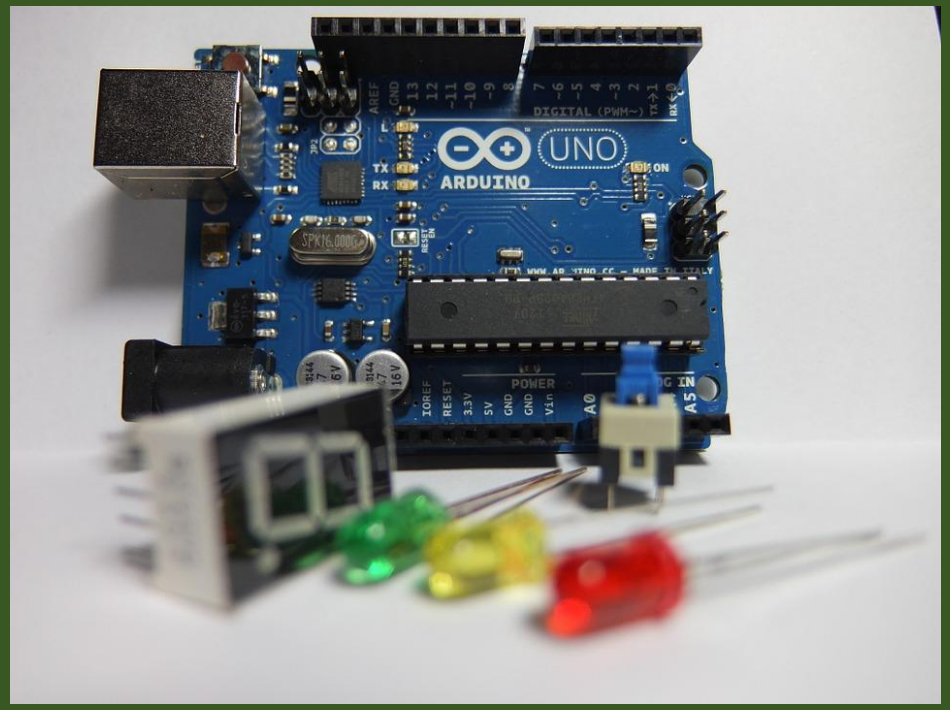
Brauer College Digital Technologies

Real world applications, Really challenging



Micro Controller Robotics in Years 8-10

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Who we are

Jason McMahon

- Primary School teacher
- First league Lego coach
- ICT teacher.

Michael Salt

- Mathematics and Physics majors
- Computer Science Minor
- Teaches Software Development and Senior Maths

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Background of Brauer College and Warrnambool

- Enrolment: Close to 800.
- High school improvement culture.
- Vertical curriculum: Complete newbies in a subject without pre-requisite skills!
- Difficulties acquiring staff for some subjects.
- Delia Jenkins: A curriculum futures powerhouse!
- Strong trade and technologies background

Starting Point

Brauer needed to refocus and align what we did in a variety of classes to address the digital curriculum.

What we thought it mainly consisted of when I got there……

- “Digital Technologies” was focussed around ICT, mainly involving Photoshop, Illustrator, Game Maker.
- Some old Lego NXTs and a few EV3s, used for Robotics Academy
- Some Arduino microcontrollers and heaps of electronics components (resistors, breadboards, switches).
- Teachers not accustomed to the Digitech Curriculum.

Early 2018 Preparation and Observations

Jason

- Robe, an Esky and an Arduino kit (and a big data bill)
- an online training course
- A low subject profile, picking up all the new students and non academics.
- Very much a hands on class.
- Understanding the curriculum (what language is this?)
- Networking: Michael, Arduino Australia FB,
- A strong focus on robotics/electronics in the Digitech curriculum.

Early 2018 Preparation and Observations

Michael

- Taught the year 8 electronics component of course.
- The focus appeared to be around “hands on” construction of circuitry and electrical fundamentals, and less about the design process.
- Students from a less academic background.
- Robotics Academy provided a strong foundation towards redesigning the Digitech curriculum.

Planning for 2019

- A lot of collaboration and planning was required to redesign the Digitech curriculum for 2019.

- The planning process kept in mind realistic restrictions around:
  - Facilities
  - Existing resources
  - Student prior knowledge

Planning for 2019

- We both passionately believe that engaging, project based learning will maximise learning outcomes in students.

