

SMART CITIES PRACTICE REPORT

June 2020



This Smart Cities program is proudly developed by Paynter Technology in collaboration with Gippsland Tech School and the Arduino Open-Source Community.

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Acknowledgements

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Individuals

Paul Boys, Director, Gippsland Tech School

Daniel Farrant, Lead Curriculum Teacher, Gippsland Tech School

Jacqueline Wilson, Solutions Architect, Gippsland Tech School

Organisations

GIPPSLAND
TECH
SCHOOL



Report Purpose

This report documents the design, development and delivery of the SMART Cities pilot undertaken in collaboration with Gippsland Tech School in May 2020.

The report aims to promote discussion around further development of applied STEM programs focused on addressing the digital technologies curriculum.

Program Background

The SMART Cities program was developed with a focus on introducing secondary school students to digital technologies, allowing them to realise the capabilities of these technologies within a tangible context of a smart-city.

As such the program addresses the following two industry contexts:

- Industry 4.0¹ and the increasing use of transformative technologies connecting the physical and digital worlds.
- The future of work² and ensuring that young Australians have the skills and experience for jobs of the future

In consultation with Gippsland Tech School a number of key objectives were identified and guided the development of the program and extended informal consultation with local Government in the region.

It was determined that the program should:

- be aligned to the Digital Technologies Curriculum
- be developed to be inclusive for students across the region.
- address the use of advanced technologies to extend existing programs.
- extend the reach, accessibility of technology programs and in the region through the design of both online and face-to-face delivery methods.

¹ [Australiann Government, Department of Industry, Science, Energy and Resources – Industry 4.0](#)

² [Foundation for Young Australians - The New Work Order](#)

Of particular importance, was the ability for students to engage and realise technology in a hands-on and practical manner so as to inspire and spark interest and understand the relevance of emerging technologies in their own real-life context.

Scalability and growth of the program was of interest, and the ability to develop the program from the initial pilot to a broader application across the region was a factor.

As such, the project established a number of key drivers in the design of the program, specifically:

Industry relevance: It was essential that the program should be grounded with a real-world and applied learning focus in industry.

Vendor Collaboration: Strong alignment with state-of-the-art technology was critical to ensure currency of skills and emerging technological practice.

Contextualisation and relevance: The program must be contextual and relevant to secondary school students and take into consideration learning styles and needs.

Program Design

The program was developed with a weave of social and technical threads, grounded in the central premise:

With increasing population growth and urbanisation, the demand on cities is ever increasing and as a result these demands require innovation and new ideas to transform the way we think about urban city living.

The premise presents students with a tangible scenario to relate to and empathise with the problem.

With the problem and context identified students are then introduced to the concepts of electronics, the internet of things and explore the capability these technologies have in improving the quality of live for current and future generations through the lens of sustainability.

This is approach is analogous to a four-thread weave in-which, SMART Cities (A), electronics (B), the Internet of Things (C) and Sustainability (D) are interwoven.

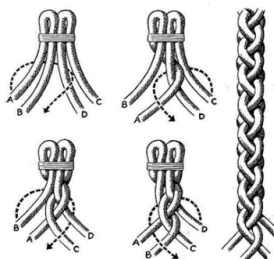


Figure 1 Four-thread weave

A purpose-built learning resource portal³ was developed to guide students through the premise and provide students with material in various formats and interwoven context and released under a Creative Commons license.

