Oide

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí

Supporting the Professional Learning of School Leaders and Teachers

Engineering

PLE Day 2023 - 2024

Meet the Team

Oide

Francis O'Farrell
Professional Learning Leader

Fergal Murphy
Professional Learning Leader

Ciarán Callaghan
Professional Learning Leader

Barry Nolan
Senior Leader

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Scoile agus Múinteoirí

Supporting the Professional
Learning of School Leaders
and Teachers

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Scoile agus Múinteoirí

Supporting the Professional
Learning of School Leaders
and Teachers

Partners

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An Roinn Oideachais
Department of Education

www.gov.ie/education

NCCA

www.ncca.ie

Coimisiún na Scrúduithe Stáit
State Examinations Commission

www.examinations.ie

Oide

www.oide.ie

Key Websites / Online information

Oide

www.curriculumonline.ie

www.ncca.ie

www.oide.ie

@Oide_PP_Tech4

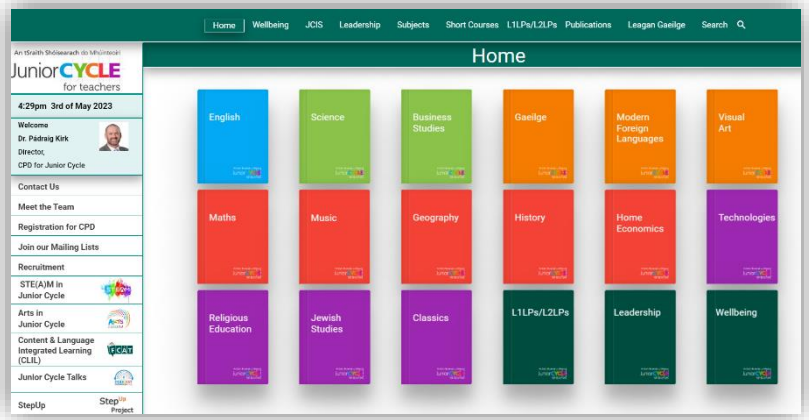
email: info@oide.ie

Oide Mailing List

Junior Cycle Engineering Supports

Oide

Supports into the future

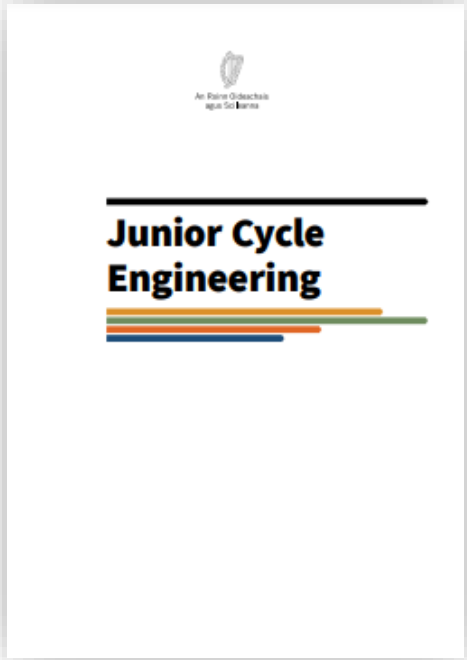


www.jct.ie

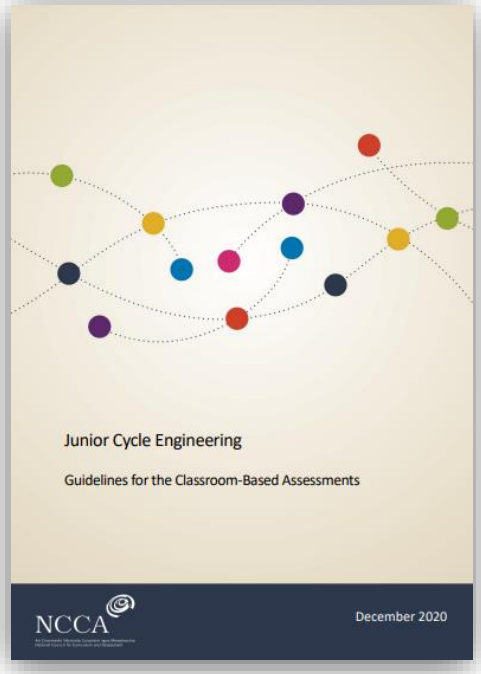
www.scoilnet.ie

www.oide.ie

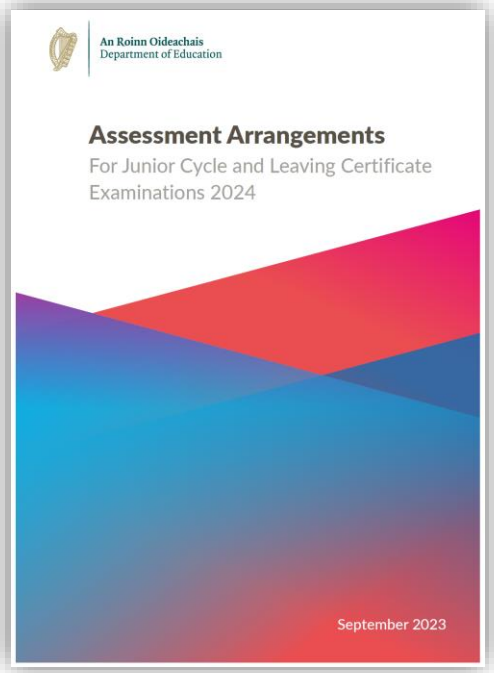
Key Documents



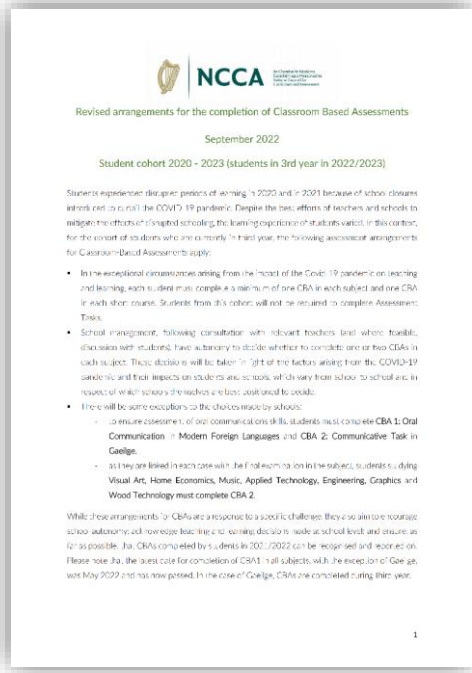
Subject Specification, NCCA



Assessment Guidelines, NCCA



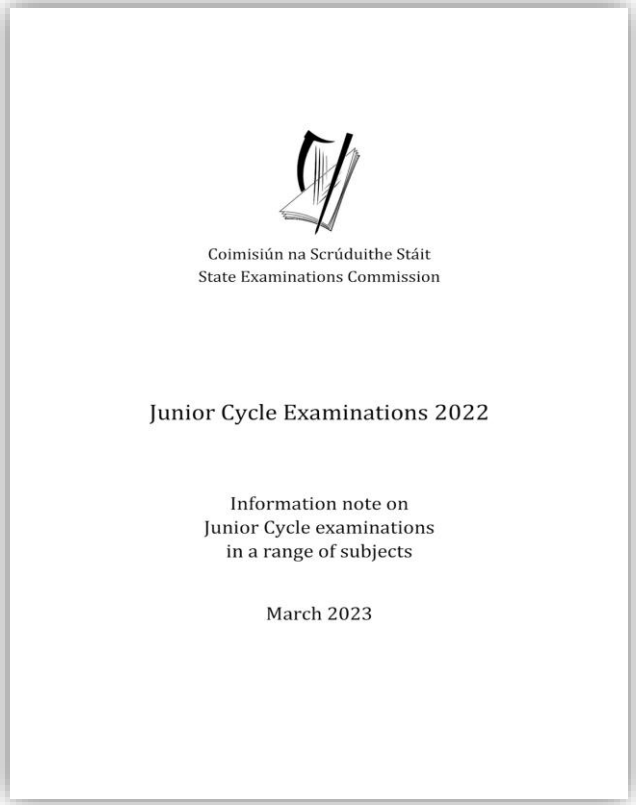
Assessment Arrangements 2023/2024, Dept. of Education



CBA Key Dates 2023/2024, NCCA

Updates

Information note on Junior Cycle examinations in a range of subjects, March 2023, S.E.C.

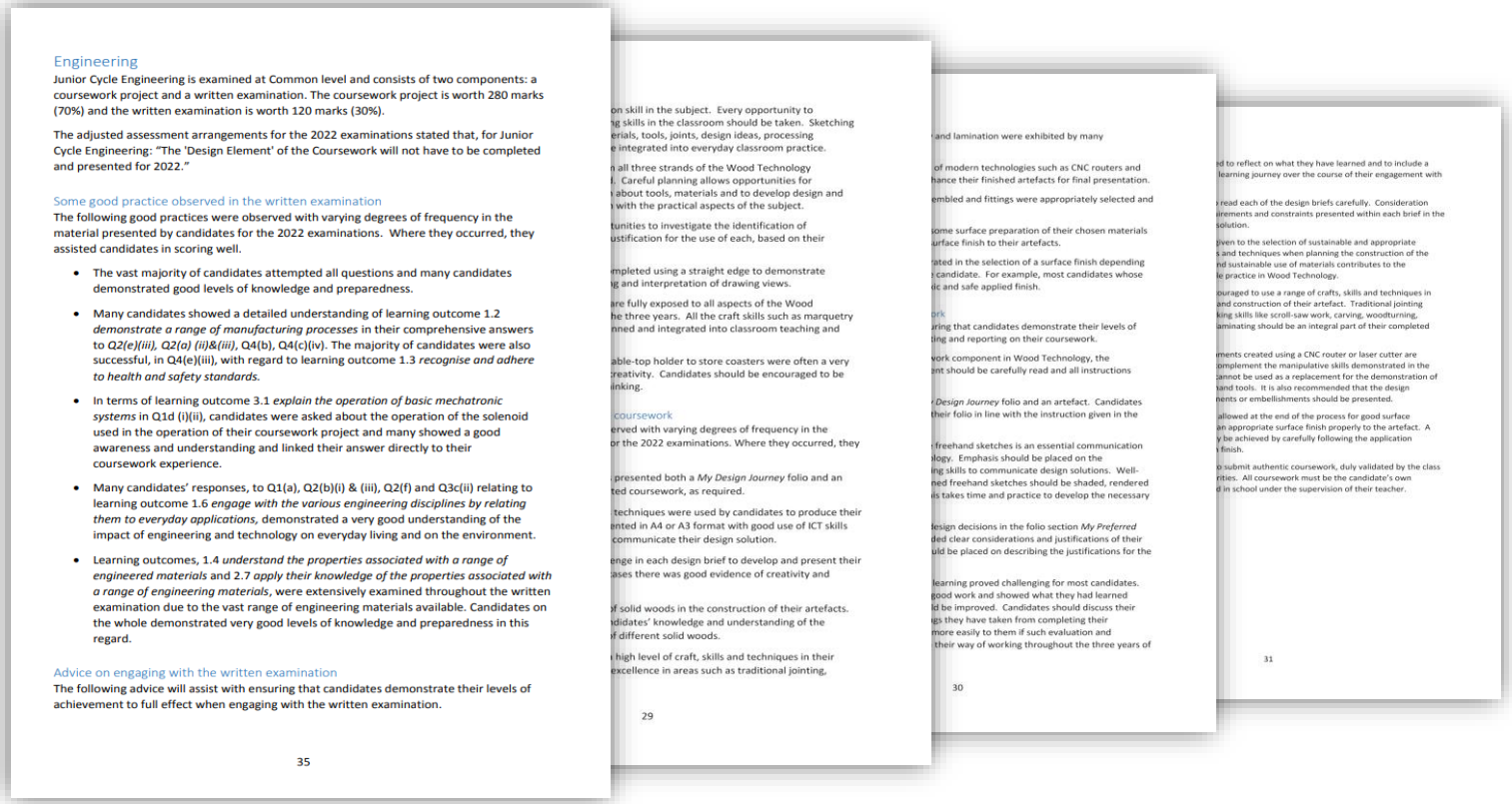


Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Examinations 2022

Information note on
Junior Cycle examinations
in a range of subjects

March 2023



Engineering

Junior Cycle Engineering is examined at Common level and consists of two components: a coursework project and a written examination. The coursework project is worth 280 marks (70%) and the written examination is worth 120 marks (30%).

The adjusted assessment arrangements for the 2022 examinations stated that, for Junior Cycle Engineering: "The 'Design Element' of the Coursework will not have to be completed and presented for 2022."

Some good practice observed in the written examination

The following good practices were observed with varying degrees of frequency in the material presented by candidates for the 2022 examinations. Where they occurred, they assisted candidates in scoring well.

- The vast majority of candidates attempted all questions and many candidates demonstrated good levels of knowledge and preparedness.
- Many candidates showed a detailed understanding of learning outcome 1.2 *demonstrate a range of manufacturing processes* in their comprehensive answers to *Q2(e)(iii), Q2(a) (ii)&(iii)*, Q4(b), Q4(c)(iv). The majority of candidates were also successful, in Q4(e)(iii), with regard to learning outcome 1.3 *recognise and adhere to health and safety standards.*
- In terms of learning outcome 3.1 *explain the operation of basic mechatronic systems* in Q1d (i)(ii), candidates were asked about the operation of the solenoid used in the operation of their coursework project and many showed a good awareness and understanding and linked their answer directly to their coursework experience.
- Many candidates' responses, to Q1(a), Q2(b)(i) & (iii), Q2(f) and Q3c(ii) relating to learning outcome 1.6 *engage with the various engineering disciplines by relating them to everyday applications*, demonstrated a very good understanding of the impact of engineering and technology on everyday living and on the environment.
- Learning outcomes, 1.4 *understand the properties associated with a range of engineered materials* and 2.7 *apply their knowledge of the properties associated with a range of engineering materials*, were extensively examined throughout the written examination due to the vast range of engineering materials available. Candidates on the whole demonstrated very good levels of knowledge and preparedness in this regard.

Advice on engaging with the written examination

The following advice will assist with ensuring that candidates demonstrate their levels of achievement to full effect when engaging with the written examination.

35

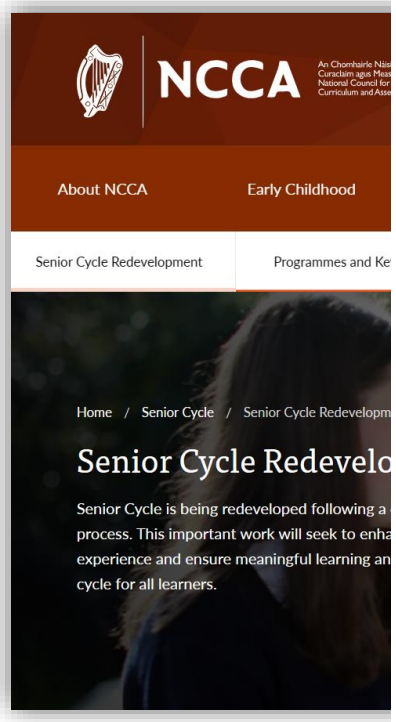
https://www.examinations.ie/misc-doc/EN-AR-19213727.pdf

Engineering, page 35.

Updates

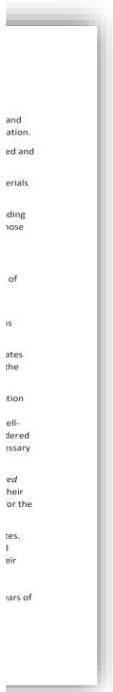
Oide

Senior Cycle Redevelopment



Tranche 2 subjects will be introduced to the curriculum for all schools in 2026 and are set out here:

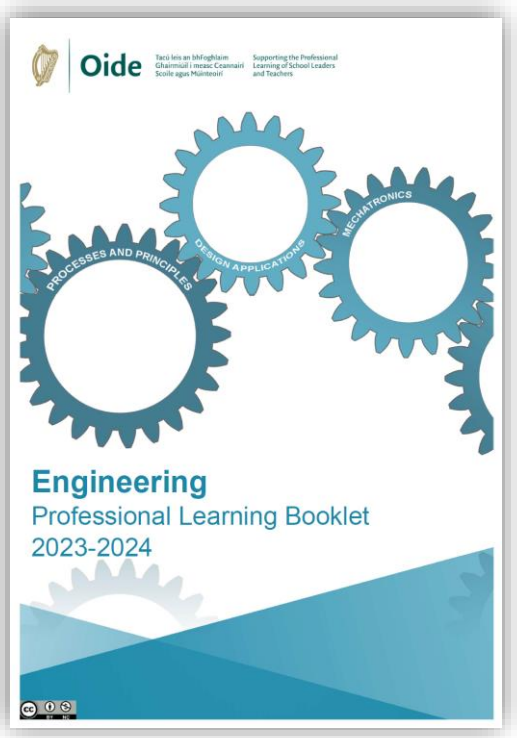
Tranche 2 subjects
Accounting
Construction Studies
Engineering
English
Geography
LCVP Link Modules
Physical Education

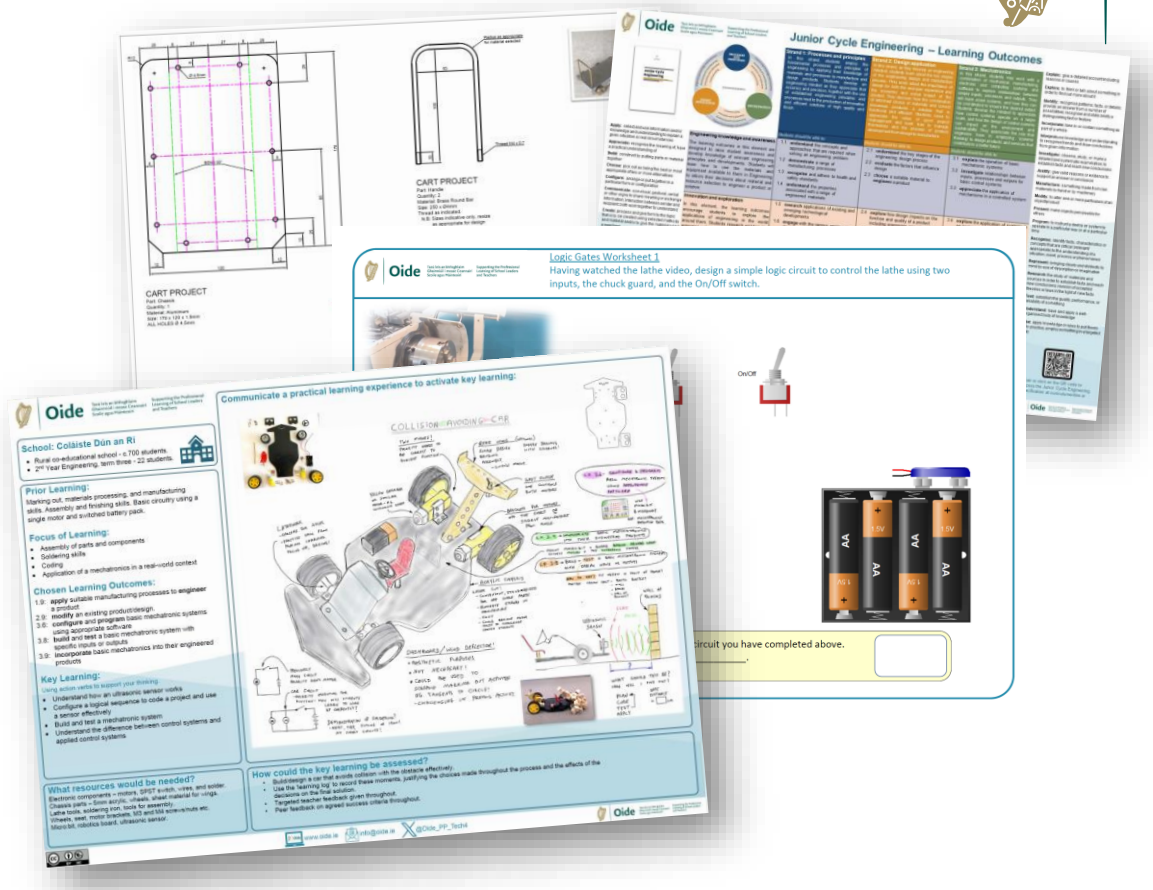


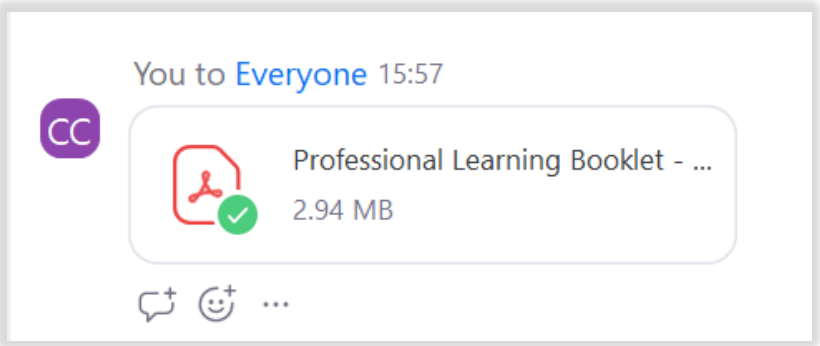
Further tranches will be introduced on an annual basis.