- The curriculum was planned to scaffold Digitech knowledge from year 7 to VCE Computing **AND** provide a pathway for VCE Systems Engineering.

Refining Digitech

- We chose engaging projects first and determined where they would fit into the curriculum.

- Examples include:
  - Mouse Traps
  - Autonomous green house
  - Light tracking solar cars

Refining Digitech

- Mapping the curriculum over
  - 8: Digital Makers
  - 9: Digital Innovators
  - 10: Digital Engineers
- Introduced an emphasis on data (binary, SQL, Excel, compression)
- Better rounded knowledge and skills.
- Developing school community awareness including it being a challenging, yet rewarding class.

2019 Reflections

- Students really enjoy binary, image storage (RGB, pixels), and compression.

- Students are really passionate about the open ended nature of robotics and computing.

- Implementing a module around networking and encryption would be beneficial for the future.

Implementation

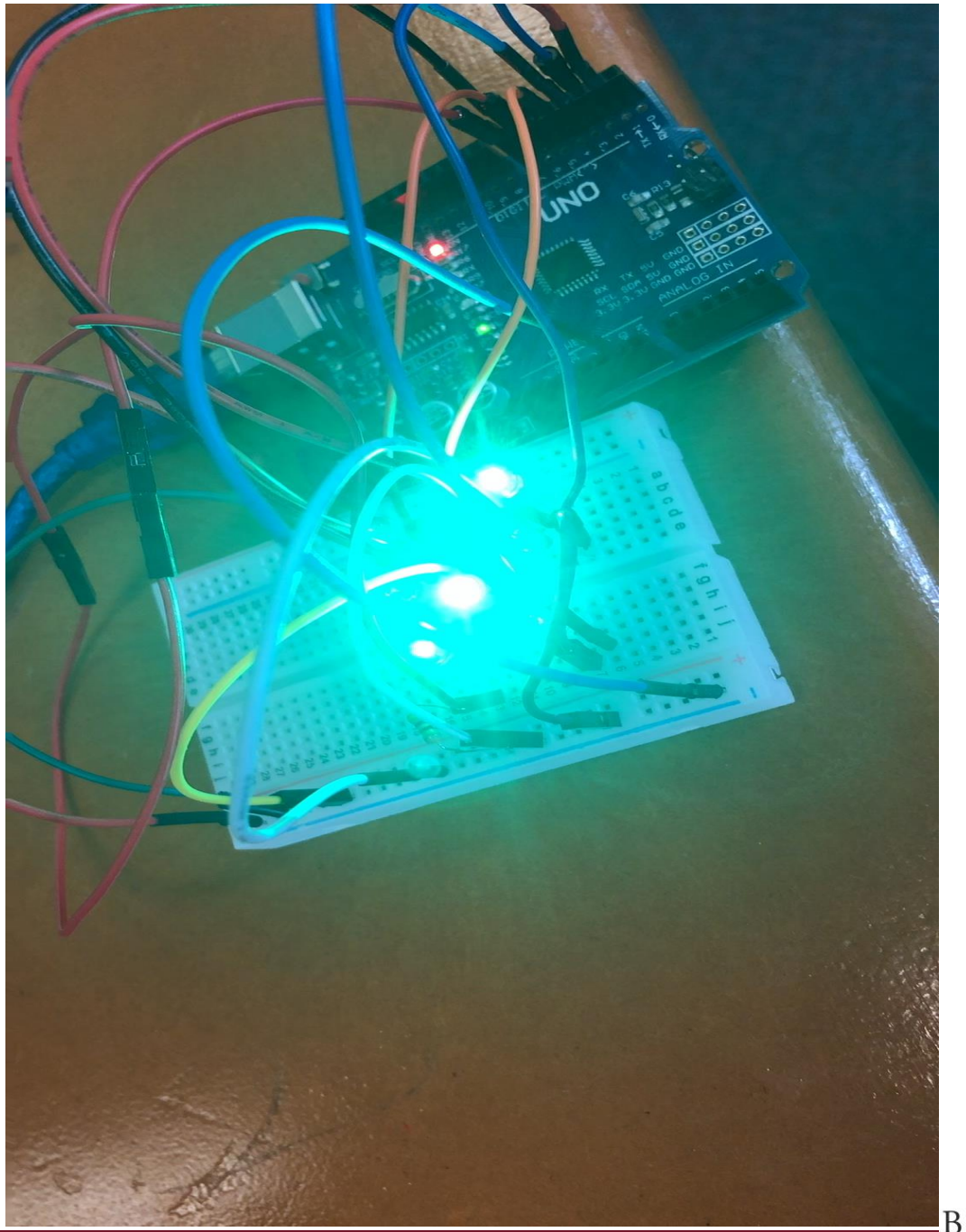
- Five periods a week (250 minutes), for one semester.
- Robotics Academy 1.2 hours a week.
- AIP focus on vocab terminology (pop quiz, Kahoot)
- Focus closely on one skill or component and then build on that to create ‘mastery’:
  - LEDs, knight rider, PWM, dice, counter.

