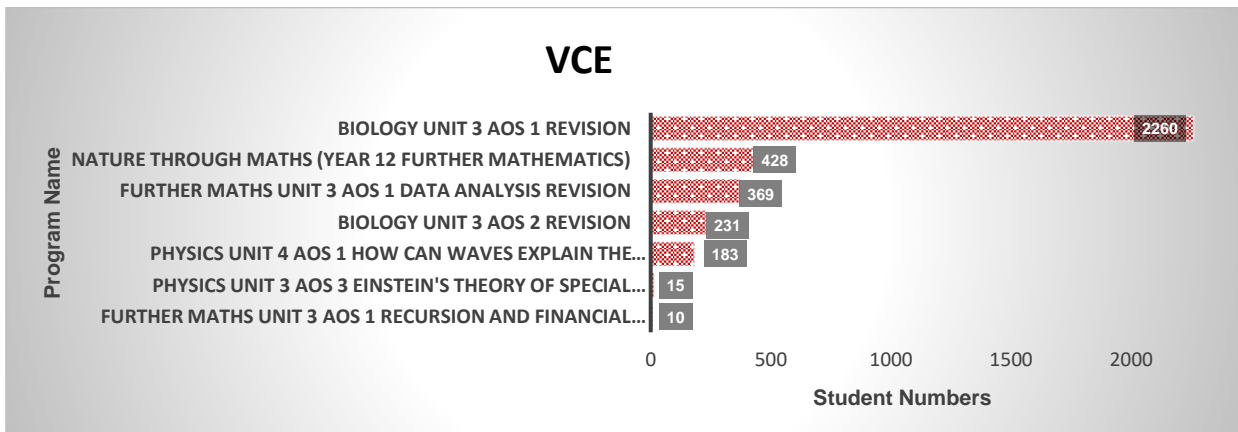
GRAPH 1 – PRIMARY MODULES



GRAPH 2 – SECONDARY MODULES



GRAPH 3 – VCE MODULES



APPENDIX 3: SURVEY RESPONSES

Onsite exit survey responses from students and teachers received in 2020 were limited due to the onset of COVID and associated restrictions and due to the small sample size, will not be included in this report.

The onset of COVID limited our capacity to deliver teacher professional learning. A limited number of responses for the STEM PBL and STEM through App Creation onsite professional learnings, were received so this data has not been included in the report.

2020 was the first time Synchronous (real time online) outreach was delivered to Victorian students. The responses received from the Primary students that engaged in the 3D Modelling & Design – TinkerCAD Synchronous Lessons are included below.

SYNCHRONOUS PRIMARY 3D MODELLING & DESIGN - TINKERCAD- EXIT SURVEYS

Table 1: Completing Challenges

I could complete the challenges.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Female	64	144	176	19	0	403
% Female	16%	36%	44%	5%	0%	
Male	341	197	83	6	0	627
% Male	54%	31%	13%	1%	0%	
Prefer not to say	1	4	2		0	7
% Prefer not to say	14%	57%	29%	0%	0%	
Total	406	345	261	25		1037
% Total	39%	33%	25%	2%	0%	100%

- More than 70% of the respondents said that they completed their challenges.
- More males completed challenges than other genders.

Table 2: Science/Maths was fun

The science/maths learned today was fun.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Female	114	224	58	5	2	403
% Female	28%	56%	14%	1%	0%	
Male	185	230	205	3	4	627
% Male	30%	37%	33%	0%	1%	
Prefer not to say	2	3	2			7
% Prefer not to say	29%	43%	29%	0%	0%	
Total	301	457	265	8	6	1037
% Total	29%	44%	26%	1%	1%	100%

- More than 70% of the respondents Agreed/Strongly Agreed that Science and Maths was fun during the synchronous lessons.
- More Female students agreed/strongly agreed that Science and Maths were fun at Quantum than other genders.

Table 3: I am better at Maths

I am better at maths after my lesson with Quantum Victoria.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Female	77	11	70	223	22	403
% Female	19%	3%	17%	55%	5%	
Male	10	17	229	10	361	627
% Male	2%	3%	37%	2%	58%	
Prefer not to say	1	0	4	1	1	7
% Prefer not to say	14%	0%	57%	14%	14%	
Total	88	28	303	234	384	1037
% Total	8%	3%	29%	23%	37%	100%

- More males agreed that they were better in Maths than other genders after the synchronous lessons.

Table 4: I am better at Science

I am better at science after my lesson with Quantum Victoria.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Female	81	27	69	203	23	403
% Female	20%	7%	17%	50%	6%	
Male	13	18	302	8	286	627
% Male	2%	3%	48%	1%	46%	
Prefer not to say	1	4	1	1		7
% Prefer not to say	14%	57%	14%	14%	0%	
Total	95	49	372	212	309	1037
% Total	9%	5%	36%	20%	30%	100%

- More females agreed that they were better in Science than other genders after the synchronous lessons.