https://ncca.ie/en/senior-cycle/senior-cycle-redevelopment/

Professional Learning Booklet







https://jctie.sharepoint.com/:b:/s/ClusterWorkshops/ETMdZmC6uXZNhAaJvujfy_QBJP9KKiTxNo3pvulHg-S0og?e=jPlBDn

Over today's three sessions - we will…

Oide

Explore mechatronic applications within practical student-centred learning experiences in the Engineering classroom

Explore how an integrated approach to structuring learning in the Junior Cycle Engineering classroom can support the development of the engineering mindset

Appreciate the role that logic gates play in everyday engineering and other applications

Ice Breaker Activity

Oide

10 minutes

- Introduce ourselves to our colleagues
- Share a learning experience that your students really enjoyed in your Junior Cycle Engineering class this year

Open Floor Discussion

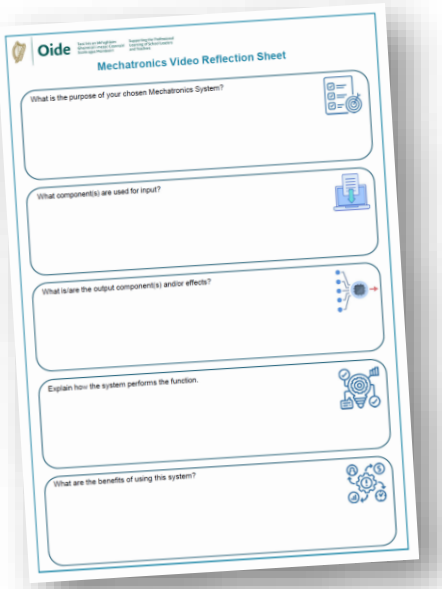
- Share a learning experience that your students really enjoyed in your Junior Cycle Engineering class

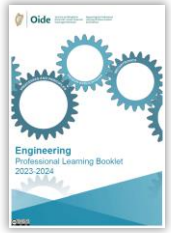
In this session - we will…

Explore mechatronic applications within practical student-centred learning experiences in the Engineering classroom


Mechatronics & Me
Practical examples of mechatronics
in everyday use

Reflection Point





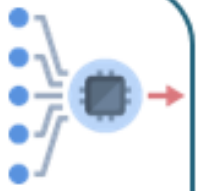
Pg. 3

Mechatronics Video Reflection Sheet

What is the purpos

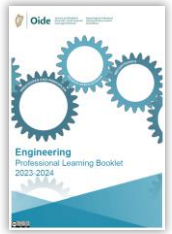
What component(s

What is/are the output component(s) and/or effects?

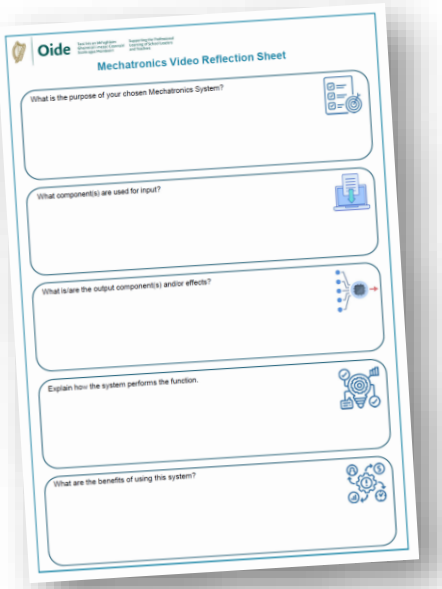


Explain how the system performs the function.

What are the benefits of using this system?

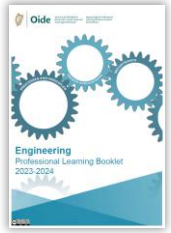


Reflection Point

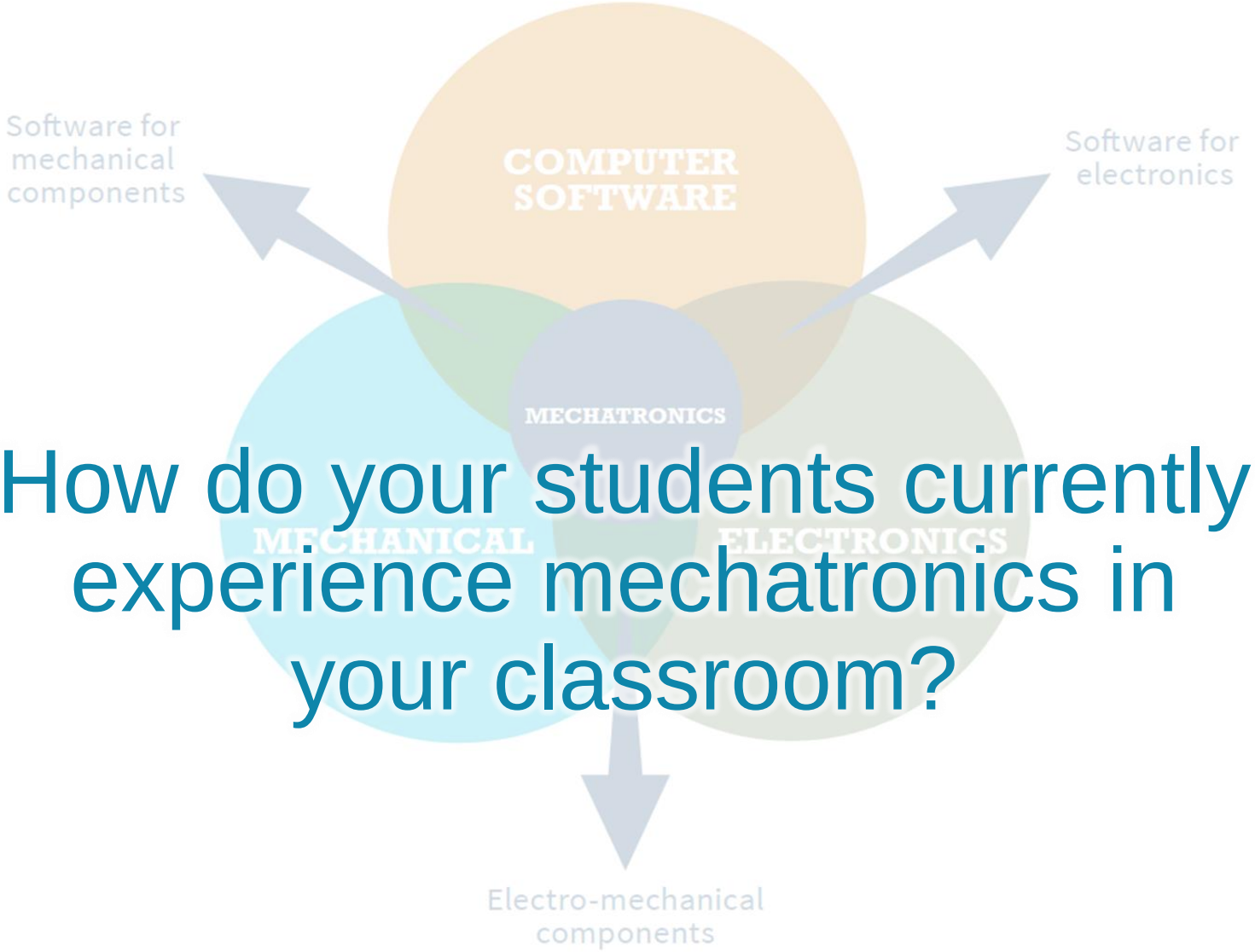


1. Using the reflection sheet, select one of the mechatronic systems shown in the video and complete the reflection sheet

2. Identify a mechatronic system in your own everyday life and complete the reflection sheet



Pg. 3

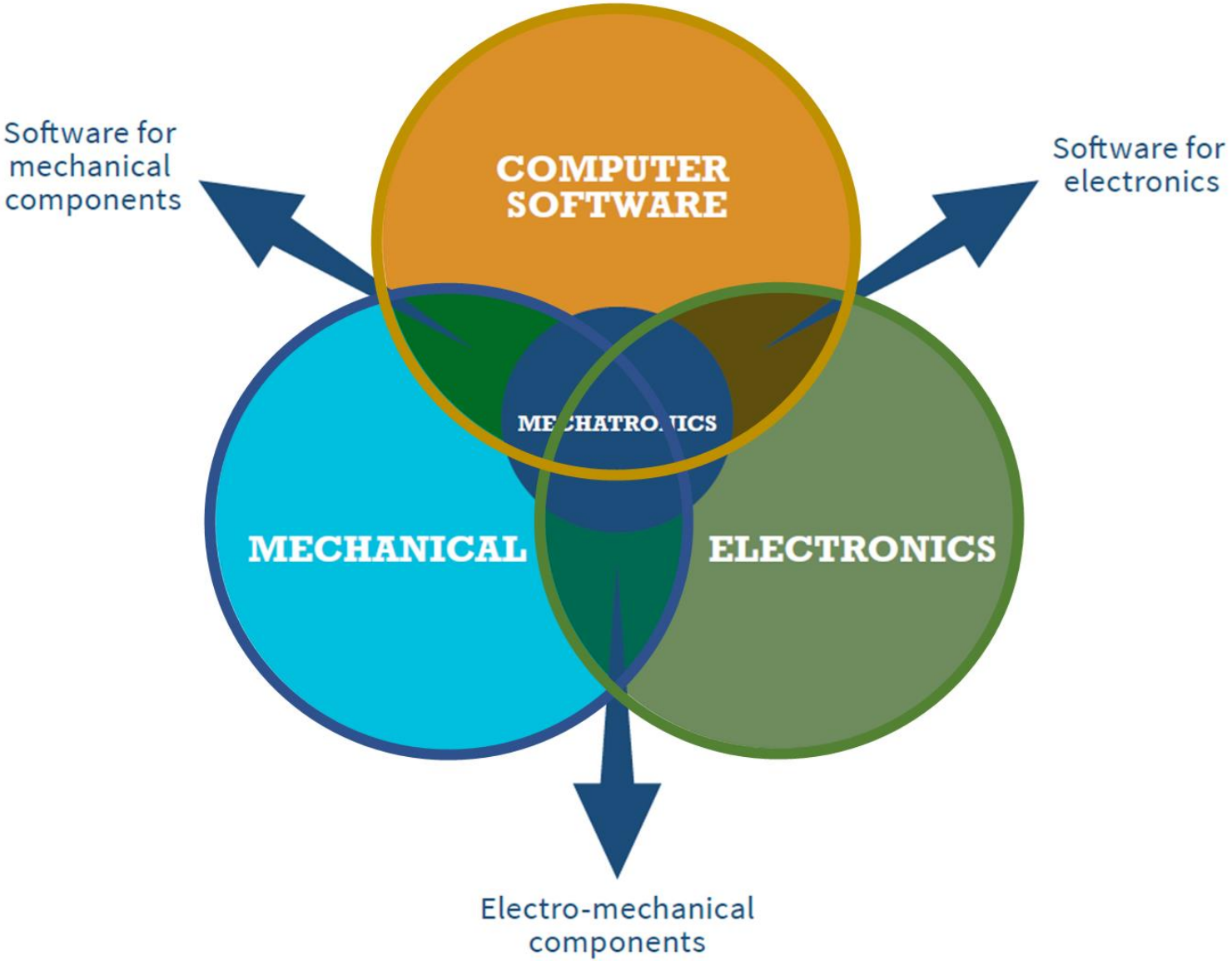


How do your students currently experience mechatronics in your classroom?

Reflect:

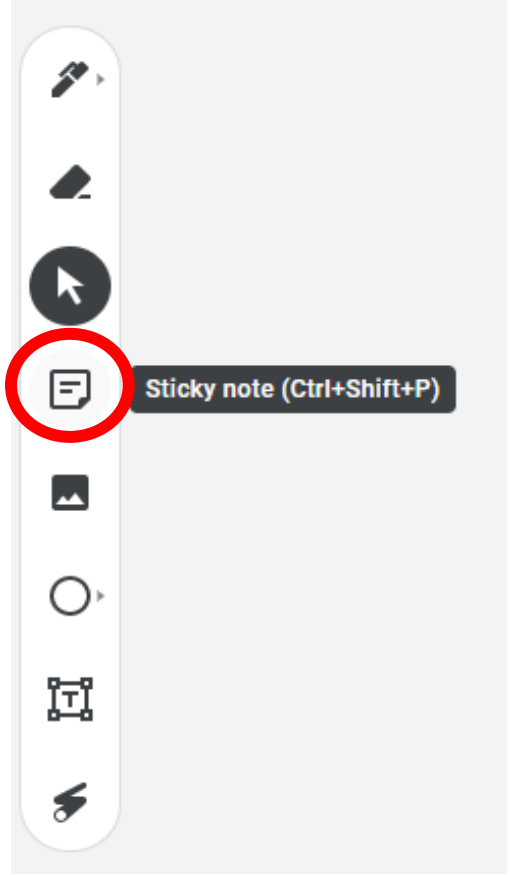
Reflect

2 minutes


Software for mechanical components
COMPUTER SOFTWARE
Software for electronics
MECHATRONICS
MECHANICAL
ELECTRONICS
Electro-mechanical components

Using the pre-loaded examples, or using sticky notes as shown on the right:

- Drag & drop the examples given to the areas of the Venn-diagram
- Create a sticky note with project details of a project you currently do with your students and show where it sits on the Venn-diagram



Jamboard

https://jamboard.google.com/d/1_DVl2jujlUHk18ZGX5GyXvkCkQ7y1s5K3JAl7a0zCyE/edit?usp=sharing

Oide

Software

Software for mechanical components

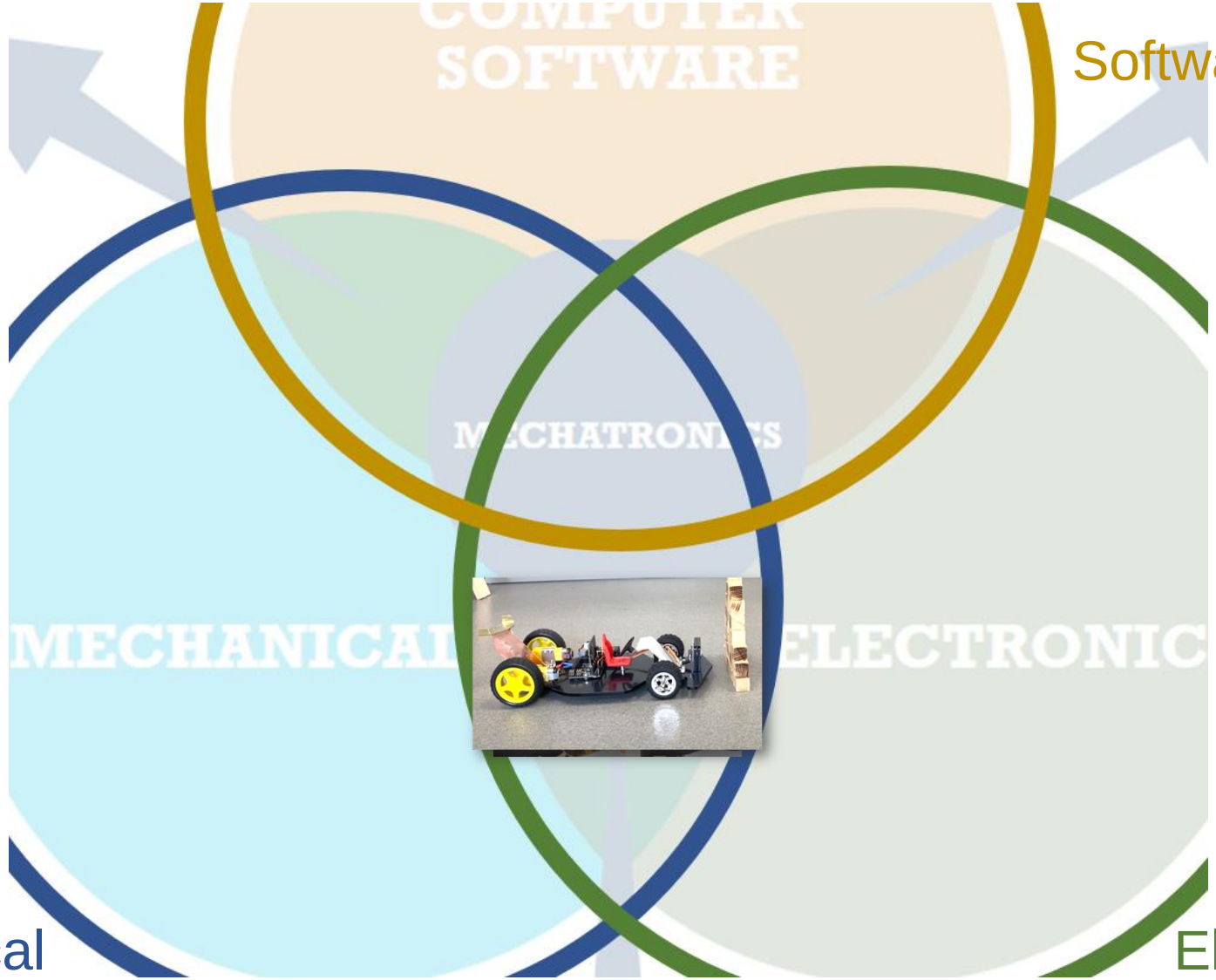
Software for electronics

Mechanical

Electronics

Electro-mechanical components

Software



Mechanical

Electronics

Mechatronics in the Engineering Room

Oide

Learner Experience

Using a mechatronics system to create a collision avoidance feature for a typical model car

School: Coláiste Dún an Rí

- Rural co-educational school - c.700 students.
- 2nd Year Engineering, term three - 22 students.

Prior Learning:

Marking out, materials processing, manufacturing skills. Assembly & finishing skills. Basic circuitry using a single motor and switched battery pack.

Focus of Learning:

- Assembly of parts and components.
- Soldering skills.
- Coding.
- An application of mechatronics in a real-world context.

Chosen Learning Outcomes:

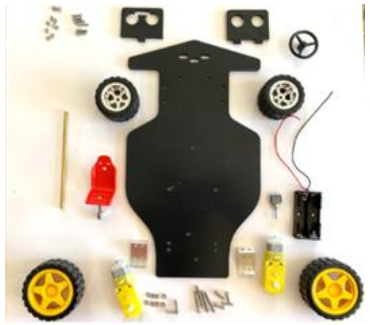
1.9: **apply** suitable manufacturing processes to **engineer** a product.
2.9: **modify** an existing product/design.
3.6: **configure and program** basic mechatronic systems using appropriate software.
3.8: **build and test** a basic mechatronic system with specific inputs or outputs.
3.9: **incorporate** basic mechatronics into their engineered products.

Key Learning:

Using action verbs to support your thinking.

- Understand how an ultrasonic sensor works.
- Configure a logical sequence to code a project and use a sensor effectively.
- Build and test a mechatronic system.
- Understand the difference between control systems and applied control systems.

Communicate a practical learning experience to activate key learning:

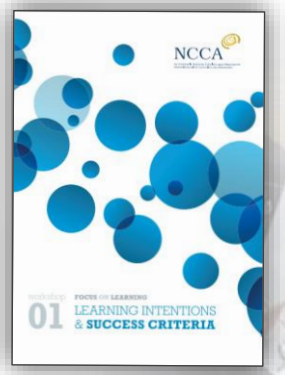


What resources would be needed?

Electronic components – motors, SPST switch, wires, solder, etc.
Chassis parts – 5mm acrylic, wheels, sheet material for wings.
Lathe tools, soldering iron, tools for assembly.
Wheels, seat, motor brackets, M3 and M4 screws/nuts etc.
Microbit, robotics board, ultrasonic sensor.

How could the key learning be assessed?

Build/design a car that avoids collision with the obstacle effectively.
Use the 'learning log' to record these moments, justifying the choices made throughout the process and the effects of the decisions on the final solution.
Targeted teacher feedback given throughout.
Peer feedback on agreed success criteria throughout.