Implementation

- **Enablers:** cloze code, schematics, designs to chose from.

- **Extension:** Let them go for it! (student ideas always encouraged) Massive global following. Individualised projects, which promotes differentiated learning.

Digital Dice



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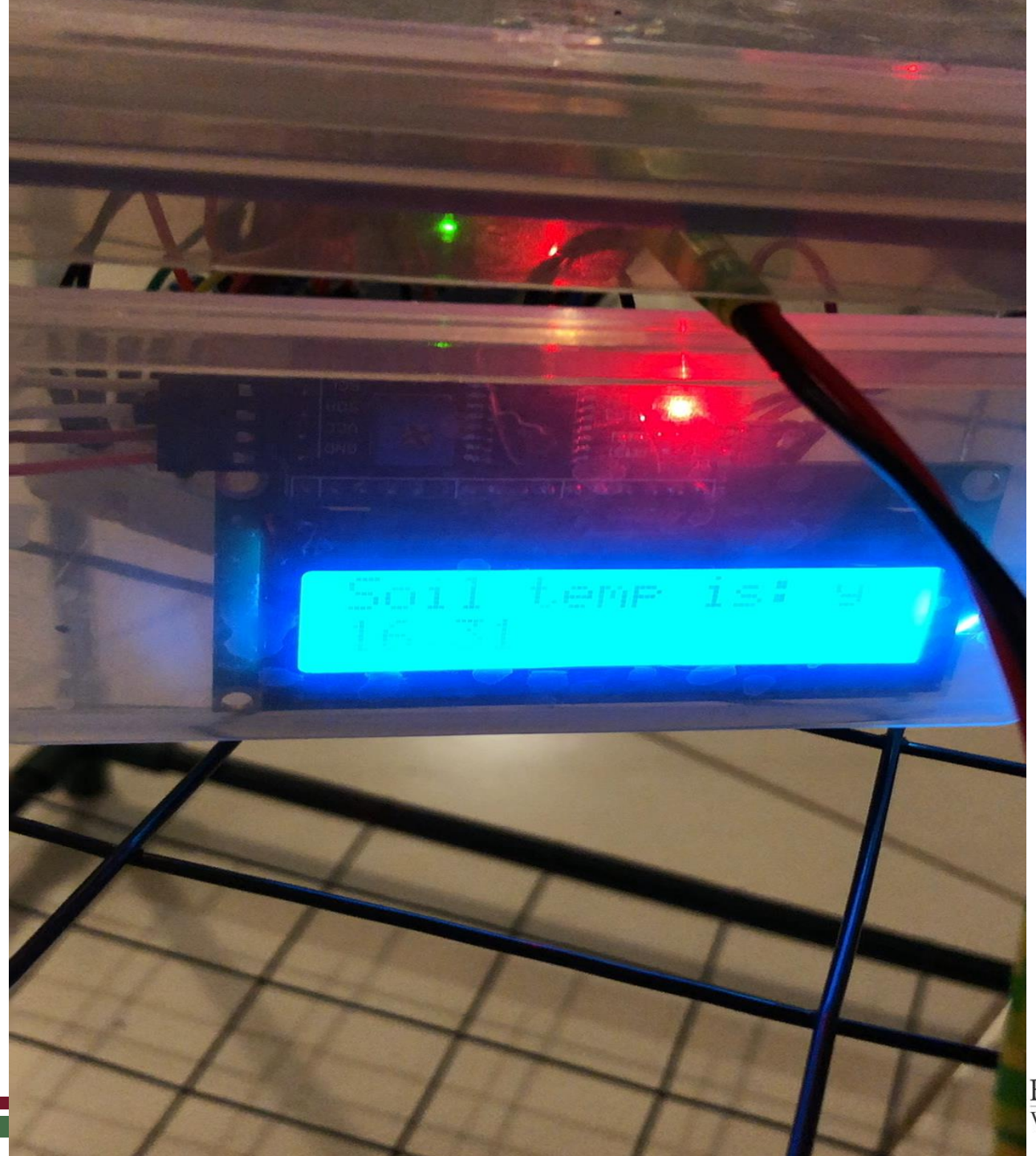
Green House Monitor