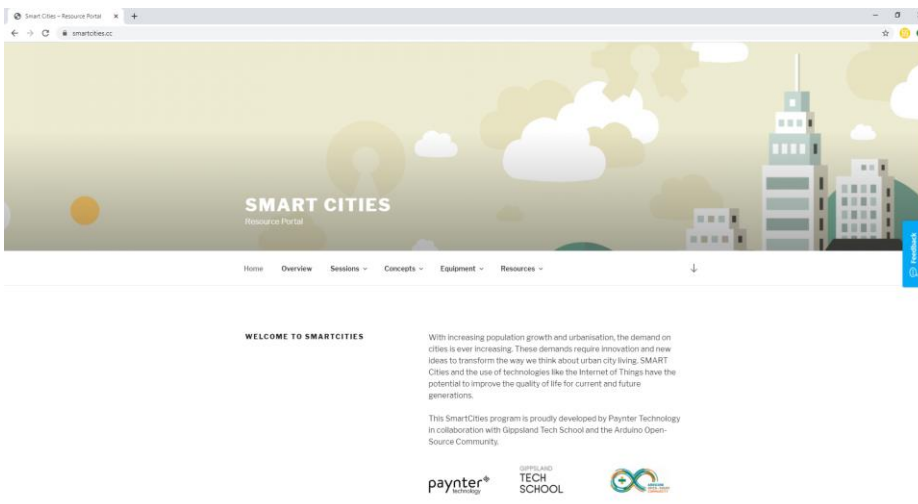


Figure 2 Smart Cities Resource Portal - smartcities.cc

Program Elements

Introductory concepts	<ul style="list-style-type: none"> SMART Cities Sustainability Systems thinking and Feedback The internet of Things The world of Electronics SMART solutions
Hands on Labs	<ul style="list-style-type: none"> Sensing the Temperature Connecting to the Cloud An IoT controlled temperature monitor
Presentations	<ul style="list-style-type: none"> Your SMART idea? Prototype Demonstration

³ Learning Resource Portal <https://smartcities.cc>

Program Delivery

Delivered online over a period of five weeks, the program took students through a range of real-world skills including conceptual thinking, technical challenges and presentation skills. Sessions leveraged the capabilities of Microsoft Teams⁴ to:

- organise the delivery of the program into channels for each Session.
- link to the external learning portal
- undertake live meetings of the sessions

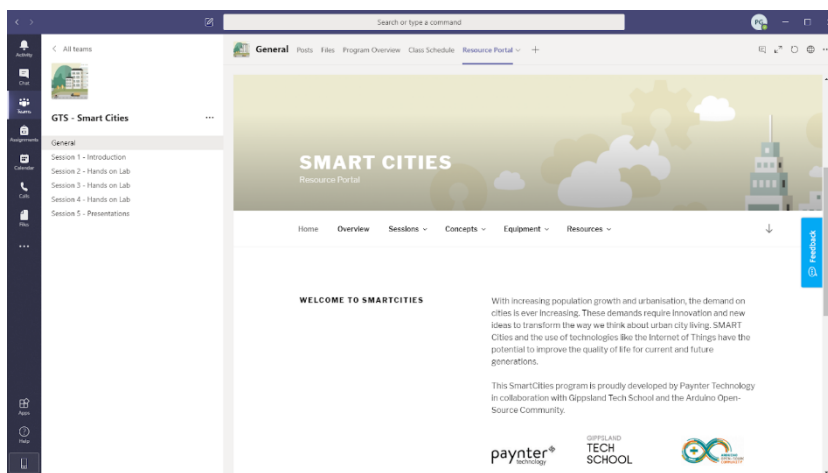


Figure 3 Screenshot of Microsoft Teams

Technology for the live meeting evolved throughout the program and resulted in the introduction of two key delivery innovations involving pre-production of the web camera feed, specifically:

⁴ [Microsoft Teams](#)

A session lobby allowing student to join to a lobby with graphical splash screen and background music whilst waiting for others to join.



Figure 4 Session lobby

An Instructional Lab camera views allowing simultaneous deliver of theory and practice.

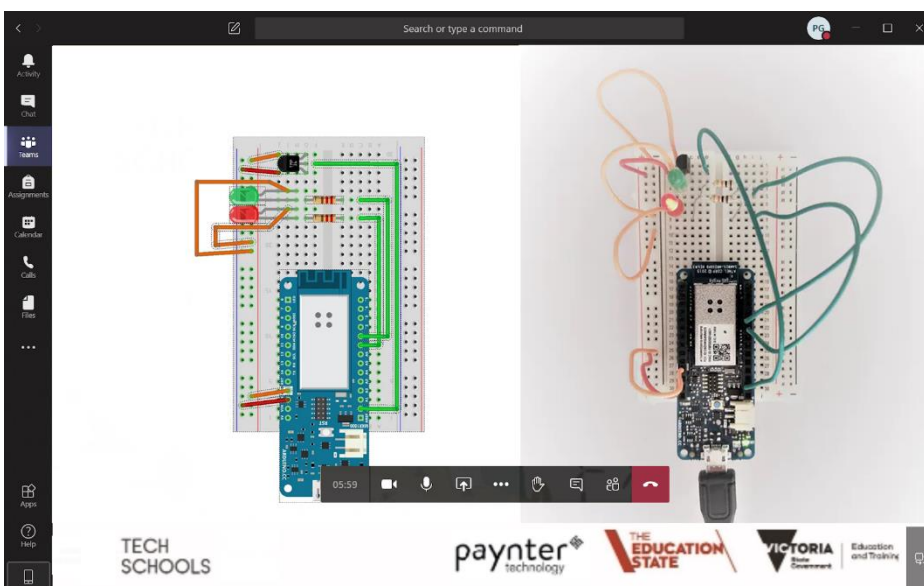


Figure 5 Instructional Lab camera

Observations

Throughout the program students demonstrated the ability to learn independently, taking ownership of their learning and were pro-active in developing their prototype devices.