Success Criteria

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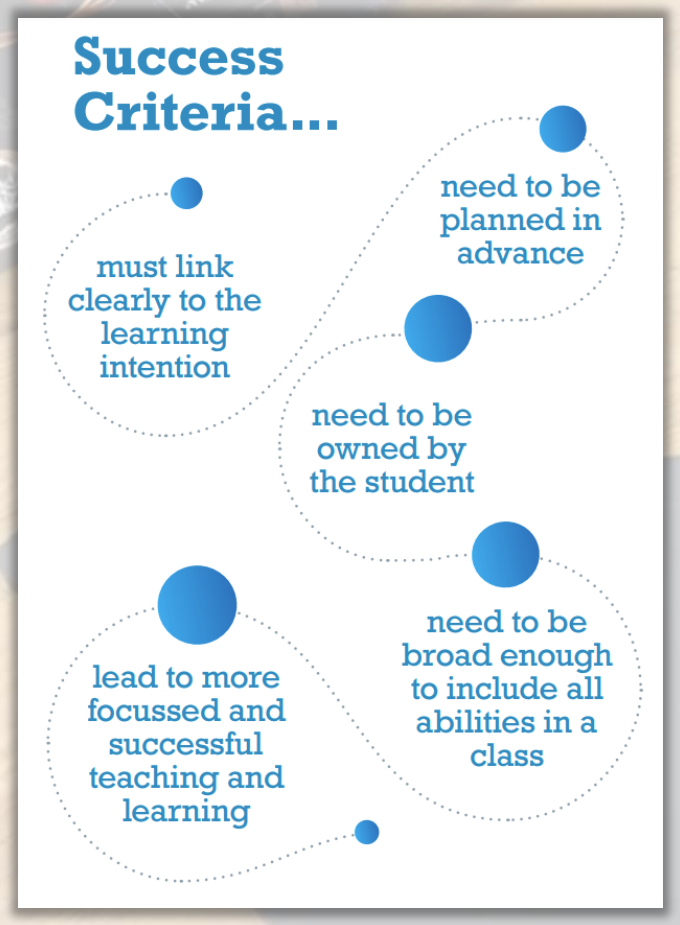
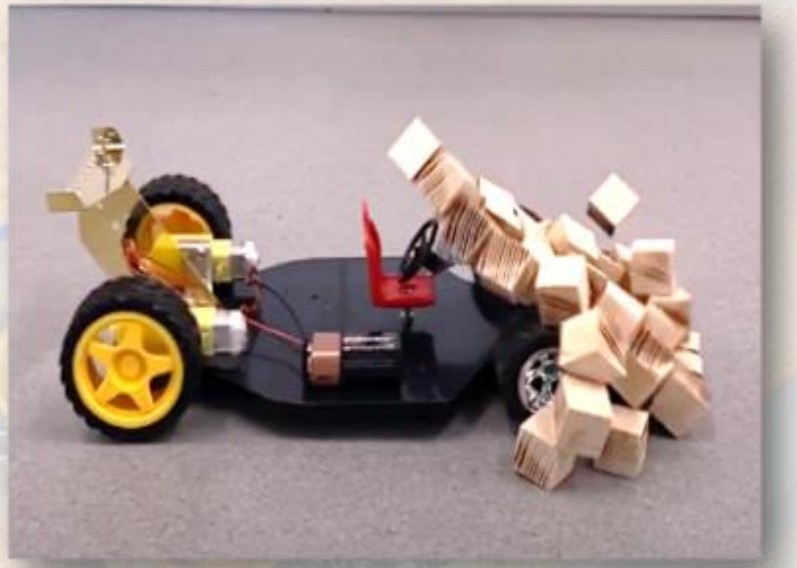


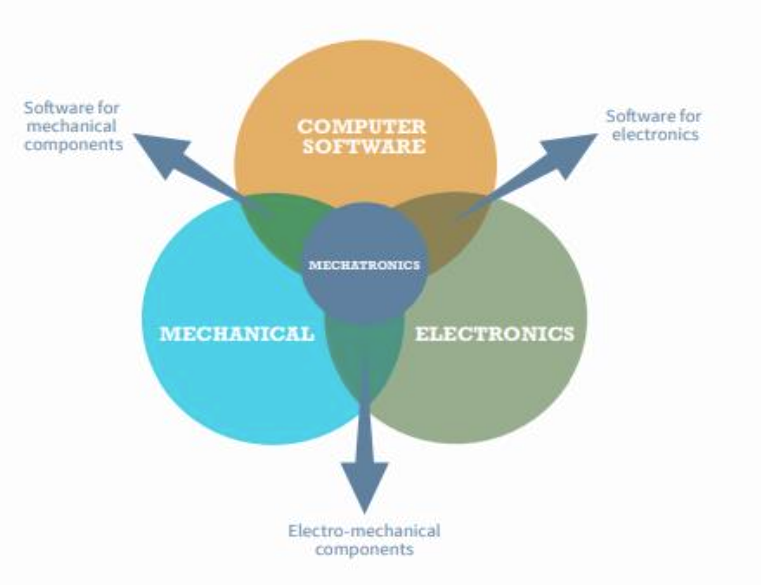


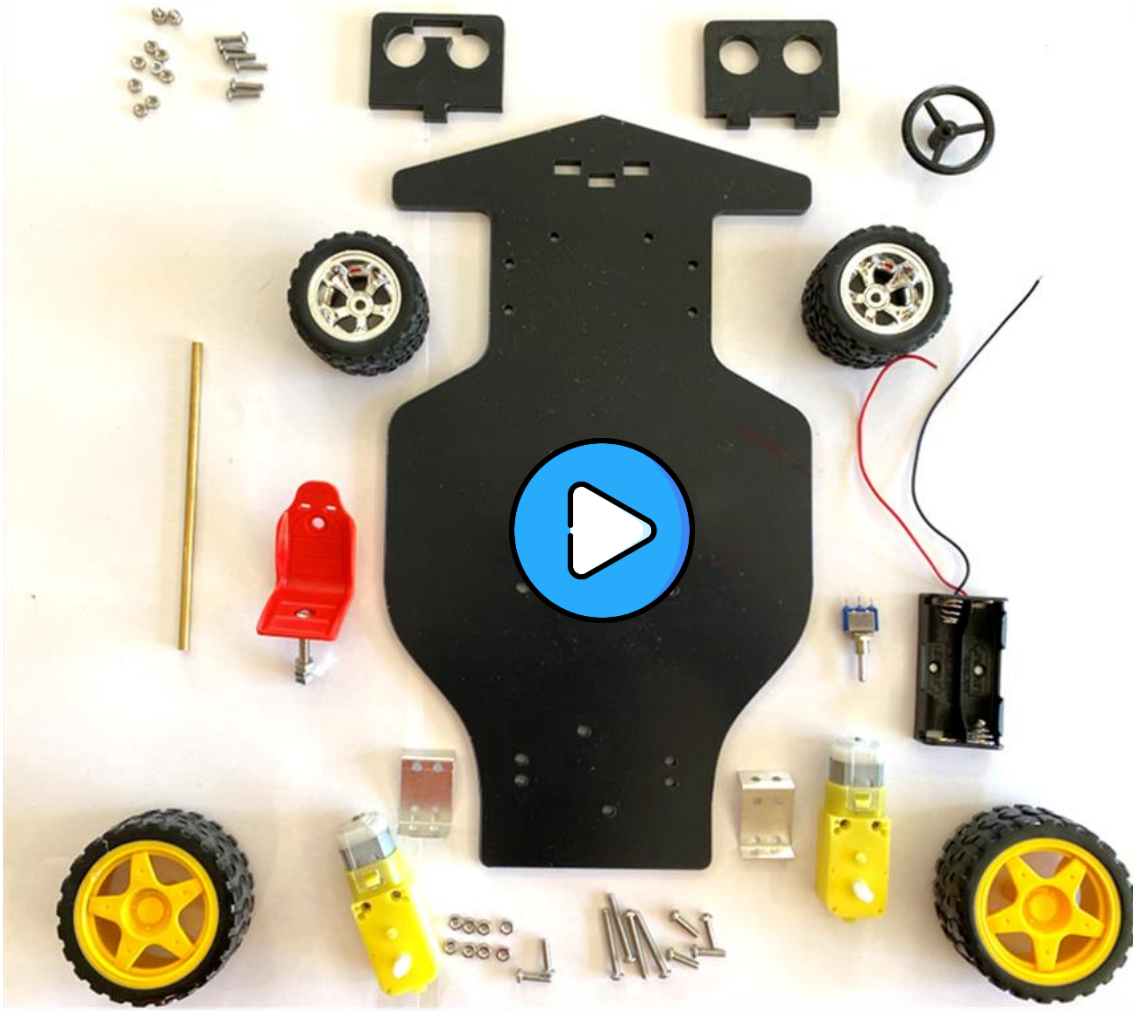
What success criteria could you co-create with your students to support this learning?

Learner Experience One

Task: Car with basic drive system

Classroom footage of students engaging with the task



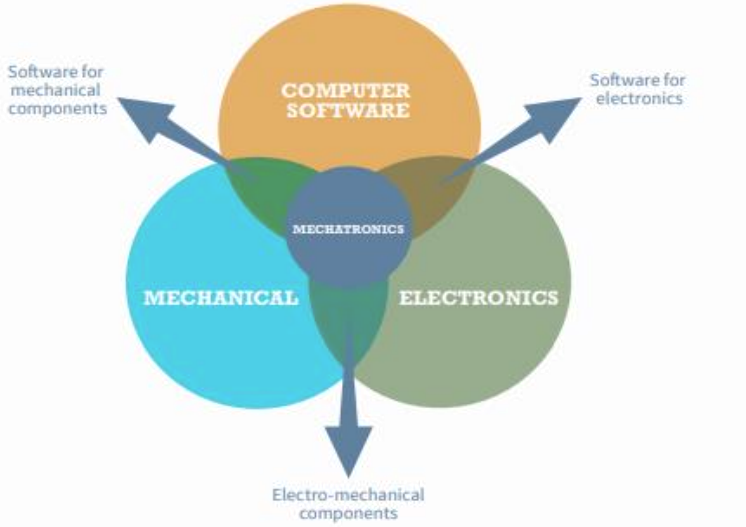


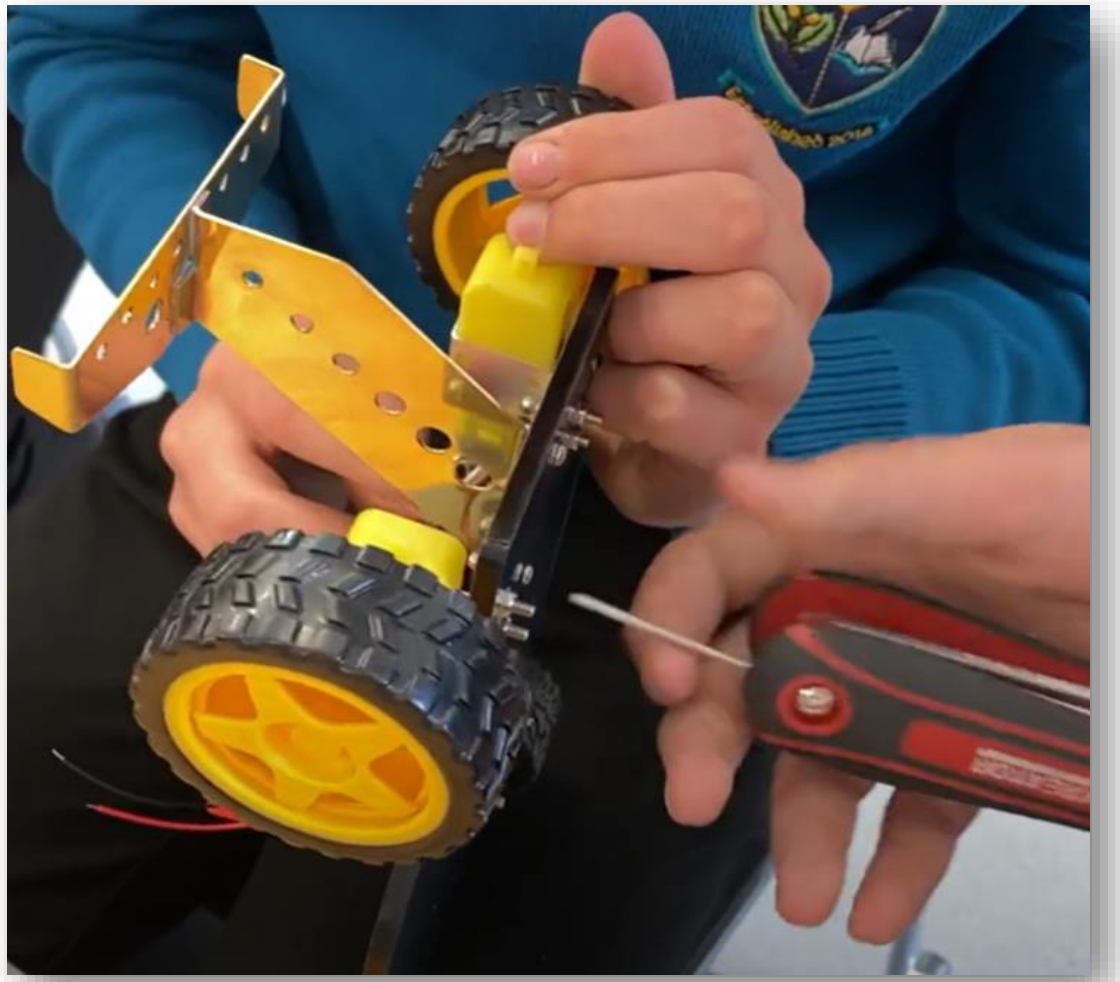
The Learner Experience

Having watched the students' progress through the car activity, consider:

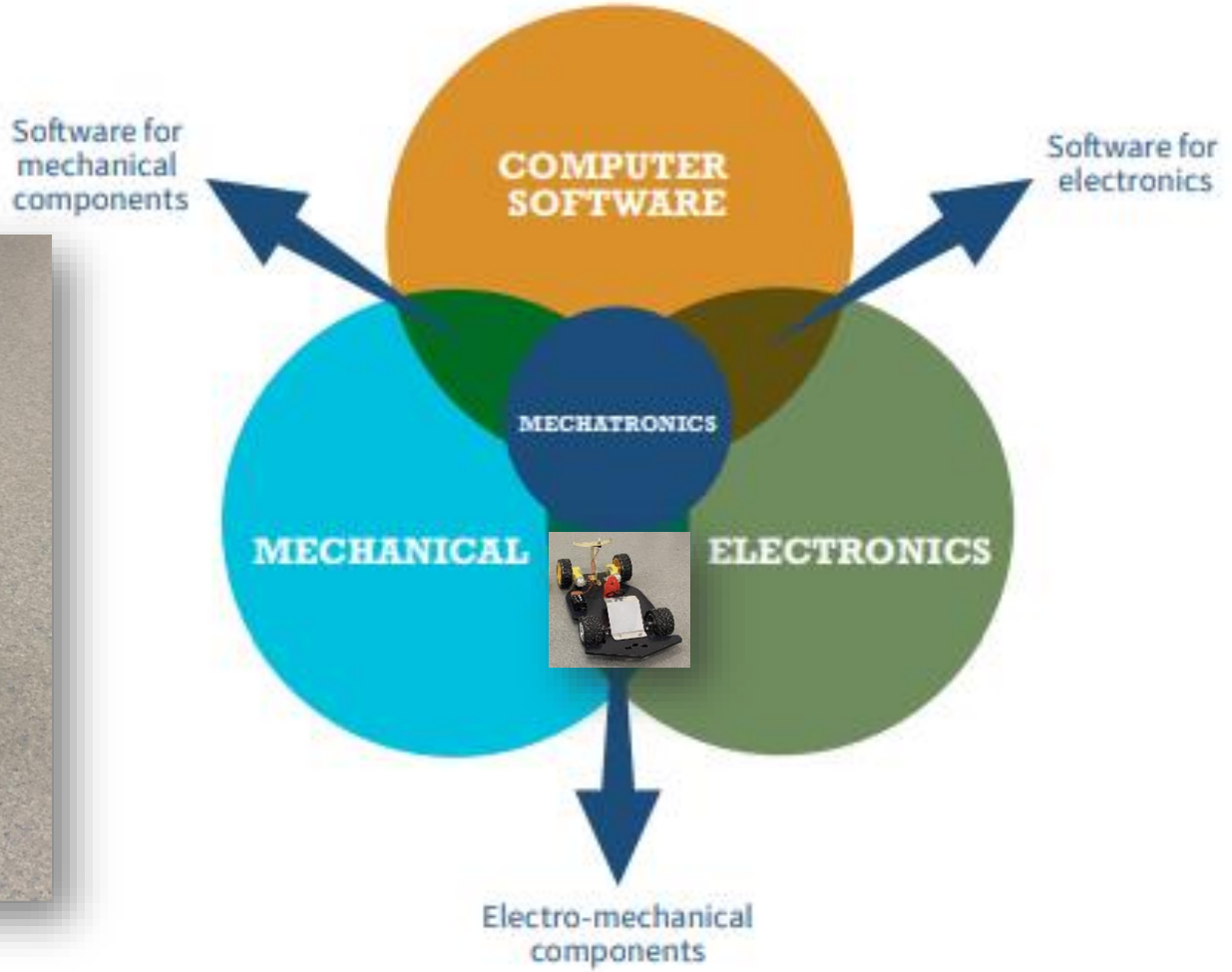
What new learning did the students gain from the activity?

What opportunities for further learning could be incorporated into the activity?

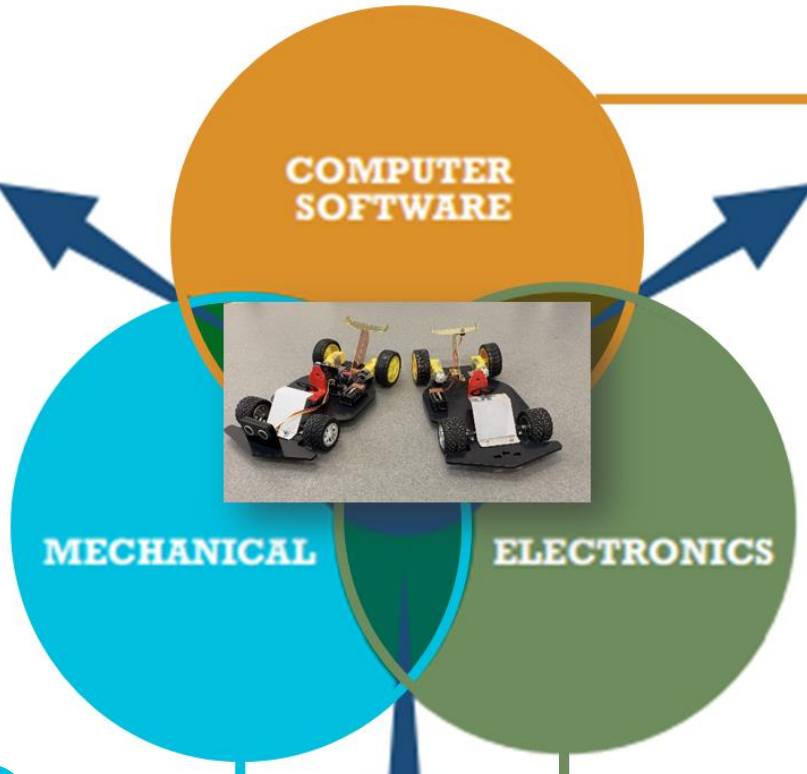




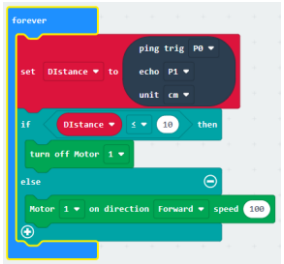
The Learner Experience



The Learner Experience

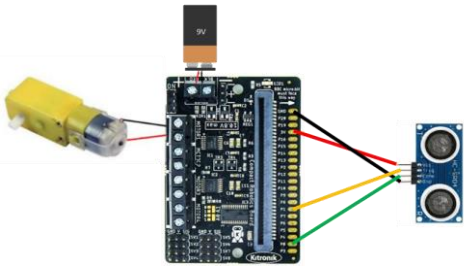


Development of skills in coding
Using an Extension Library
Development of a logical sequence
Motor Control
External sensors to that on the board



Mechanical subsystems
Drive systems
Axle Connection
Mechanical advantage
Motor types
Connecting wheels

Sensor control
Wiring of a sensor
Using a breakout board
Soldering
Motor polarity
Analog inputs/outputs