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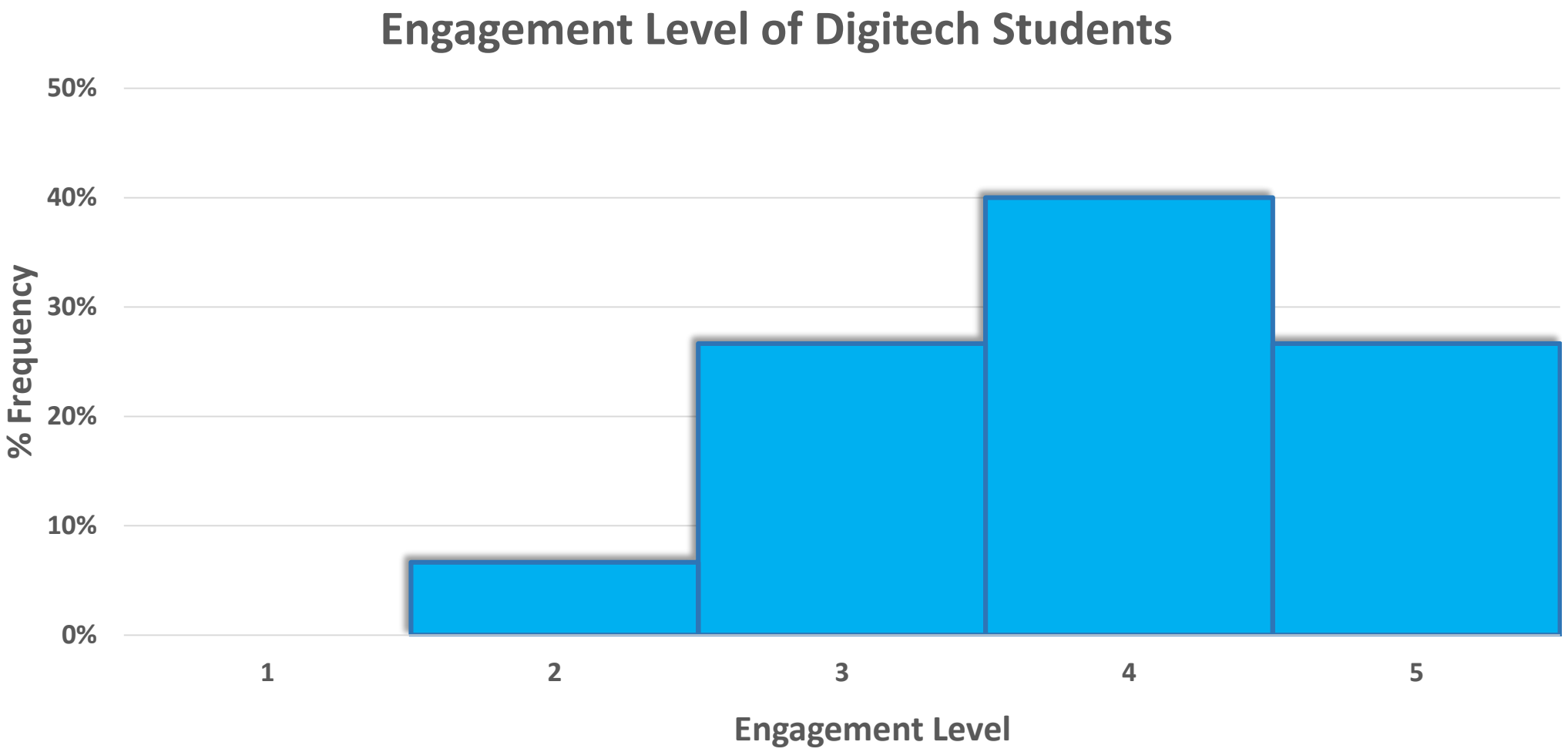
Assessing Subject Implementation

- Courses are directly compared Victorian Curriculum content descriptions.
- Learning walks between teachers occur regularly.
- Student feedback surveys are also completed.