Hands-on-labs and worked lab notes provided students the opportunity to work independently within the sessions to fault find and resolve bugs in their experiments.

In Final presentations students demonstrated the ability to conceptualise and realise creative applications of the skills learnt in the program.

Student presentations illustrated strong engagement in the problem-based learning context and demonstrated progression of learning. Some examples included:

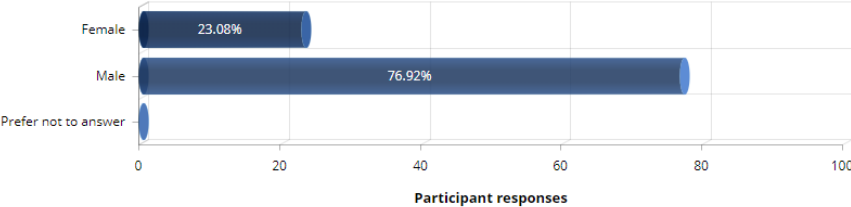
- an increased understanding in the role and assembly of electronic circuits.
- a working understanding of the elements and components of the Internet of Things.

SMART City Applications included:

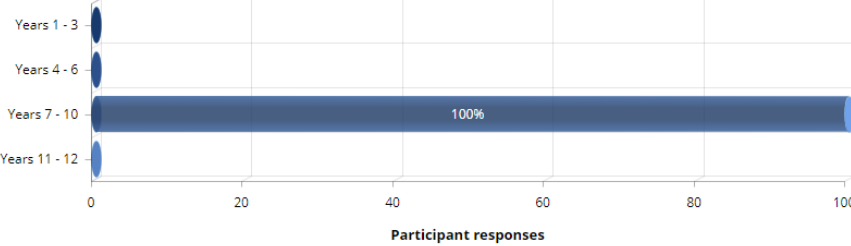
- SMART House, door closing device to minimise heat-loss and power consumption
- SMART street lighting that integrated motion detection and light sensing to reduce power consumption for local councils.
- Machine automation and control for commercial businesses to improve customer service and product quality.

Appendix 1 - Student Feedback

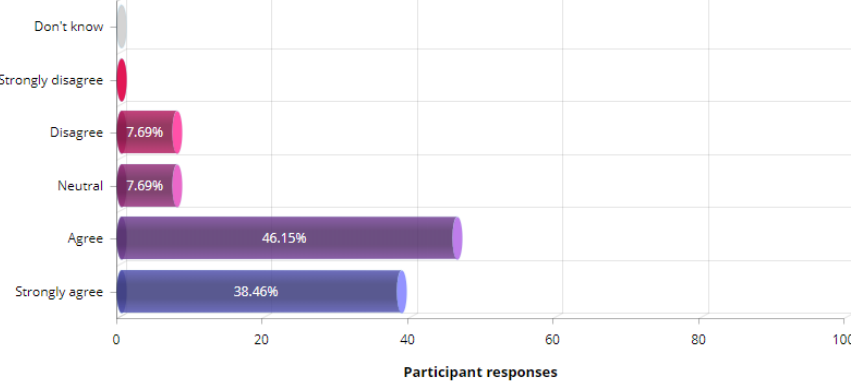
1 What is your gender?



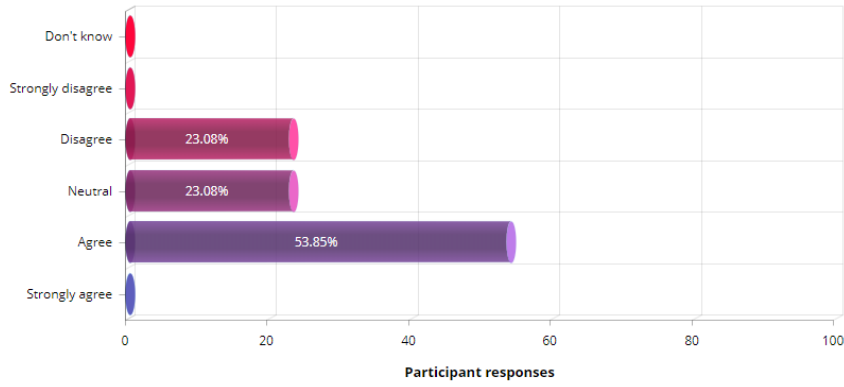
2 What Year level are you?