COMPUTER SOFTWARE

Computer Software

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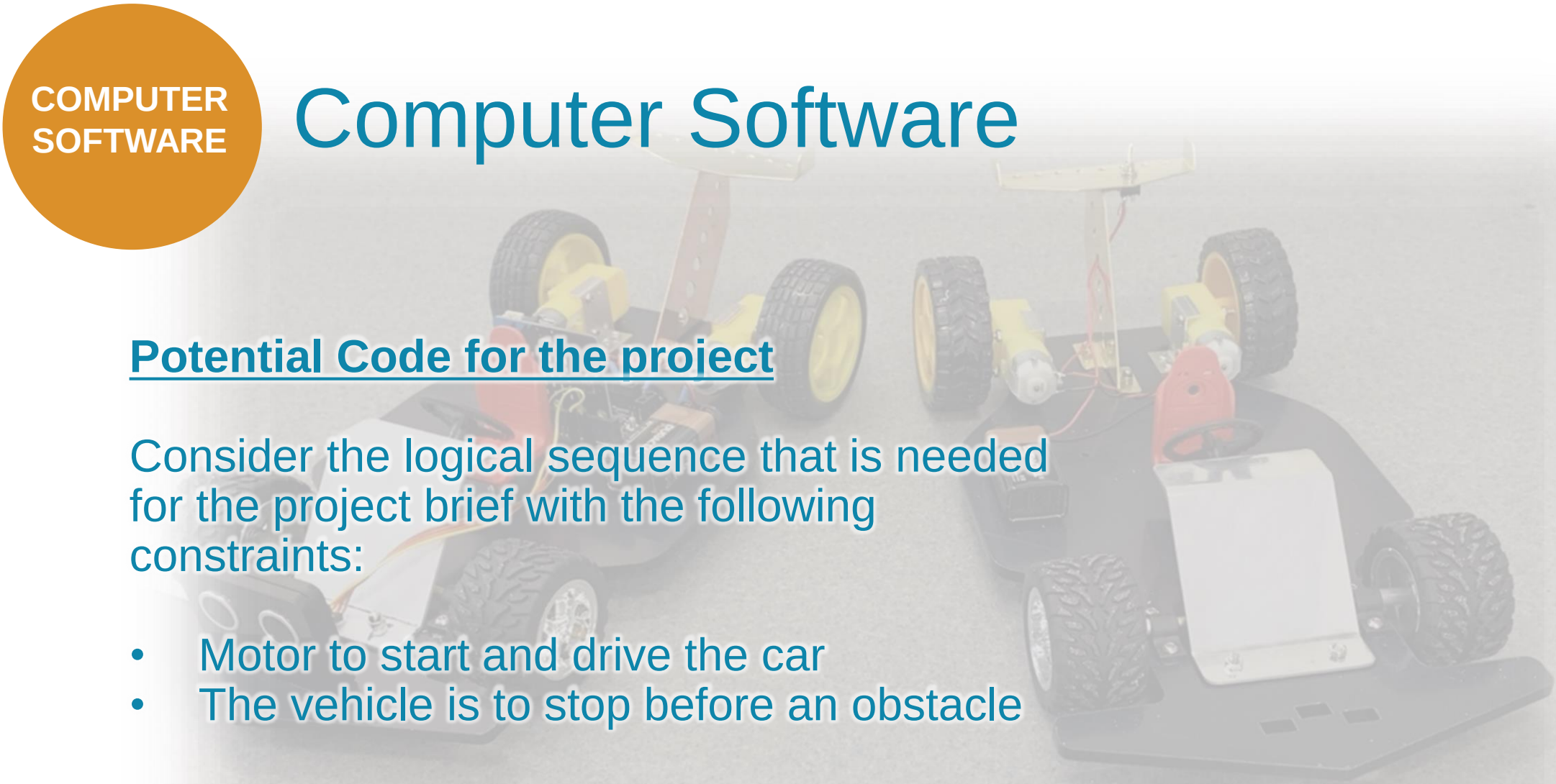


Potential Code for the project

Consider the logical sequence that is needed for the project brief with the following constraints:

- Motor to start and drive the car
- The vehicle is to stop before an obstacle

Task 1:

Sketch

10 minutes
Individually

COMPUTER SOFTWARE

Computer Software

Oide

Task 1:

Sketch

10 minutes
Individually

Potential Code for the project

Write out your plan

Go to Makecode.org and investigate what blocks may allow your sequence to work

Program the project and send the file in the chat

Microsoft MakeCode for micro:bit (microbit.org)

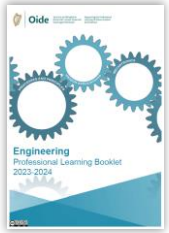

Oide

Mechatronics Challenge

A selection of common components that could be found in the Engineering room are shown below. You may find these useful when designing your solution.

Outline a suitable sequence of actions to ensure the desired output from the car:

micro:bit


Oide

Engineering
Professional Learning Booklet
2023-2024

Pg. 6

COMPUTER SOFTWARE

Computer Software

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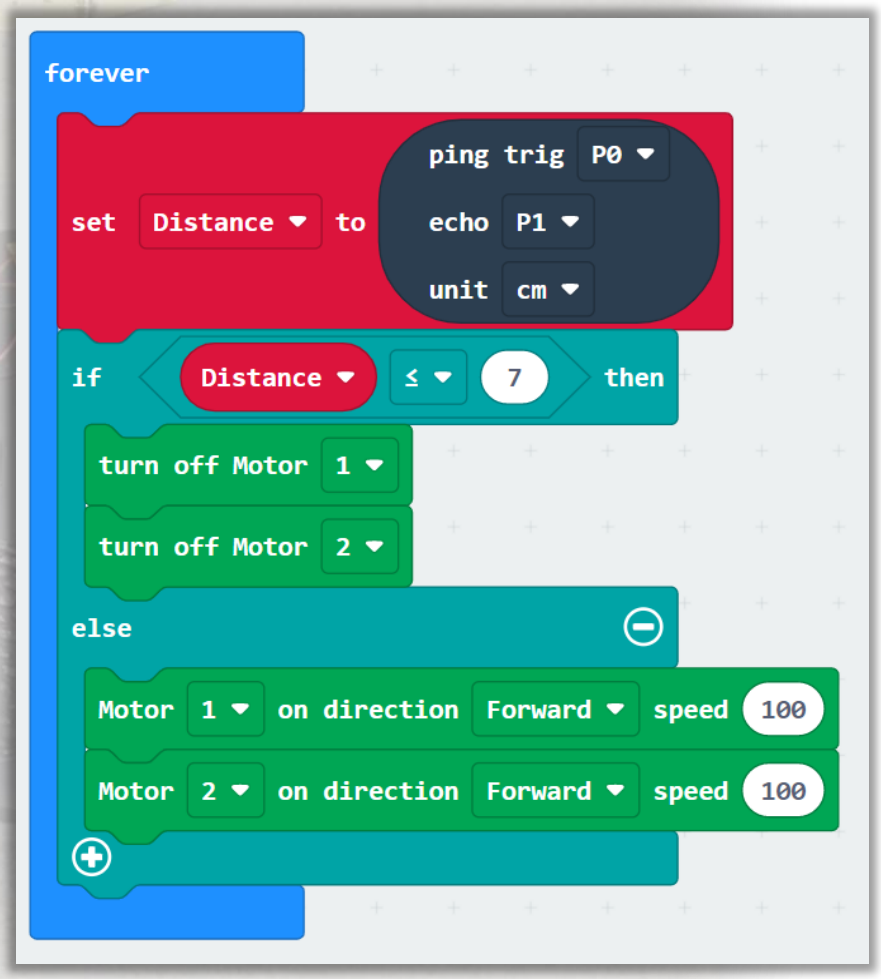
Potential Code for the project

Using Makecode, the code here can make the project work

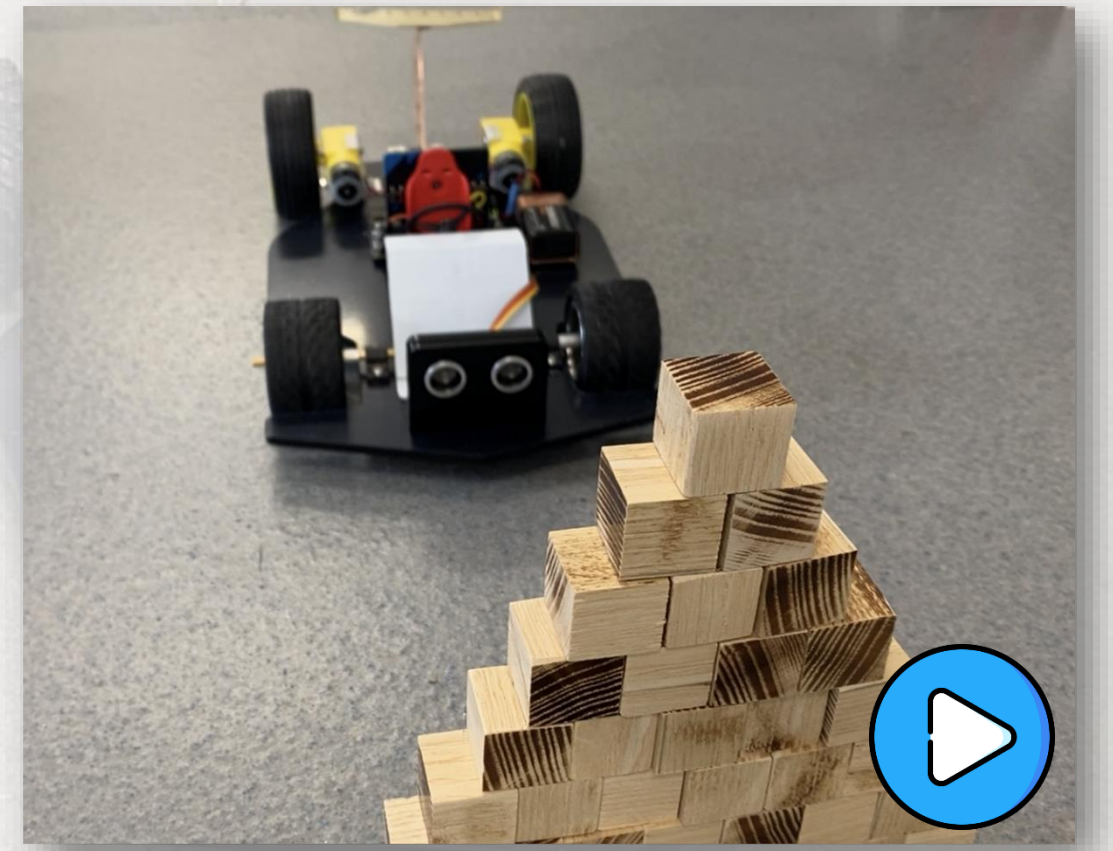


The Learner experience

Oide

Project: Collision Avoiding Car

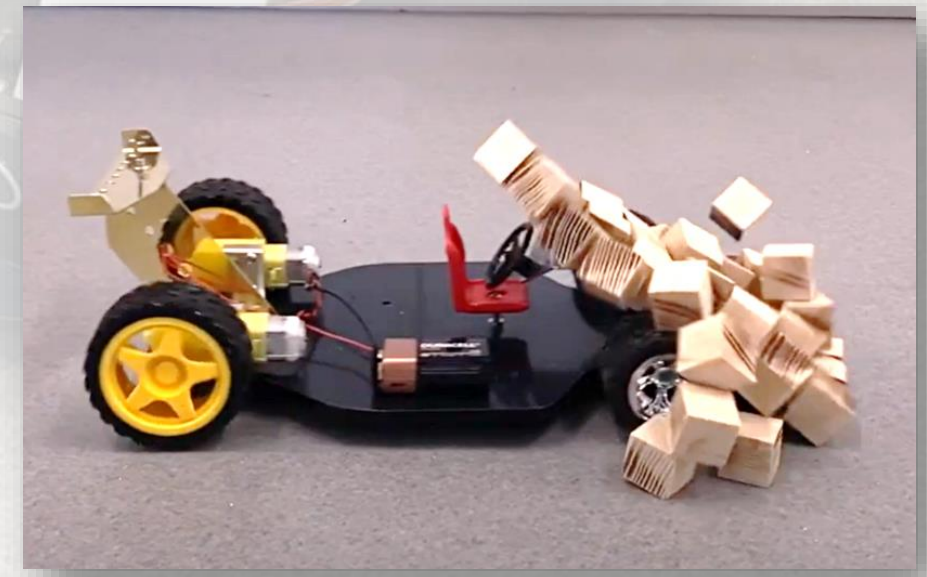
Student Experience Part 2



Learner Experience

Having watched the students' progress through the collision avoidance system activity, consider:

What learning and skill development is evidenced in the student testimonials?



Mechatronics and You

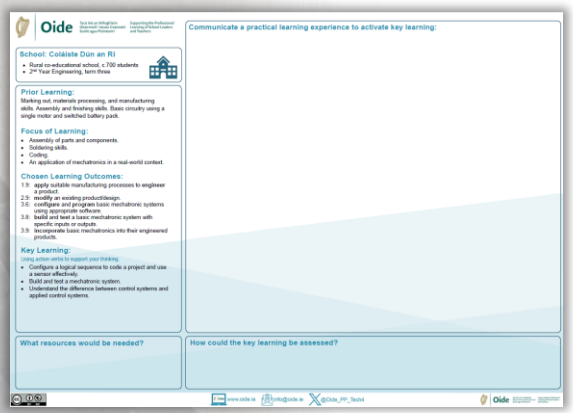
Individual Activity:

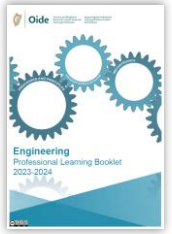
Consider the examples of mechatronics we have explored

Develop a similar learning experience that you feel would be appropriate for your students' context

What challenges to student learning might arise?

15 minutes





Pg. 7

Mechatronics and Us

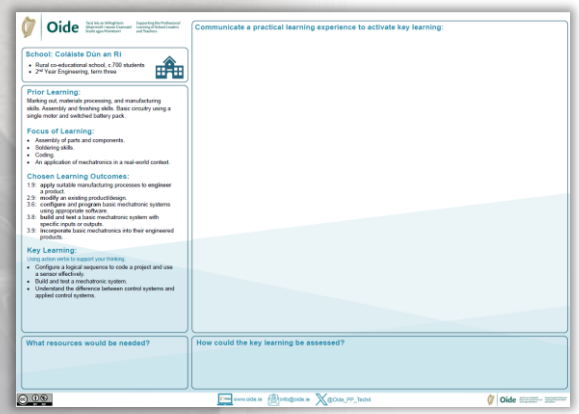
Open floor discussion:

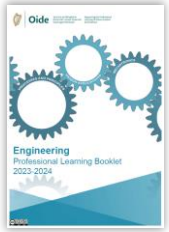
Share a brief overview of your plan with the group

Discuss your learning experience and how you feel it would be appropriate for your students' context

Reflecting on your colleagues' ideas or feedback, what opportunities are there for developing the student learning in your room?

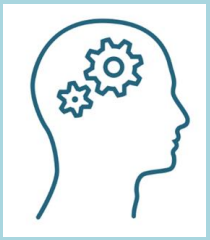
15 minutes





Pg. 7

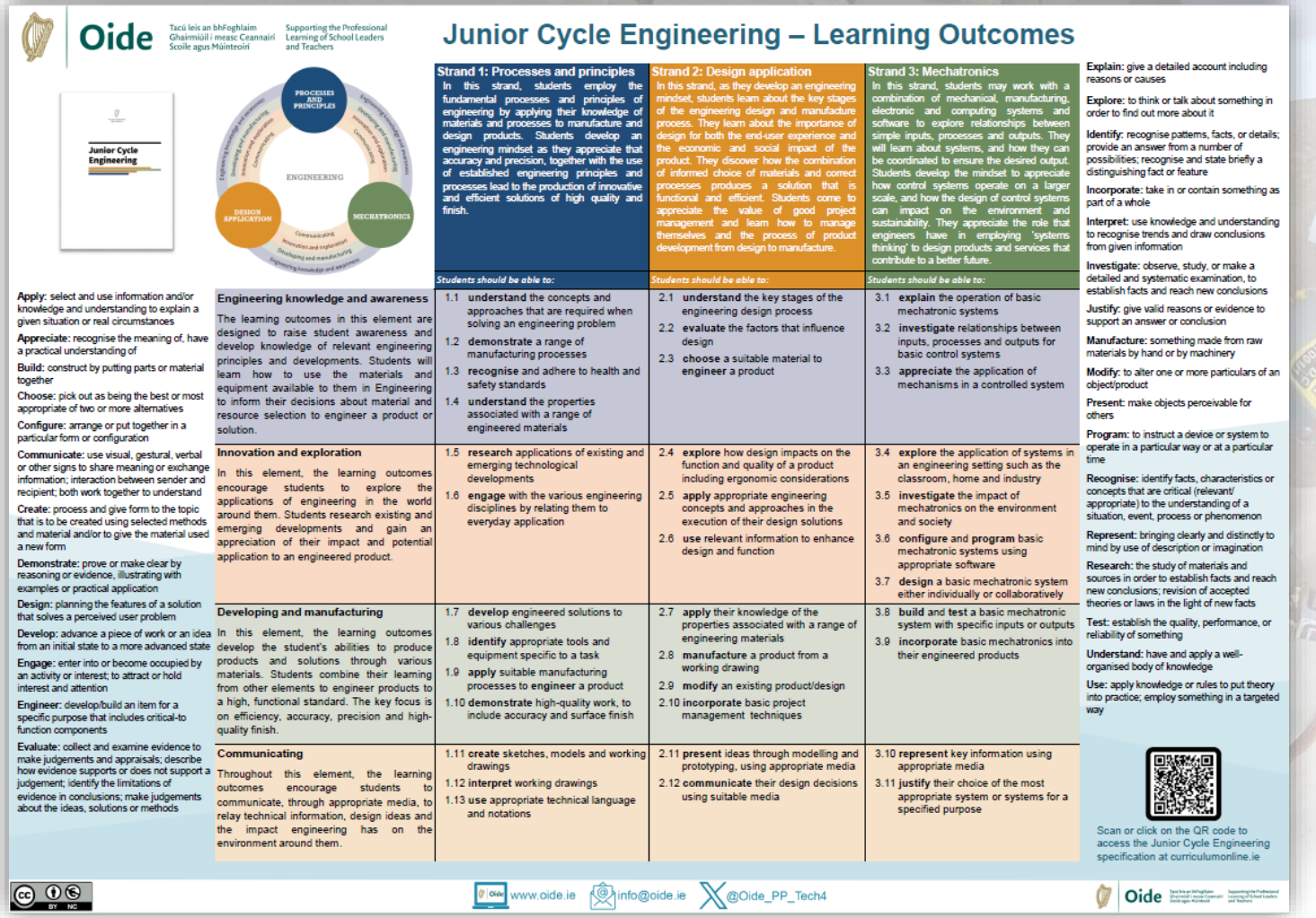
In this session - we will…



Explore how an integrated approach to structuring learning in the Junior Cycle Engineering classroom can support the development of the engineering mindset

The Integrated Approach in Engineering

Oide



Oide Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí — Supporting the Professional Learning of School Leaders and Teachers

Junior Cycle Engineering – Learning Outcomes

Junior Cycle Engineering

PROCESSES AND PRINCIPLES · DESIGN APPLICATION · MECHATRONICS · ENGINEERING

Strand 1: Processes and principles
In this strand, students employ the fundamental processes and principles of engineering by applying their knowledge of materials and processes to manufacture and design products. Students develop an engineering mindset as they appreciate that accuracy and precision, together with the use of established engineering principles and processes lead to the production of innovative and efficient solutions of high quality and finish.

Strand 2: Design application
In this strand, as they develop an engineering mindset, students learn about the key stages of the engineering design and manufacture process. They learn about the importance of design for both the end-user experience and the economic and social impact of the product. They discover how the combination of informed choice of materials and correct processes produces a solution that is functional and efficient. Students come to appreciate the value of good project management and learn how to manage themselves and the process of product development from design to manufacture.

Strand 3: Mechatronics
In this strand, students may work with a combination of mechanical, manufacturing, electronic and computing systems and software to explore relationships between simple inputs, processes and outputs. They will learn about systems, and how they can be coordinated to ensure the desired output. Students develop the mindset to appreciate how control systems operate on a larger scale, and how the design of control systems can impact on the environment and sustainability. They appreciate the role that engineers have in employing systems thinking' to design products and services that contribute to a better future.