Student Feedback

First Name	Class	Growth	Coding difficulty	Circuitry difficulty	Engagement	Explain your answer above
Jacob	08TE	5	suitably challenged	Too easy	4	the class is engaging as the learning is created around something i am interested in
Iszac	08TE	1	Too hard	Too hard	2	I don't know
dyan	08TE	3	suitably challenged	Suitably challenged	3	learnt and understand most of it
Liam	08TE	4	suitably challenged	Suitably challenged	4	I am enjoying the work and really interested in robotics but am not the most enthusiastic student.
Bailey	08TE	5	suitably challenged	Suitably challenged	4	
jake	08TE	2	suitably challenged	in between Too easy a	5	I LOVE IT!!!!!!!!!!!!!
Caeden	08TE	3	suitably challenged	Too hard	3	Robotics might be too complex for other students like me
seth	08TE	4	suitably challenged	Suitably challenged	5	i really like computers and electronics
Seth-lee	08TE	3	suitably challenged	Suitably challenged	3	i don't know
Alexzander	08TE	4	suitably challenged	Too easy	5	i find it something fun cause I'm always interested in robotics
judd	08TE	4	suitably challenged	Suitably challenged	4	I enjoy the class its interesting
Jordan	08TE	5	suitably challenged	Suitably challenged	3	i put down a three because i am not that into robots and electronics
Tarryn	08TE	4	suitably challenged	Too easy	5	I enjoy doing Prac and coding machines and lights to do things
Simon	08TE	5	suitably challenged	I bit of a struggle but c	4	I enjoy the typing and coding side of the circuits, as well as seeing my creations come to life.
evan	08TE	4	suitably challenged	Too easy	4	we could do a bit more soltring
Eli	08TE	5	suitably challenged	Suitably challenged	5	This is a very great class if you want to be challenged, coding is very different to other subjects.

Student Feedback



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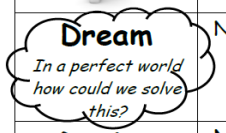
Assessing Student Work

- Student work is mainly assessed using the 6D's assessment rubric:
  - **Define**
  - **Discover**
  - **Dream**
  - **Design**
  - **Deliver**
  - **Debrief**
- The 6D's are highly suited for project based work.

Assessing Student Work

Assessment Rubric

	Beginner	Novice (1 mark)	Apprentice (2 marks)	Capable (3 marks)	Expert (4 marks)
Define 	Not shown	Student ***copies*** the problem word for word.	Students ***attempts*** to write the problem in their **own words**. Important pieces of information have been omitted.	Students ***has*** written the problem in their **own words** yet they have left out a few important facts.	All aspects of the problem are clearly stated in the students' own words.
Discover 	Not shown	Student gathered incorrect or irrelevant information required to solve the problem.	Student gathered a limited amount of relevant information.	Student investigated and gathered most of the information needed to solve the problem.	Student accurately investigated and gathered all the required information to solve the problem.
Dream 	Not shown	The idea shown was unrealistic.	Student suggested an idea which was partially credible.	Student produce one credible idea.	Student produced a comprehensive list of ideas.
Design 	Not shown or too difficult to follow	Explanation is very sketchy and/or shows confusion or difficult to clarify.	Explanation shows some of the steps undertaken. Needs help to give full explanation.	Explanation is clear and all major steps are present. Some details may be missed or some language may not be completely precise.	Explanation lays out the solution clearly and completely. More than one solution is indicated, or detail of solution shows deep understanding.
Deliver 	No solution written	Solutions stated lacked working out needed to achieve the final product.	Solutions stated and written in the context of the Problem.	Solutions clearly stated however not all details were outlined. Student was able to generalise the solution and can communicate some of the steps taken when questioned.	Solutions clearly stated with all details outlined to achieve the final product. Student was able to generalise the solution and explain why it is the best possible answer and can communicate this clearly when questioned.
Debrief 	Not shown	Student named some appropriate problem solving strategies used.	Student stated the problem solving strategies used and/or the Mathematics used.	Student stated the problem solving strategies used and/or the Mathematics used and what was difficult.	Student stated the problem solving strategies used and/or the Mathematics used, what they learnt and what could have been done better or different next time.