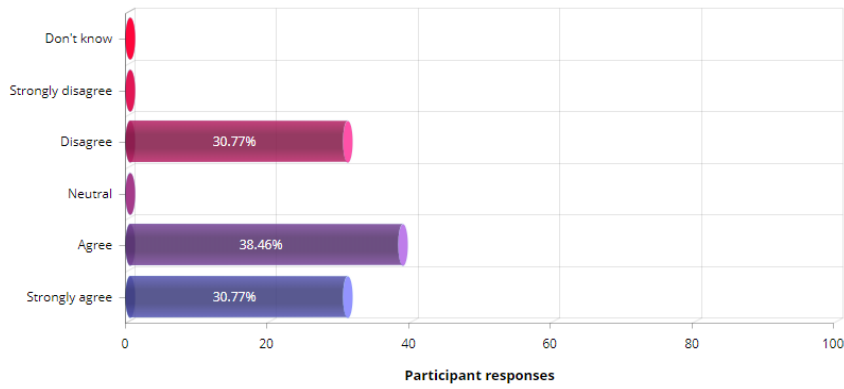
3 How did you enjoy today's session?



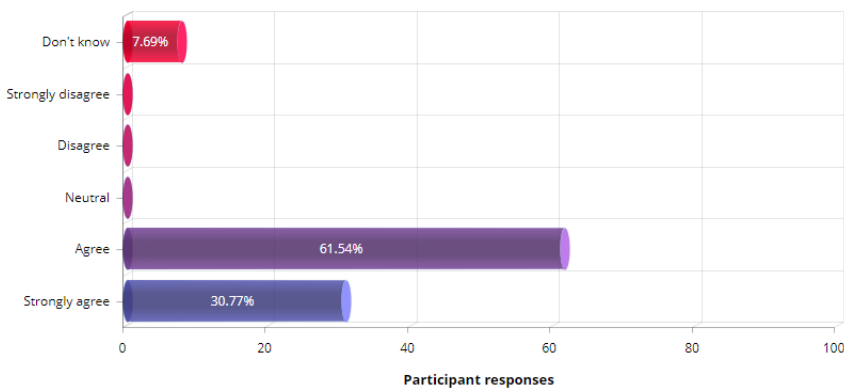
4 I found the session easy to follow



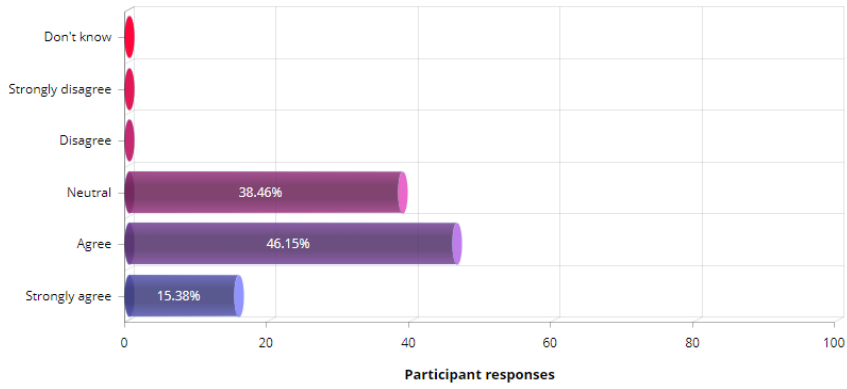
5 The teacher of the program was clear in his instructions and learning goals for the session



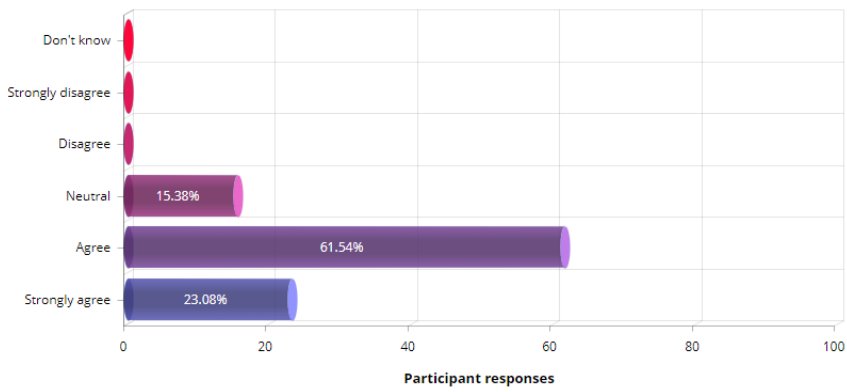
6 The Arduino activities challenged me to extend my learning with electronics?



7 I felt well supported during today's session



8 My teachers motivate me to learn



9 Is there any other feedback that you would like to provide from today's session?

- 2020-06-08
Australia needs better internet
- 2020-06-08
maybe go a bit slower when discussing stuff
- 2020-05-25
Australia needs better internet