	Students should be able to:	*Students should be able to:*	*Students should be able to:*
Engineering knowledge and awareness The learning outcomes in this element are designed to raise student awareness and develop knowledge of relevant engineering principles and developments. Students will learn how to use the materials and equipment available to them in Engineering to inform their decisions about material and resource selection to engineer a product or solution.	1.1 **understand** the concepts and approaches that are required when solving an engineering problem 1.2 **demonstrate** a range of manufacturing processes 1.3 **recognise** and adhere to health and safety standards 1.4 **understand** the properties associated with a range of engineered materials	2.1 **understand** the key stages of the engineering design process 2.2 **evaluate** the factors that influence design 2.3 **choose** a suitable material to **engineer** a product	3.1 **explain** the operation of basic mechatronic systems 3.2 **investigate** relationships between inputs, processes and outputs for basic control systems 3.3 **appreciate** the application of mechanisms in a controlled system
Innovation and exploration In this element, the learning outcomes encourage students to explore the applications of engineering in the world around them. Students research existing and emerging developments and gain an appreciation of their impact and potential application to an engineered product.	1.5 **research** applications of existing and emerging technological developments 1.6 **engage** with the various engineering disciplines by relating them to everyday application	2.4 **explore** how design impacts on the function and quality of a product including ergonomic considerations 2.5 **apply** appropriate engineering concepts and approaches in the execution of their design solutions 2.6 **use** relevant information to enhance design and function	3.4 **explore** the application of systems in an engineering setting such as the classroom, home and industry 3.5 **investigate** the impact of mechatronics on the environment and society 3.6 **configure** and **program** basic mechatronic systems using appropriate software 3.7 **design** a basic mechatronic system either individually or collaboratively
Developing and manufacturing In this element, the learning outcomes develop the student's abilities to produce products and solutions through various materials. Students combine their learning from other elements to engineer products to a high, functional standard. The key focus is on efficiency, accuracy, precision and high-quality finish.	1.7 **develop** engineered solutions to various challenges 1.8 **identify** appropriate tools and equipment specific to a task 1.9 **apply** suitable manufacturing processes to **engineer** a product 1.10 **demonstrate** high-quality work, to include accuracy and surface finish	2.7 **apply** their knowledge of the properties associated with a range of engineering materials 2.8 **manufacture** a product from a working drawing 2.9 **modify** an existing product/design 2.10 **incorporate** basic project management techniques	3.8 **build** and **test** a basic mechatronic system with specific inputs or outputs 3.9 **incorporate** basic mechatronics into their engineered products
Communicating Throughout this element, the learning outcomes encourage students to communicate, through appropriate media, to relay technical information, design ideas and the impact engineering has on the environment around them.	1.11 **create** sketches, models and working drawings 1.12 **interpret** working drawings 1.13 **use** appropriate technical language and notations	2.11 **present** ideas through modelling and prototyping, using appropriate media 2.12 **communicate** their design decisions using suitable media	3.10 **represent** key information using appropriate media 3.11 **justify** their choice of the most appropriate system or systems for a specified purpose

Apply: select and use information and/or knowledge and understanding to explain a given situation or real circumstances

Appreciate: recognise the meaning of, have a practical understanding of

Build: construct by putting parts or material together

Choose: pick out as being the best or most appropriate of two or more alternatives

Configure: arrange or put together in a particular form or configuration

Communicate: use visual, gestural, verbal or other signs to share meaning or exchange information; interaction between sender and recipient; both work together to understand

Create: process and give form to the topic that is to be created using selected methods and material and/or to give the material used a new form

Demonstrate: prove or make clear by reasoning or evidence, illustrating with examples or practical application

Design: planning the features of a solution that solves a perceived user problem

Develop: advance a piece of work or an idea from an initial state to a more advanced state

Engage: enter into or become occupied by an activity or interest; to attract or hold interest and attention

Engineer: develop/build an item for a specific purpose that includes critical-to function components

Evaluate: collect and examine evidence to make judgements and appraisals; describe how evidence supports or does not support a judgement; identify the limitations of evidence in conclusions; make judgements about the ideas, solutions or methods

Explain: give a detailed account including reasons or causes

Explore: to think or talk about something in order to find out more about it

Identify: recognise patterns, facts, or details; provide an answer from a number of possibilities; recognise and state briefly a distinguishing fact or feature

Incorporate: take in or contain something as part of a whole

Interpret: use knowledge and understanding to recognise trends and draw conclusions from given information

Investigate: observe, study, or make a detailed and systematic examination, to establish facts and reach new conclusions

Justify: give valid reasons or evidence to support an answer or conclusion

Manufacture: something made from raw materials by hand or by machinery

Modify: to alter one or more particulars of an object/product

Present: make objects perceivable for others

Program: to instruct a device or system to operate in a particular way or at a particular time

Recognise: identify facts, characteristics or concepts that are critical (relevant/appropriate) to the understanding of a situation, event, process or phenomenon

Represent: bringing clearly and distinctly to mind by use of description or imagination

Research: the study of materials and sources in order to establish facts and reach new conclusions; revision of accepted theories or laws in the light of new facts

Test: establish the quality, performance, or reliability of something

Understand: have and apply a well-organised body of knowledge

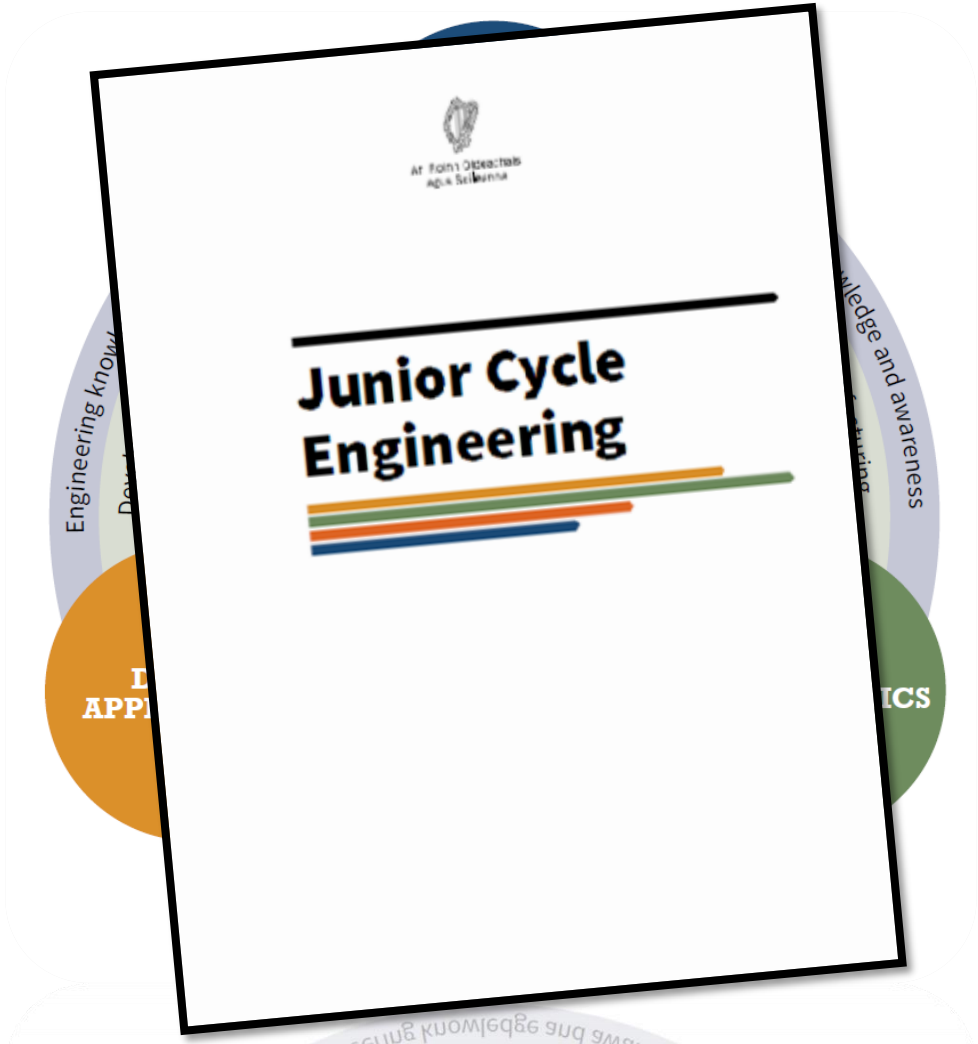
Use: apply knowledge or rules to put theory into practice; employ something in a targeted way

Scan or click on the QR code to access the Junior Cycle Engineering specification at curriculumonline.ie

'Engineering uses an interdisciplinary approach which encourages the integration of the three strands in the teaching and learning of the subject'

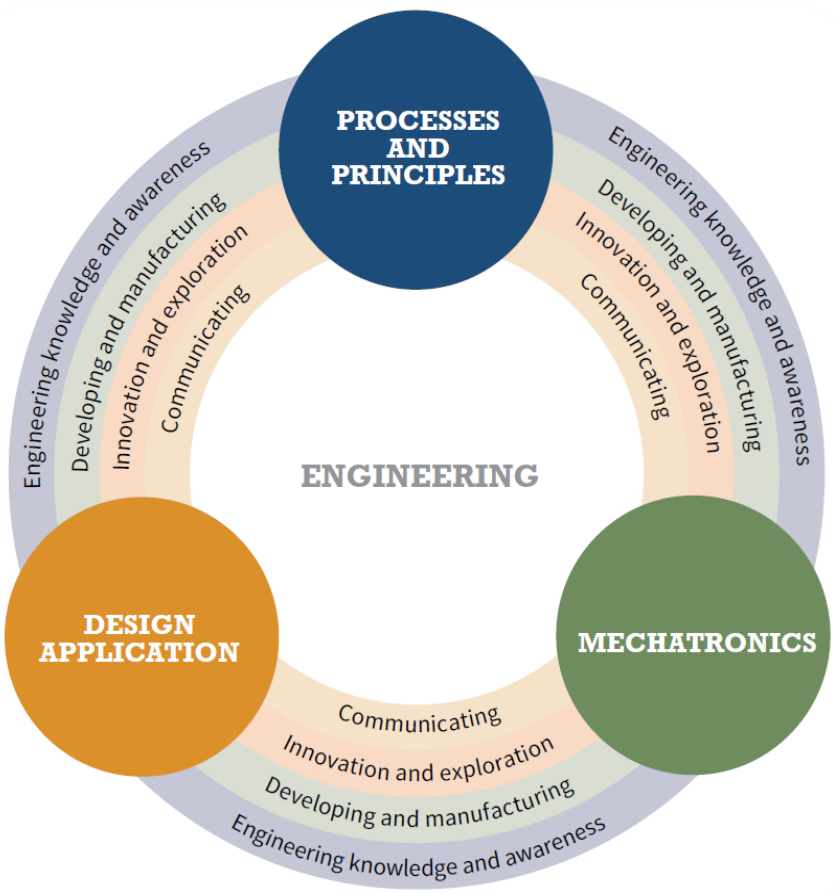
Engineering specification, Overview: Course, page 9.

The Engineering Specification



The elements are consistent throughout the strands, so that there is **a systematic development of students' fundamental knowledge, understanding and key skills** as they progress through the course. This structure supports an **integrated, non-linear approach** to teaching and learning

The Engineering Specification



Students develop an engineering mindset …. **accuracy and precision**, ….. **engineering principles and processes, …high quality and finish.**

…manage themselves and the process of product development from design to manufacture.

…develop the engineering mindset to appreciate how control systems operate……. '**systems thinking**' to design products and services…

Through the study of engineering, students will have the **opportunity to behave as engineers**, and **develop an engineering mindset.**

Where was an integrated approach to teaching and learning evident in the learning experiences in session one?

Reflect:

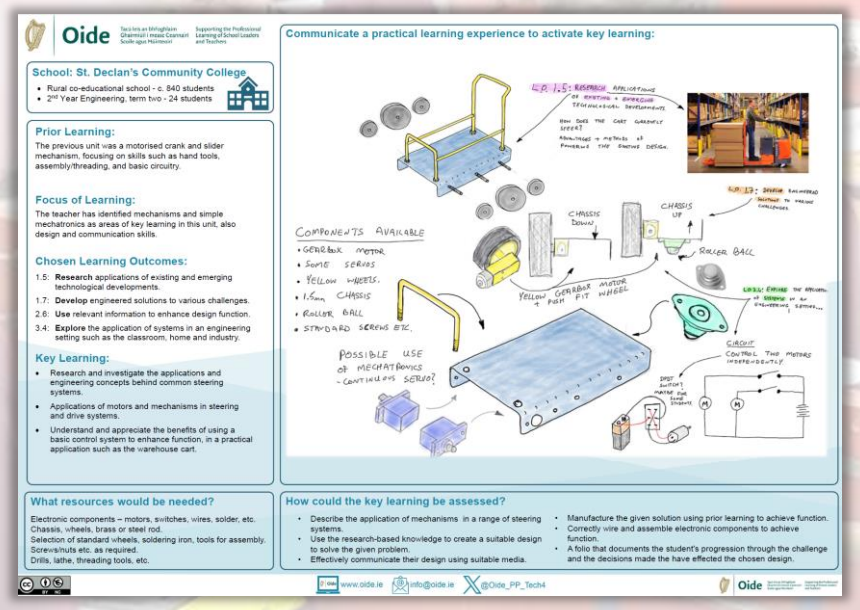
Reflect

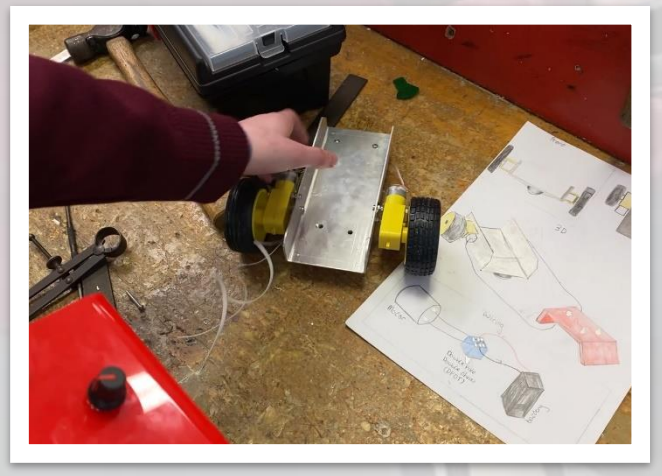
3 minutes

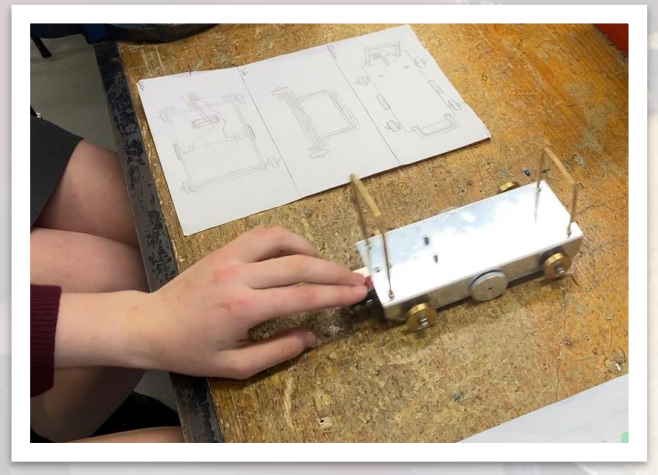
Learner Experience

Unit of Learning: Warehouse Cart

Task: Steering and Drive System







Student Context

840 Student in a rural Co-educational school

2nd year mixed gender and ability group of students

24 second year students who have previously completed projects, engaged in research, and presentation of research findings from first year

Unit of Learning: Warehouse Cart

Oide

Prior knowledge:

- Previous project engaged with motor control
- Aware of how crank and slider mechanisms work
- The importance of precision and accuracy in previous projects
- How basic electronic circuits function
- Research and presented findings

Focus of Learning:

The teacher has identified mechanisms and simple mechatronics as areas of key learning in this unit, alongside design and communication skills

School: St. Declan's Community College

- Rural co-educational school - c.840 students.
- 2nd Year Engineering, term two - 24 students.

Prior Learning:

The previous unit was a motorised crank and slider mechanism, focusing on hand tool skills, assembly/threading skills, and basic circuitry skills.

Focus of Learning:

The teacher has identified mechanisms and simple mechatronics as areas of key learning. Design and communication skills are also in focus.

Chosen Learning Outcomes:

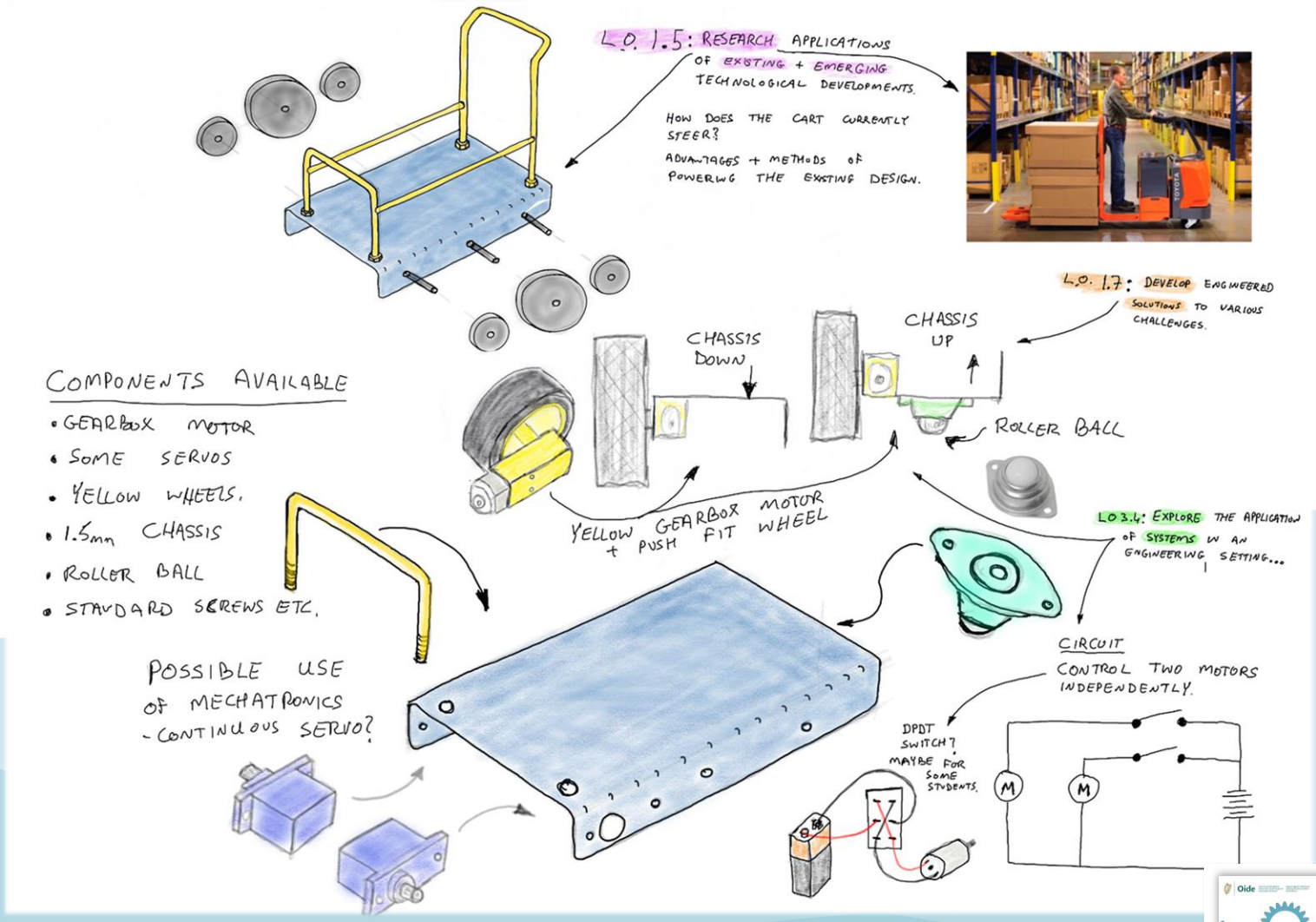
1.5: **Research** applications of existing and emerging technological developments.
1.7: **Develop** engineered solutions to various challenges.
2.6: **Use** relevant information to enhance design function.
3.4: **Explore** the application of systems in an engineering setting such as the classroom, home and industry.

Key Learning:

Using action verbs to support your thinking.

- Research and investigate the applications and engineering concepts behind common steering systems.
- Recognise applications of motors and mechanisms in steering and drive systems.
- Understand and appreciate the benefits of using a basic control system to enhance function in a practical application, such as the warehouse cart.

Communicate a practical learning experience to activate key learning:

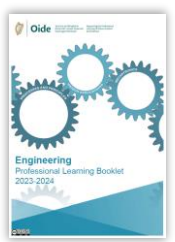


What resources would be needed?

Electronic components – motors, switches, wires, solder, etc.
Chassis, wheels, brass/steel rod, screws/nuts etc.
Selection of standard wheels, soldering iron, and tools for assembly.
Drills, lathe, threading tools, etc.