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Top Tips for Teaching Arduino Microcontrollers

- Get students $24 kits. (Freenove).
- Find awesome real word problems that require research.
- Pay for good resources to train the teacher (book or online).
- Find people that know Arduino (FB, Arduino community hub).
- Take it slow and continually reuse skills such as LED arrays (student built libraries).

Top Tips for Teaching Arduino Microcontrollers

- Cheap soldering kits such as headphone amps and LED alarm clocks are a good lead into the horror of teaching soldering. (soldering isn't necessary)
- For engineering, place an emphasis on making things out of recycled materials. It's cheap and works better than woodwork.
- **TinkerCAD** is a must for demonstrating circuitry

Sample Work: Drone Construction in Robotics

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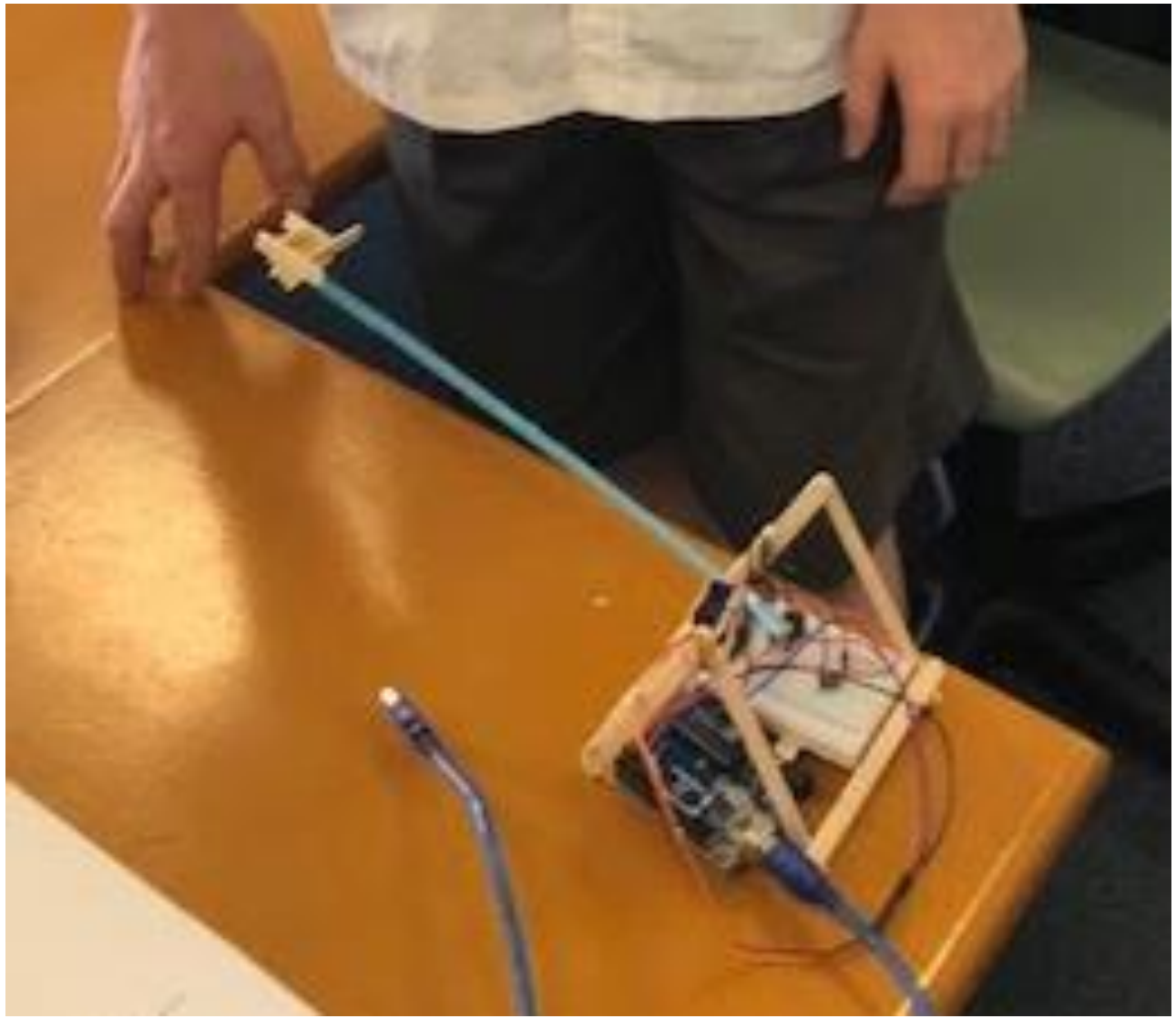
Sample Work: Motion sensing catapault in 8: Digitech