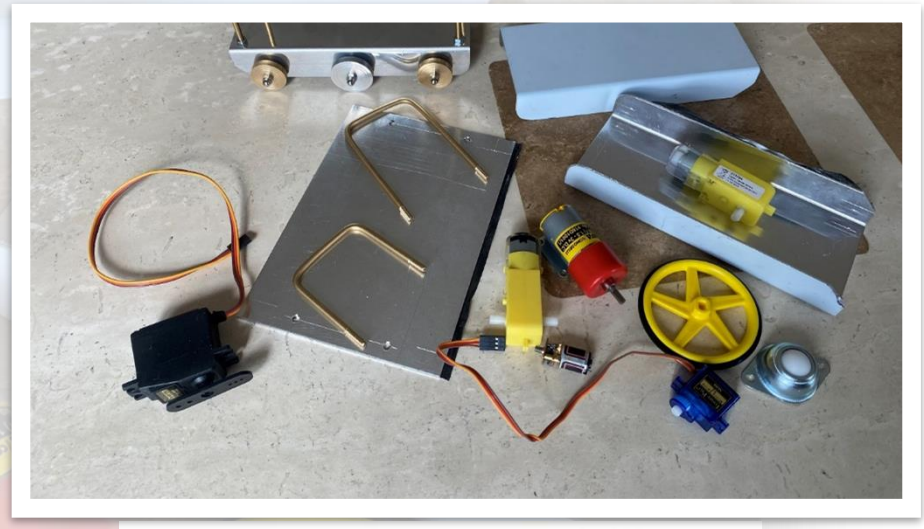
How could the key learning be assessed?

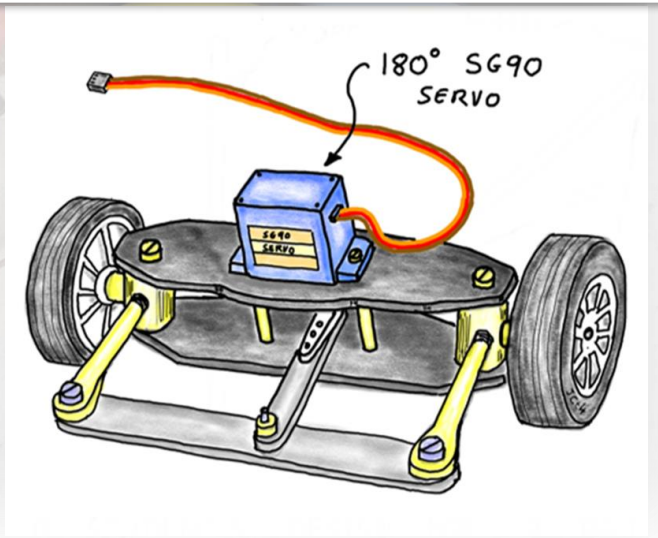
Describe the application of mechanisms in a range of steering systems.
Use the research-based knowledge to create a suitable design to solve the given problem.
Effectively communicate their design using suitable media.
Manufacture the given solution using prior learning function.
Correctly wire and assemble electronic component function.
A folio that documents the student's progression thr challenge and the decisions that affected the chose



Personal Reflection

How do your students currently experience mechanisms/motors in your Engineering room?





Breakout Room

Oide

Discuss and share with your colleagues how your students experience mechanisms/motors in your Engineering room

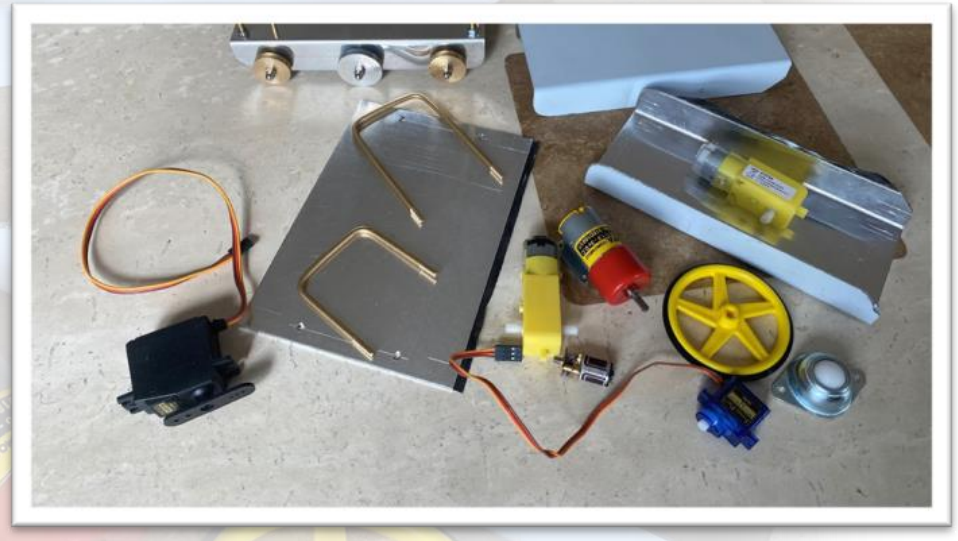
10 minutes

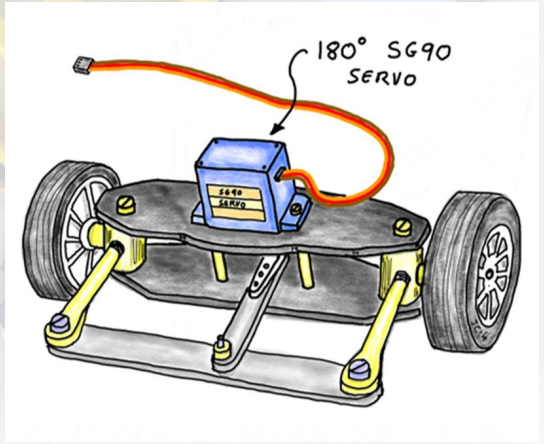
Actions:

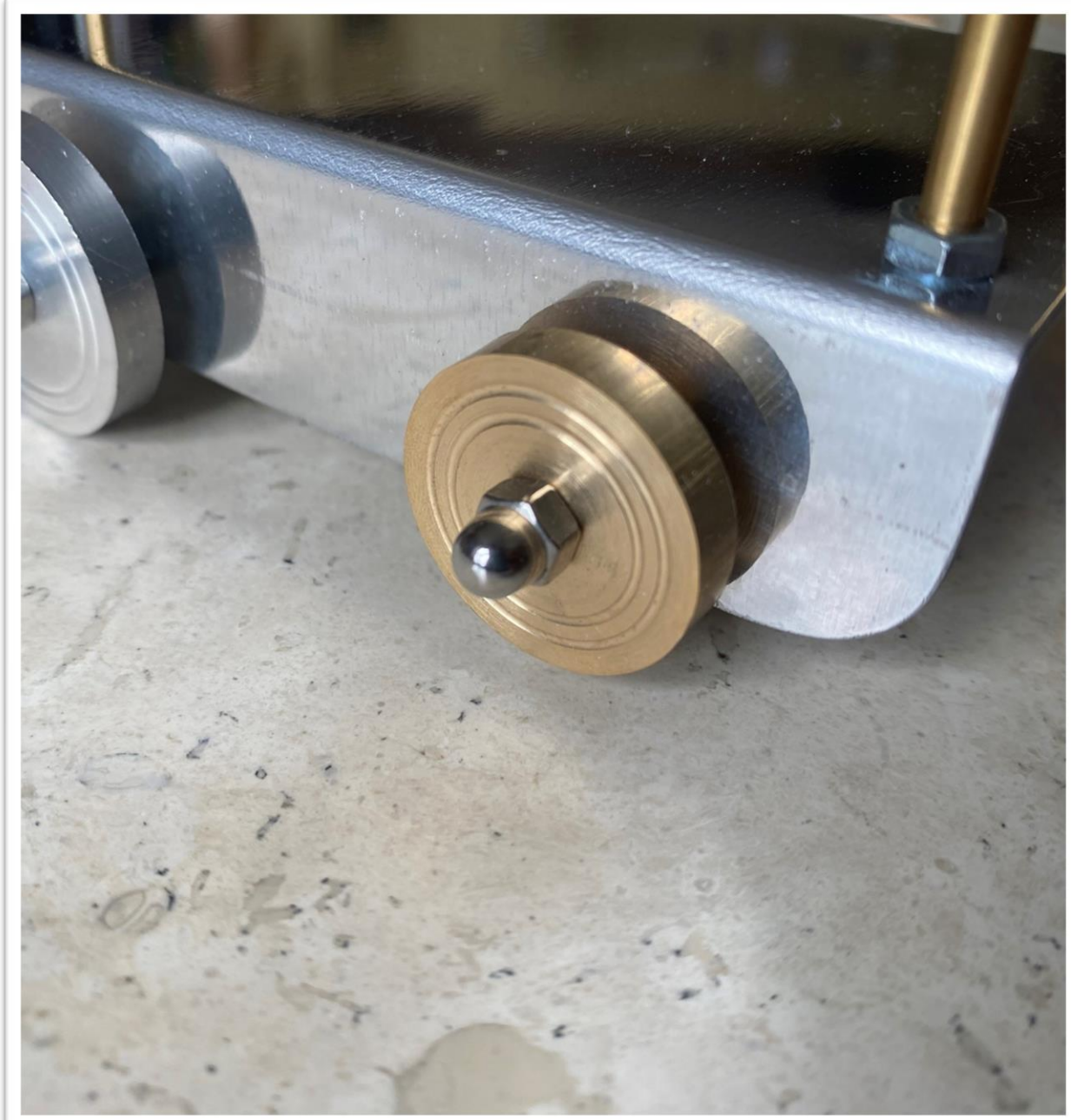
- Monitor the time (10 minutes)
- Reporter to collate notes on the discussion
- Report the main points to the full room

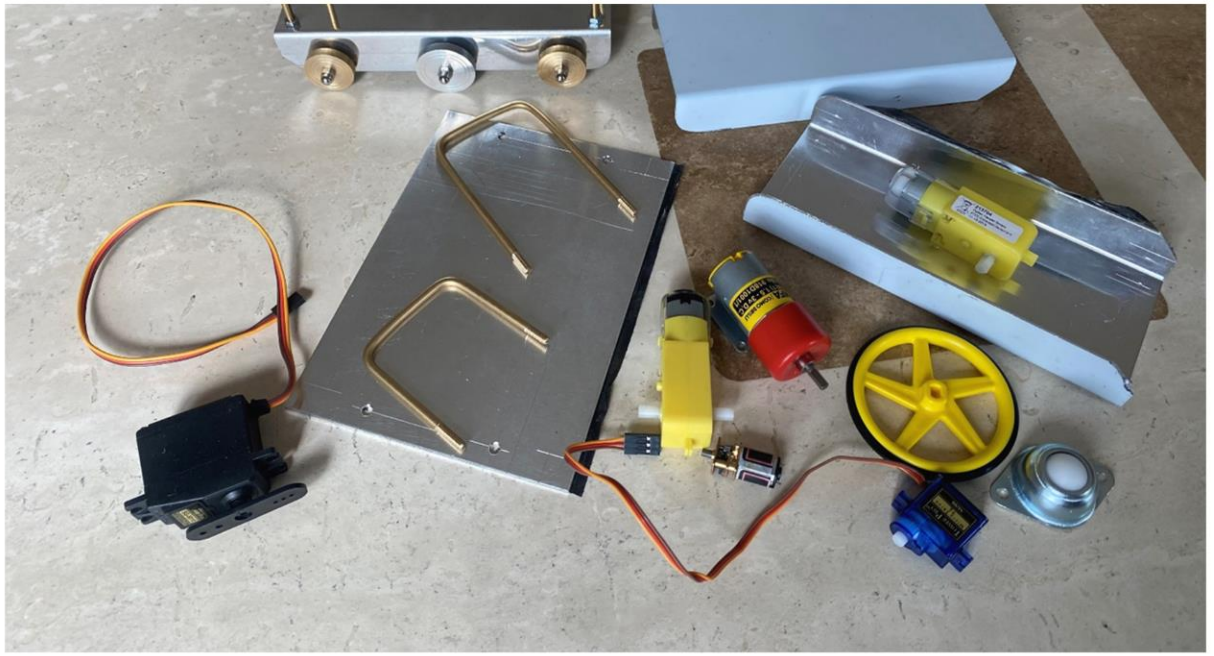
Feedback

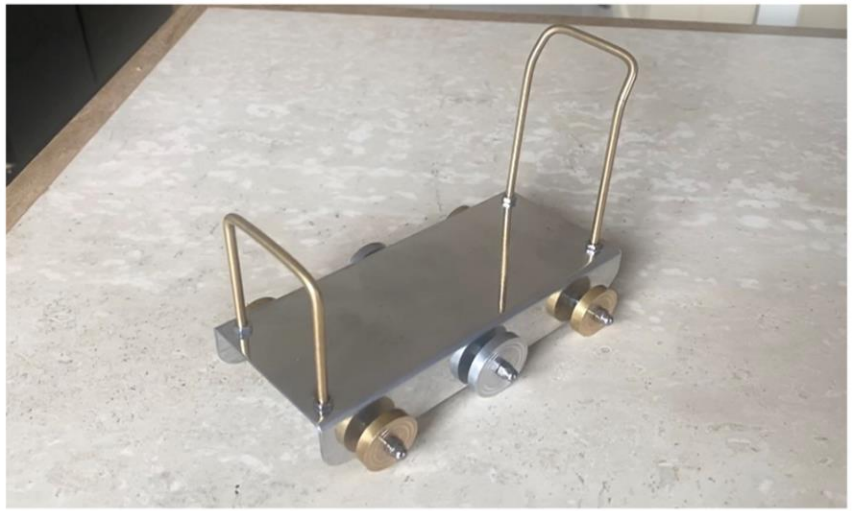
Currently how do your students experience mechanisms/motors in your Engineering Room?











Learner Experience

2nd Year Group

Resource: Student Context and Initial Research Sample videos

Oide Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí Supporting the Professional Learning of School Leaders and Teachers

Engineering – Research on Motors and Mechanisms Name: _____

Use this page to show your research about the topic.
You should explore a wide range of research and be creative in the way you present your findings.
Use additional pages if necessary.

Engineering – Project Logbook

You are the on-site engineer in a warehouse for a busy distribution company. The company are seeking to upgrade their existing fleet of manual warehouse carts, which are al

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strain on wo
They have t
incorporate:

- A mo
- A sim
  warel

Success Criteria for Research- My research should:

- Come from a variety of trusted sources
- Contain primary and secondary sources
- Be relevant to the task

Engineering – Project Logbook

You are the on-site engineer in a warehouse for a busy distribution company. The company are seeking to upgrade their existing fleet of manual warehouse carts, which are all similar to the traditional U boat cart design as shown below.

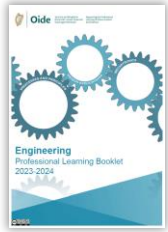
The company would like to add a drive system to the carts to reduce physical strain on workers and to allow for faster and easier transportation of heavy loads. They have tasked you, the engineer, with upgrading their existing carts to incorporate:

- A motorised drive system to reduce physical strain on the workers.
- A simple method of steering to navigate the aisles and obstacles in the warehouse.

my cart?

List examples of drive systems that are commonly used? How could I apply this to my cart?

Reflection Point: What am I being asked to do?



Pg.10

Oide Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí Supporting the Professional Learning of School Leaders and Teachers

Engineering – Research on Motors and Mechanisms

Name: _____

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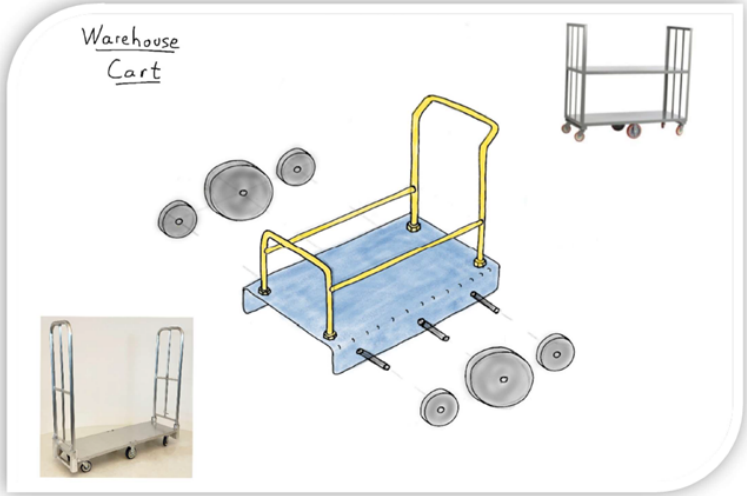


Reflection Point: What am I being asked to do?

_____

_____

Success Criteria for Research- My research should:

- Come from a variety of trusted sources
- Contain primary and secondary sources
- Be relevant to the task
- Have up-to-date information

Initial Research: Using a variety of sources, consider the following:

What is this cart used for?

_____

_____

How is this cart moved?

_____

_____

How does the user currently steer the cart?

_____

_____

_____

Further Research:

Give examples of steering systems that are commonly used? How could I apply this to my cart?

_____

_____

_____

_____

List examples of drive systems that are commonly used? How could I apply this to my cart?

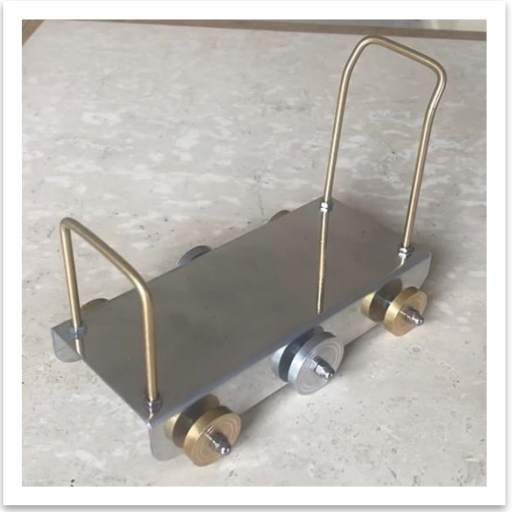
_____

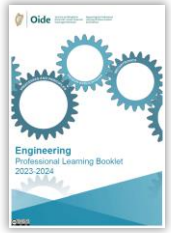
_____

_____

_____

_____





Pg. 10

For support on research and design, you can access 'My Design Guide,' here

Steering systems that might work:
Sketch ideas for steering systems you feel might suit the cart.

Drive systems that might work:
Sketch ideas for drive systems you feel might suit the cart.

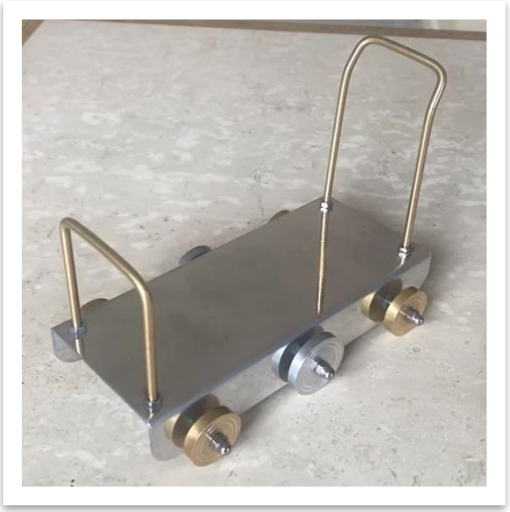
Success Criteria for Design- My design should:

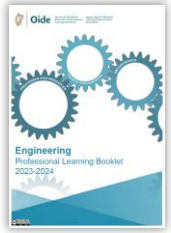
- Have a motor control to reduce physical strain when using the cart
- Incorporate a simple method to steer the cart
- Fit on the given cart chassis
- Sketches should be neat, rendered appropriately, and labelled

My Design: Sketch out your suggested design for the upgraded U boat cart below.

Looking back, what did I already know and think about this topic / problem / challenge that helped me?

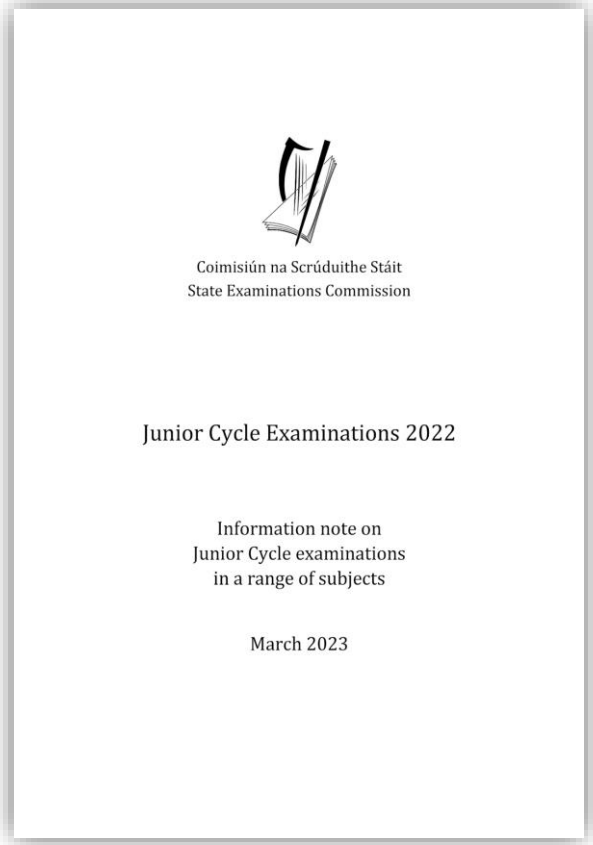
On reflection, have I created a solution that meets the needs of this project/brief? If so, how?
If not, why?





Pg. 11

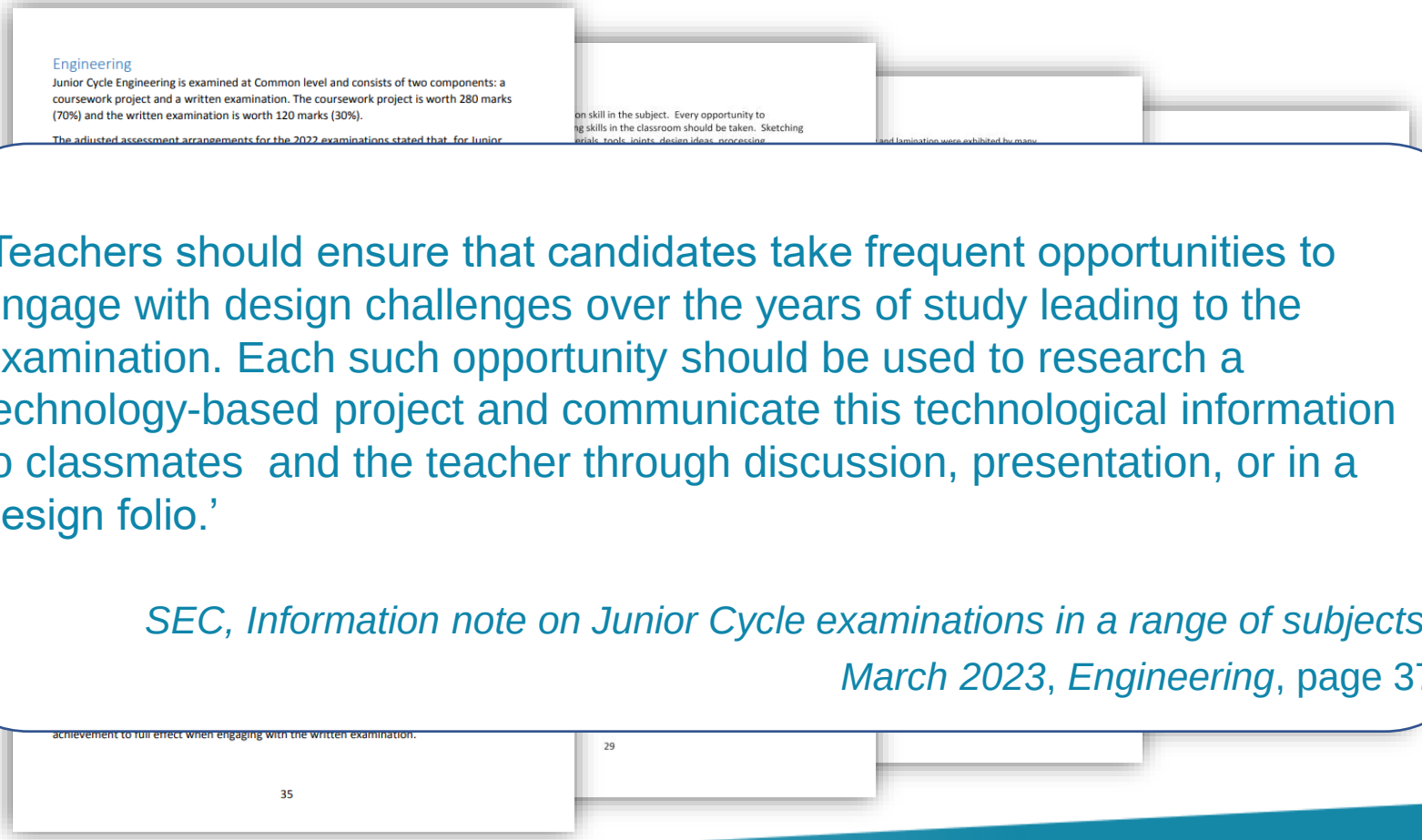
Information note on Junior Cycle examinations in a range of subjects, March 2023, S.E.C.


Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Examinations 2022

Information note on
Junior Cycle examinations
in a range of subjects

March 2023


Engineering

Junior Cycle Engineering is examined at Common level and consists of two components: a coursework project and a written examination. The coursework project is worth 280 marks (70%) and the written examination is worth 120 marks (30%).

The adjusted assessment arrangements for the 2022 examinations stated that, for Junior

achievement to full effect when engaging with the written examination.

35

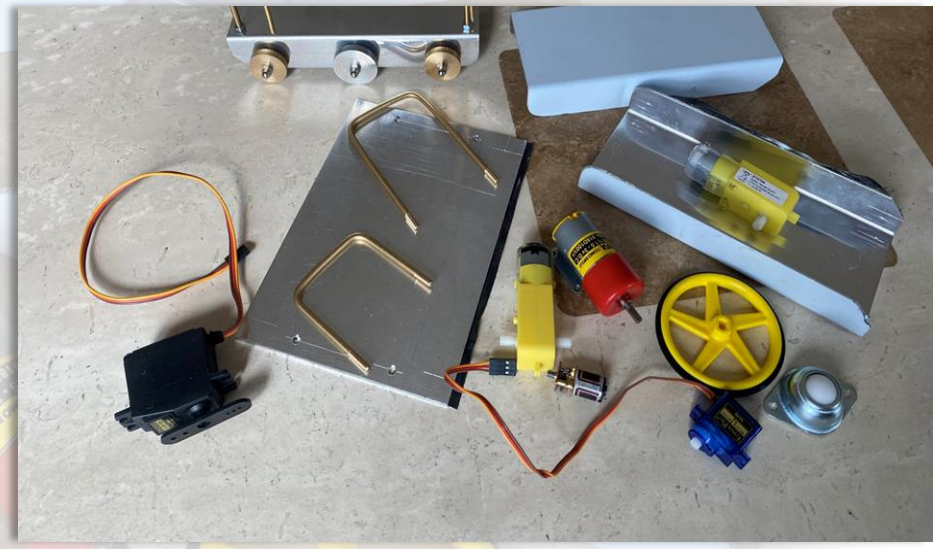
29

‘Teachers should ensure that candidates take frequent opportunities to engage with design challenges over the years of study leading to the examination. Each such opportunity should be used to research a technology-based project and communicate this technological information to classmates and the teacher through discussion, presentation, or in a design folio.’

SEC, Information note on Junior Cycle examinations in a range of subjects, March 2023, *Engineering*, page 37

https://www.examinations.ie/misc-doc/EN-AR-19213727.pdf

Engineering Challenge



Using the cart design shown, design a drive system for the cart using any components or form of applied control to make the cart move

Challenge elements:

- A motorised drive system to reduce physical strain on the workers
- A simple method of steering to navigate in the aisles and obstacles in the warehouse

Breakout Room

Discuss and share your initial design ideas in the group

Choose your preferred solution as a group

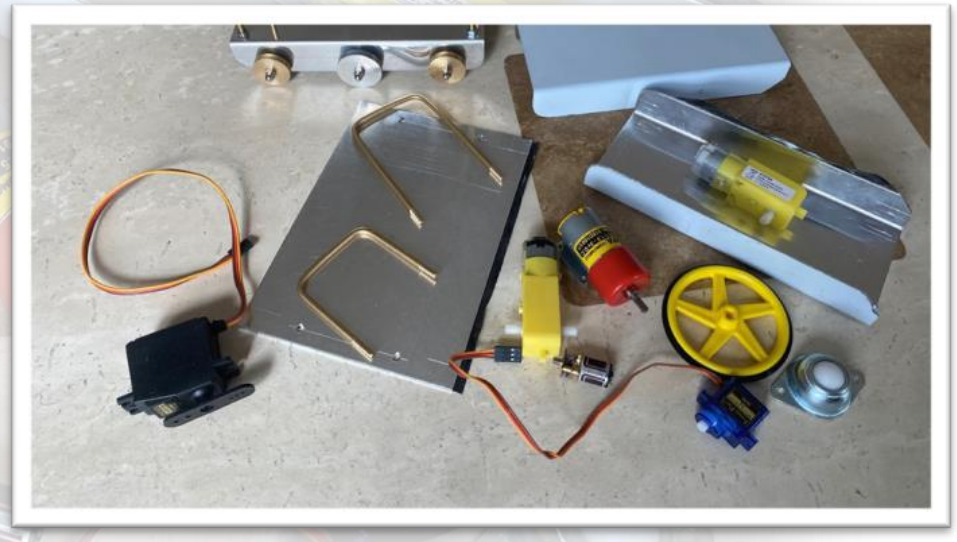
10 minutes

Based on your conversation refine your design/system

Justify your group decisions along the design process

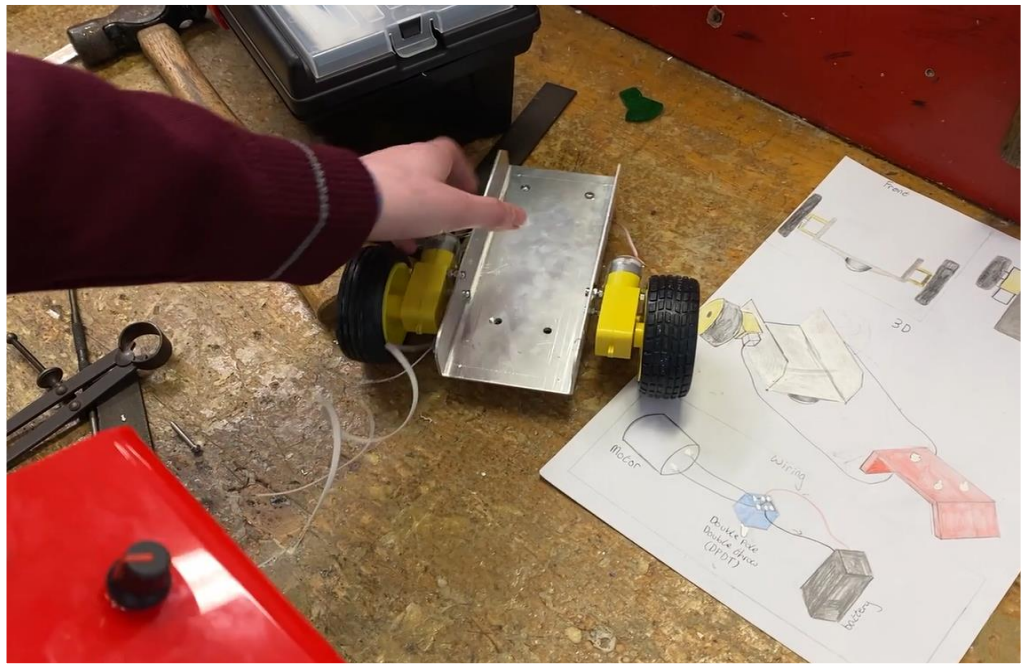
Feedback

Each group to outline your chosen solution



Learner Experience

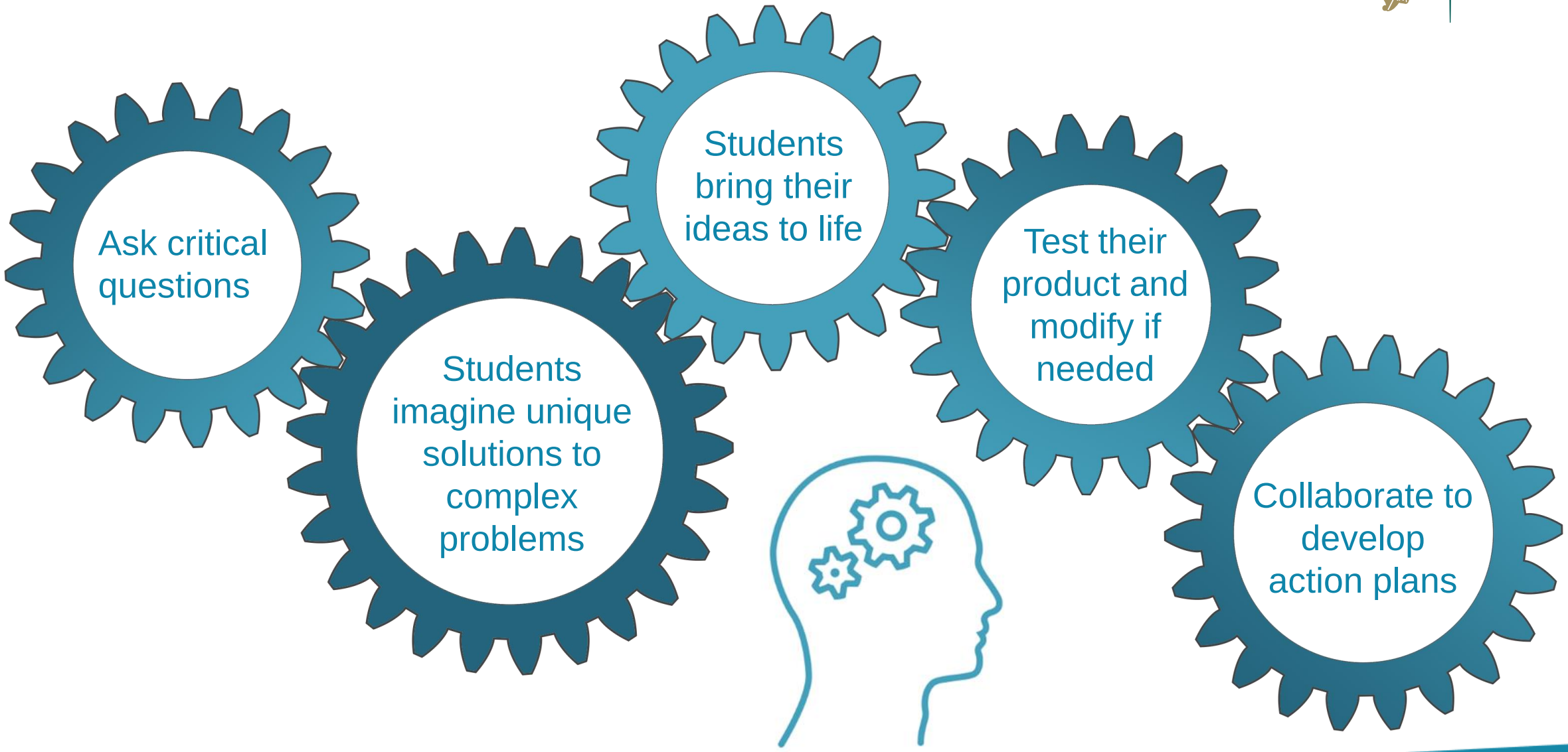
2nd Year Group,
St. Declan's Community College



How are the students behaving as engineers in this learning experience?

Behaving as Engineers

Oide



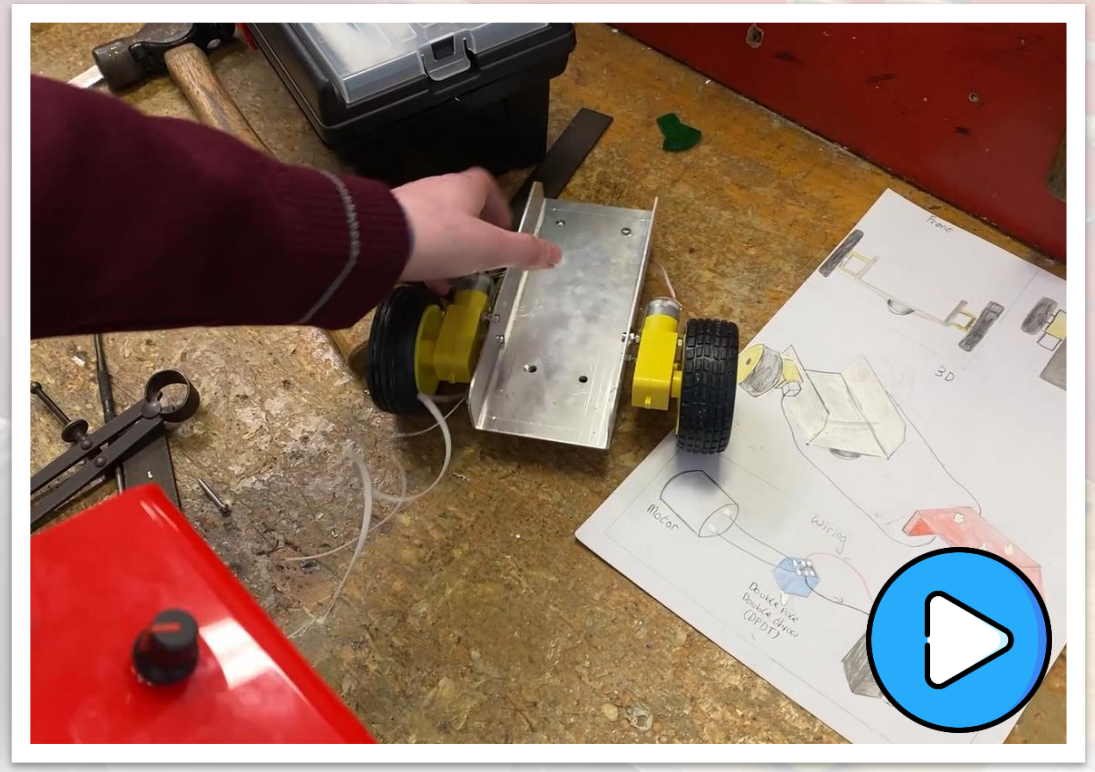
https://www.engineeringpassion.com/developing-the-engineering-mindset/
https://raeng.org.uk/media/brjjknt3/thinking-like-an-engineer-full-report.pdf

Learner Experience

2nd Year Group,
St. Declan's Community College

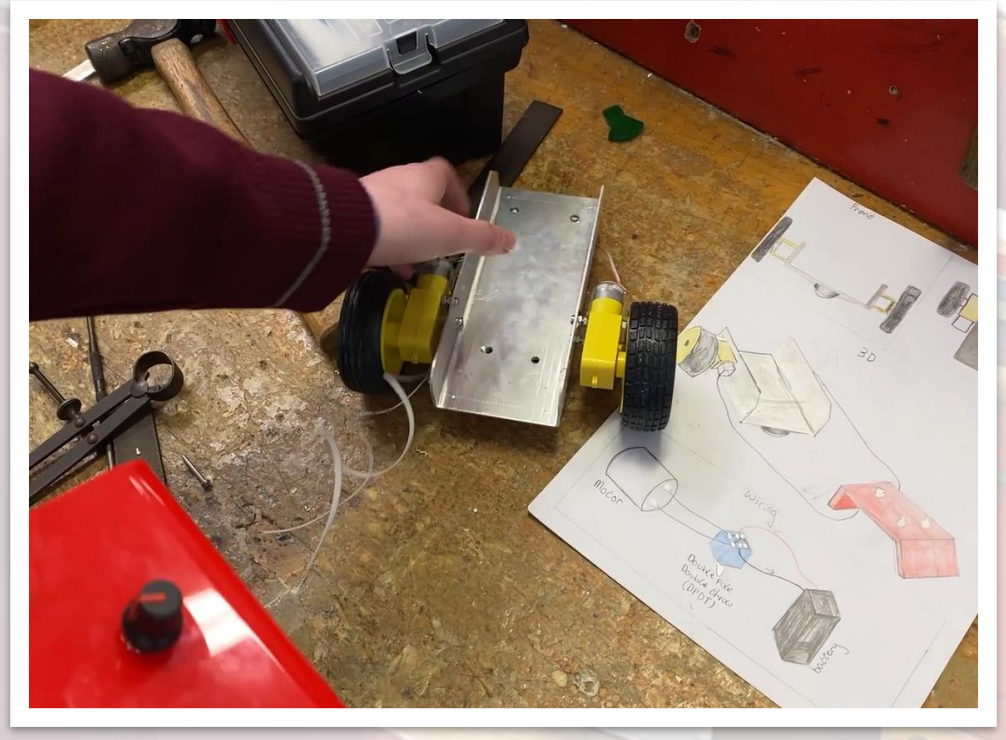
Project: Warehouse Cart

Task: Steering and Drive System



Learner Experience

2nd Year Group,
St. Declan's Community College

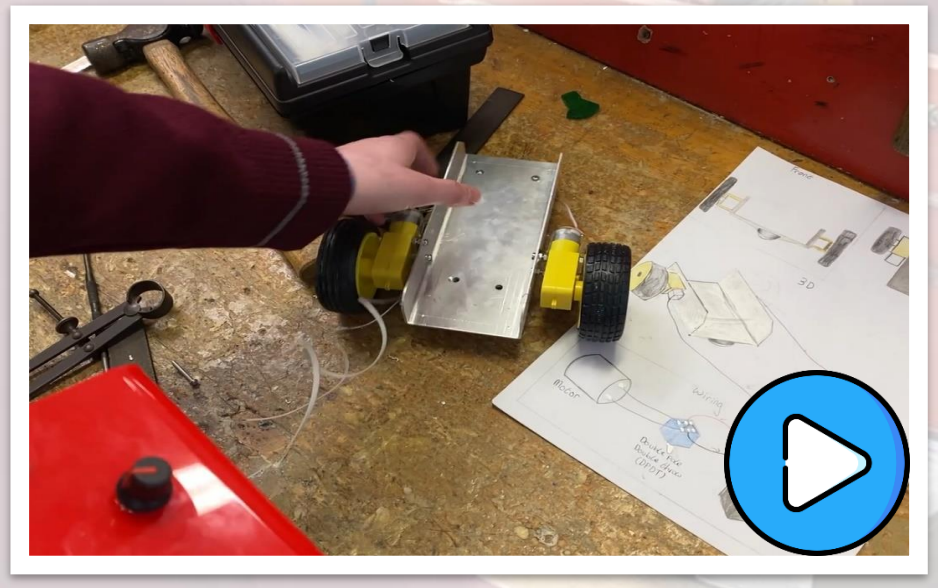


How are the students behaving as an engineers in this learning experience?