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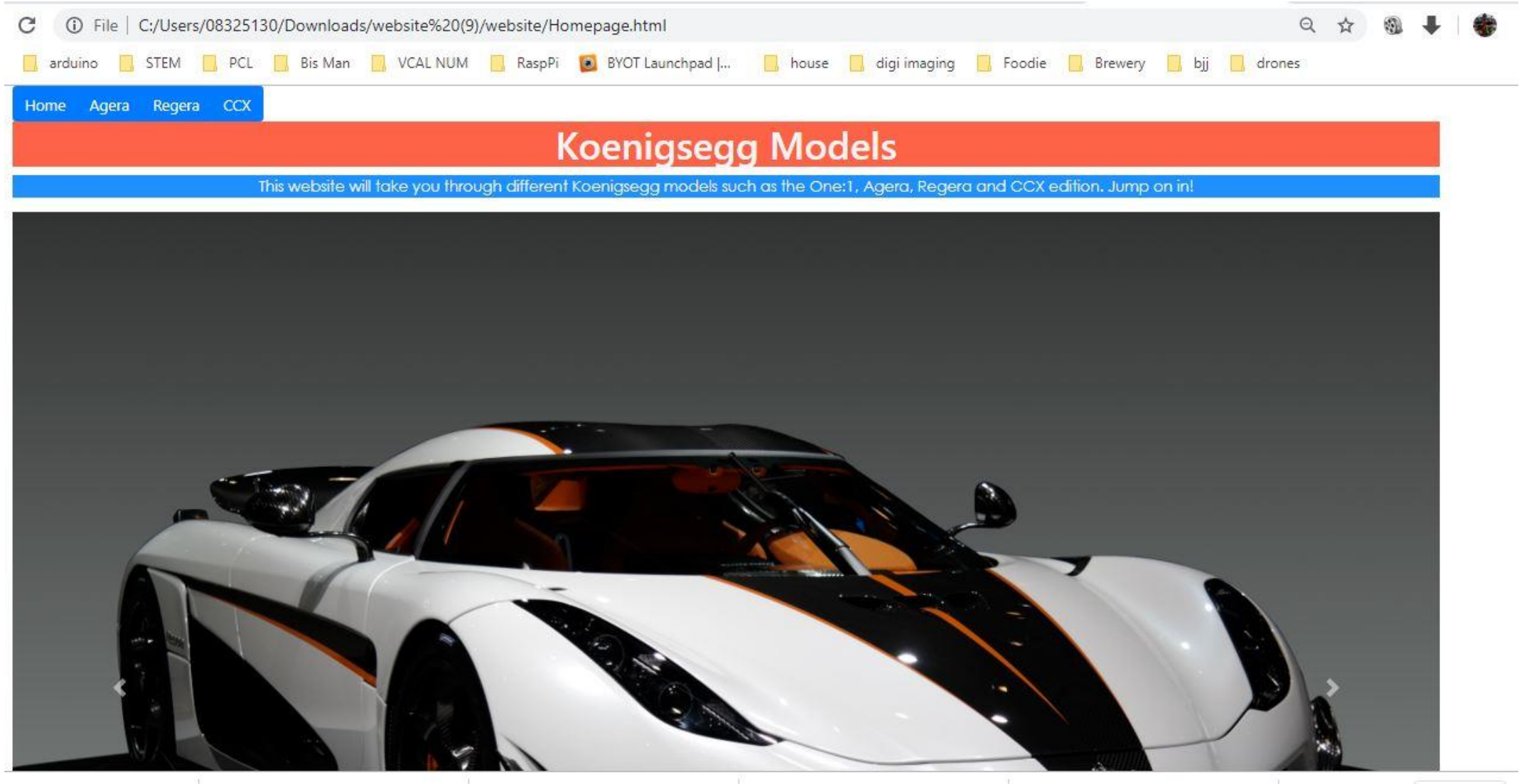
Sample Work: Website built with html and css



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To the future

- Internet of Things: Weather station collecting data from Dunkeld Campus.
- Drones and Sensors: **Drone racing**
- Raspberry Pi's: Student constructed arcade machines.
- Cross curricular approach: A focus towards implementing data analysis in science.