Teacher Experience

2nd Year Group,
St. Declan's Community College

Discussing the approach, strategies, engagement and student learning through the cart activities



Where and how is an integrated approach to teaching and learning evident in this video?

Where was an integrated approach to teaching and learning evident in this unit of learning?

1.5 **research** applications of existing and emerging technological developments

1.7 **develop** engineered solutions to various challenges

2.6 **Use** relevant information to enhance design and function

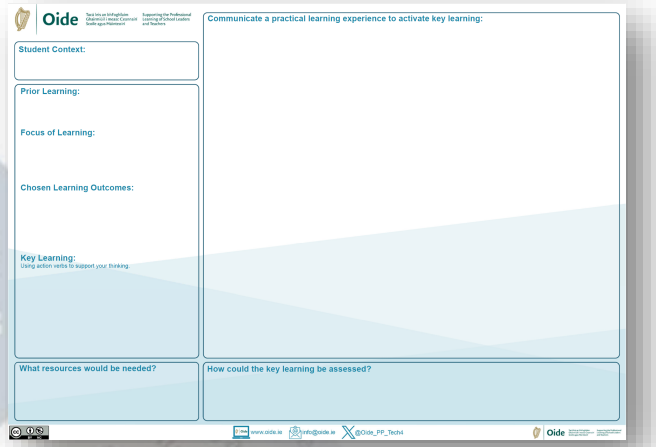
3.4 **explore** the application of systems in an engineering setting such as the classroom, home, and industry

Accuracy in marking out processes
Precision in a range of manufacturing processes
High quality finish to ensure smooth operation of the system
System assembled accurately to obtain efficient function

Research components
Evaluate materials, assembly, etc.
Communicate designs through suitable media
Prototype the mechanism/system

Explain the operation of the mechanical system
Choose a suitable motor and mounting of such
Configure, wire, and test the system
Incorporate the mechatronic system into a project
Use ‘systems thinking’ to achieve the desired output

Putting a Plan in Place



The Learners:

- Age and stage of learning
- Context of the class group
- What they have learned previously
- What are their interests and strengths
- Areas where they need support with

Planning:

Reflect

5 minutes

Putting a Plan in Place

Oide

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí

Supporting the Professional Learning of School Leaders and Teachers

Student Context:

Prior Learning:

Focus of Learning:

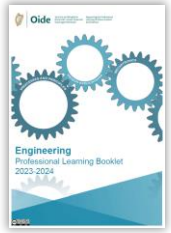
Chosen Learning Outcomes:

Key Learning:
Using action verbs to support your thinking.

Communicate a practical learning experience to activate key learning:

What resources would be needed?

How could the key learning be assessed?



Pg. 13

Putting a plan in place

Identify the focus of the student learning:

Electronics

Marking Out

Assembly

Coding

Material Properties

Forces & Motion

Mechanisms

Mechatronics

Communication

Interpreting a Drawing

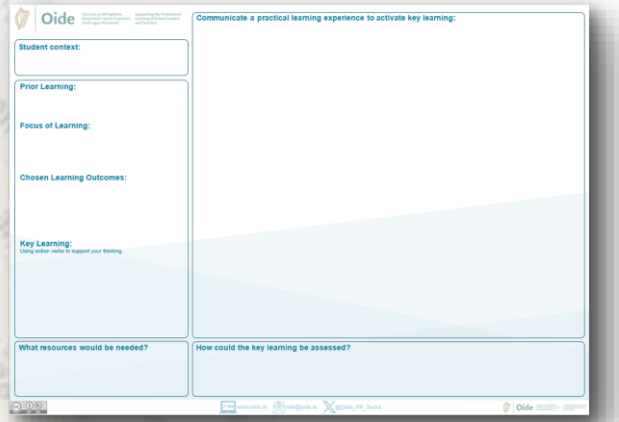
Health and Safety

Soldering

Design

Machine Tools

Bench Skills

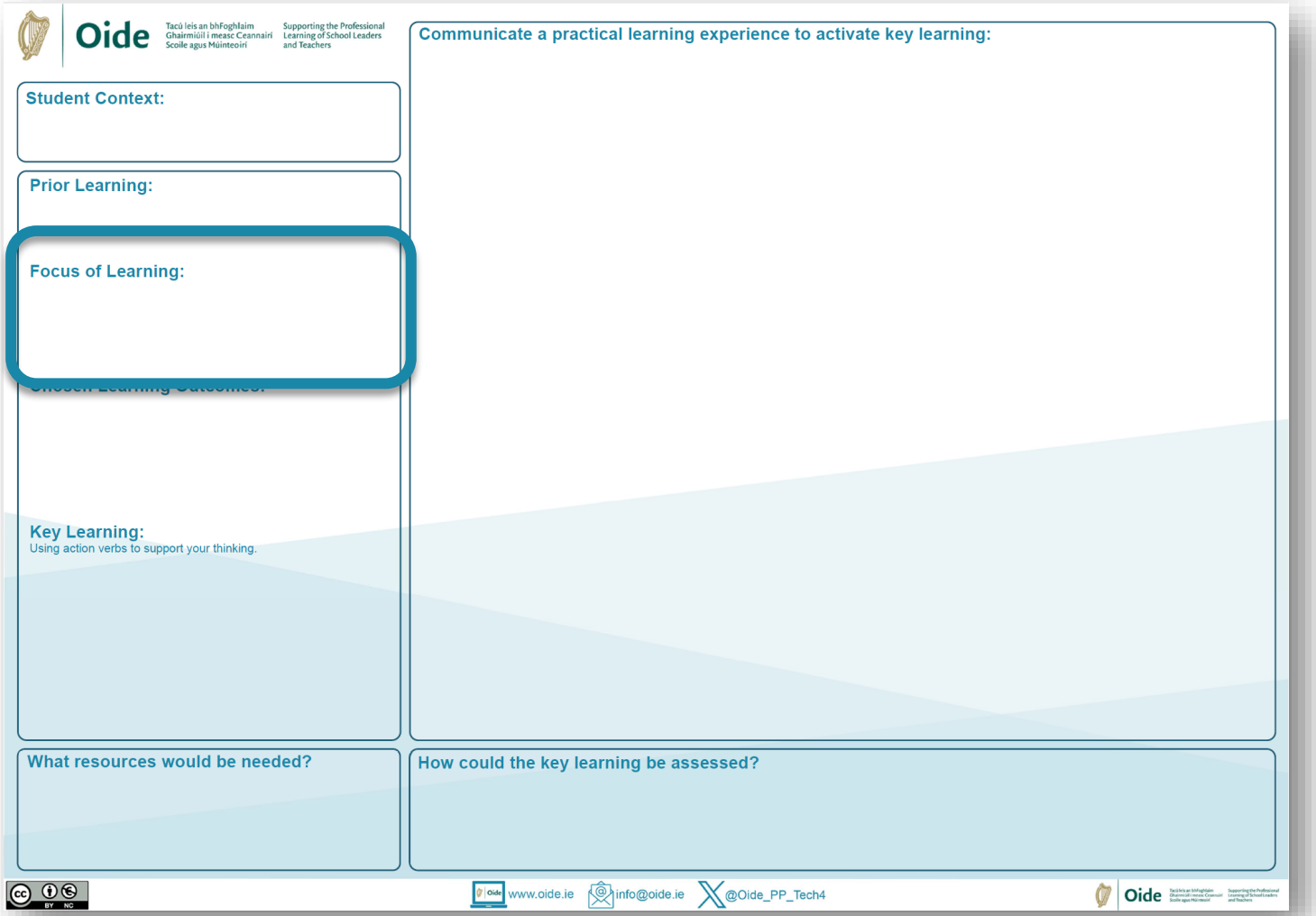


Planning:

Reflect

5 minutes

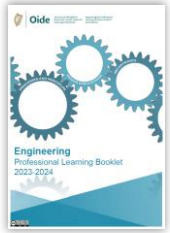
Putting a Plan in Place



Planning:

Reflect

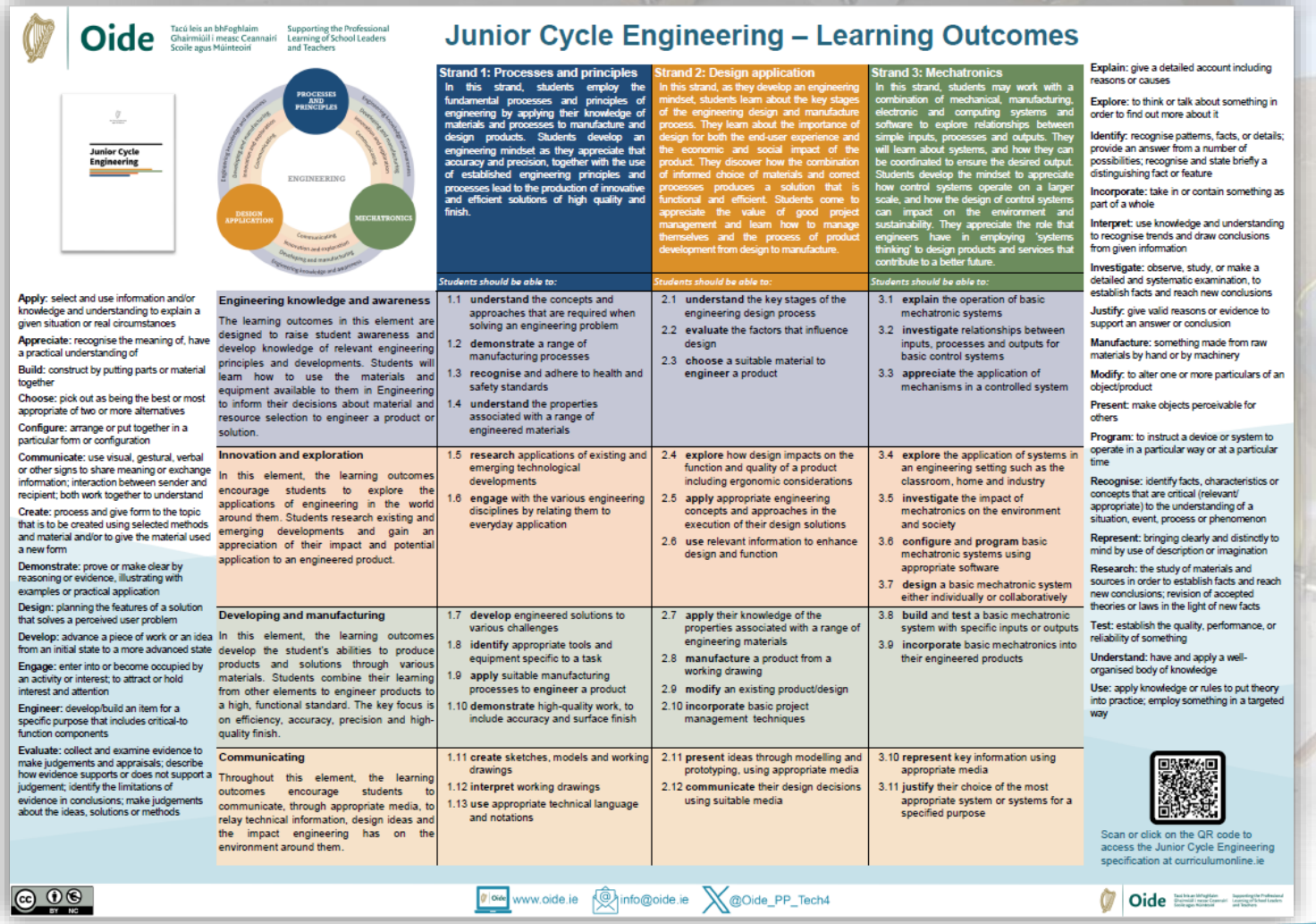
8 minutes



Pg. 13

Putting a Plan in Place

Consider the Learning outcomes from across the strands and elements and select the ones you wish to include in this unit of learning



Oide Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí — Supporting the Professional Learning of School Leaders and Teachers

Junior Cycle Engineering – Learning Outcomes

Strand 1: Processes and principles
In this strand, students employ the fundamental processes and principles of engineering by applying their knowledge of materials and processes to manufacture and design products. Students develop an engineering mindset as they appreciate that accuracy and precision, together with the use of established engineering principles and processes lead to the production of innovative and efficient solutions of high quality and finish.

Strand 2: Design application
In this strand, as they develop an engineering mindset, students learn about the key stages of the engineering design and manufacture process. They learn about the importance of design for both the end-user experience and the economic and social impact of the product. They discover how the combination of informed choice of materials and correct processes produces a solution that is functional and efficient. Students come to appreciate the value of good project management and learn how to manage themselves and the process of product development from design to manufacture.

Strand 3: Mechatronics
In this strand, students may work with a combination of mechanical, manufacturing, electronic and computing systems and software to explore relationships between simple inputs, processes and outputs. They will learn about systems, and how they can be coordinated to ensure the desired output. Students develop the mindset to appreciate how control systems operate on a larger scale, and how the design of control systems can impact on the environment and sustainability. They appreciate the role that engineers have in employing 'systems thinking' to design products and services that contribute to a better future.

Apply: select and use information and/or knowledge and understanding to explain a given situation or real circumstances
Appreciate: recognise the meaning of, have a practical understanding of
Build: construct by putting parts or material together
Choose: pick out as being the best or most appropriate of two or more alternatives
Configure: arrange or put together in a particular form or configuration
Communicate: use visual, gestural, verbal or other signs to share meaning or exchange information; interaction between sender and recipient; both work together to understand
Create: process and give form to the topic that is to be created using selected methods and material and/or to give the material used a new form
Demonstrate: prove or make clear by reasoning or evidence, illustrating with examples or practical application
Design: planning the features of a solution that solves a perceived user problem
Develop: advance a piece of work or an idea from an initial state to a more advanced state
Engage: enter into or become occupied by an activity or interest; to attract or hold interest and attention
Engineer: develop/build an item for a specific purpose that includes critical-to function components
Evaluate: collect and examine evidence to make judgements and appraisals; describe how evidence supports or does not support a judgement; identify the limitations of evidence in conclusions; make judgements about the ideas, solutions or methods

	Students should be able to:	Students should be able to:	Students should be able to:
Engineering knowledge and awareness The learning outcomes in this element are designed to raise student awareness and develop knowledge of relevant engineering principles and developments. Students will learn how to use the materials and equipment available to them in Engineering to inform their decisions about material and resource selection to engineer a product or solution.	1.1 **understand** the concepts and approaches that are required when solving an engineering problem 1.2 **demonstrate** a range of manufacturing processes 1.3 **recognise** and adhere to health and safety standards 1.4 **understand** the properties associated with a range of engineered materials	2.1 **understand** the key stages of the engineering design process 2.2 **evaluate** the factors that influence design 2.3 **choose** a suitable material to **engineer** a product	3.1 **explain** the operation of basic mechatronic systems 3.2 **investigate** relationships between inputs, processes and outputs for basic control systems 3.3 **appreciate** the application of mechanisms in a controlled system
Innovation and exploration In this element, the learning outcomes encourage students to explore the applications of engineering in the world around them. Students research existing and emerging developments and gain an appreciation of their impact and potential application to an engineered product.	1.5 **research** applications of existing and emerging technological developments 1.6 **engage** with the various engineering disciplines by relating them to everyday application	2.4 **explore** how design impacts on the function and quality of a product including ergonomic considerations 2.5 **apply** appropriate engineering concepts and approaches in the execution of their design solutions 2.6 **use** relevant information to enhance design and function	3.4 **explore** the application of systems in an engineering setting such as the classroom, home and industry 3.5 **investigate** the impact of mechatronics on the environment and society 3.6 **configure** and **program** basic mechatronic systems using appropriate software 3.7 **design** a basic mechatronic system either individually or collaboratively
Developing and manufacturing In this element, the learning outcomes develop the student's abilities to produce products and solutions through various materials. Students combine their learning from other elements to engineer products to a high, functional standard. The key focus is on efficiency, accuracy, precision and high-quality finish.	1.7 **develop** engineered solutions to various challenges 1.8 **identify** appropriate tools and equipment specific to a task 1.9 **apply** suitable manufacturing processes to **engineer** a product 1.10 **demonstrate** high-quality work, to include accuracy and surface finish	2.7 **apply** their knowledge of the properties associated with a range of engineering materials 2.8 **manufacture** a product from a working drawing 2.9 **modify** an existing product/design 2.10 **incorporate** basic project management techniques	3.8 **build** and **test** a basic mechatronic system with specific inputs or outputs 3.9 **incorporate** basic mechatronics into their engineered products
Communicating Throughout this element, the learning outcomes encourage students to communicate, through appropriate media, to relay technical information, design ideas and the impact engineering has on the environment around them.	1.11 **create** sketches, models and working drawings 1.12 **interpret** working drawings 1.13 **use** appropriate technical language and notations	2.11 **present** ideas through modelling and prototyping, using appropriate media 2.12 **communicate** their design decisions using suitable media	3.10 **represent** key information using appropriate media 3.11 **justify** their choice of the most appropriate system or systems for a specified purpose

Explain: give a detailed account including reasons or causes
Explore: to think or talk about something in order to find out more about it
Identify: recognise patterns, facts, or details; provide an answer from a number of possibilities; recognise and state briefly a distinguishing fact or feature
Incorporate: take in or contain something as part of a whole
Interpret: use knowledge and understanding to recognise trends and draw conclusions from given information
Investigate: observe, study, or make a detailed and systematic examination, to establish facts and reach new conclusions
Justify: give valid reasons or evidence to support an answer or conclusion
Manufacture: something made from raw materials by hand or by machinery
Modify: to alter one or more particulars of an object/product
Present: make objects perceivable for others
Program: to instruct a device or system to operate in a particular way or at a particular time
Recognise: identify facts, characteristics or concepts that are critical (relevant/appropriate) to the understanding of a situation, event, process or phenomenon
Represent: bringing clearly and distinctly to mind by use of description or imagination
Research: the study of materials and sources in order to establish facts and reach new conclusions; revision of accepted theories or laws in the light of new facts
Test: establish the quality, performance, or reliability of something
Understand: have and apply a well-organised body of knowledge
Use: apply knowledge or rules to put theory into practice; employ something in a targeted way

Scan or click on the QR code to access the Junior Cycle Engineering specification at curriculumonline.ie

www.oide.ie info@oide.ie @Oide_PP_Tech4

'Engineering uses an interdisciplinary approach which encourages the integration of the three strands in the teaching and learning of the subject'

Engineering specification, Overview: Course, page 9.

Putting a Plan in Place

Oide

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí

Supporting the Professional Learning of School Leaders and Teachers

Student Context:

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Focus of Learning:

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Communicate a practical learning experience to activate key learning:

What resources would be needed?

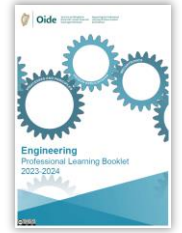
How could the key learning be assessed?

Oide

Planning:

Reflect

15 minutes



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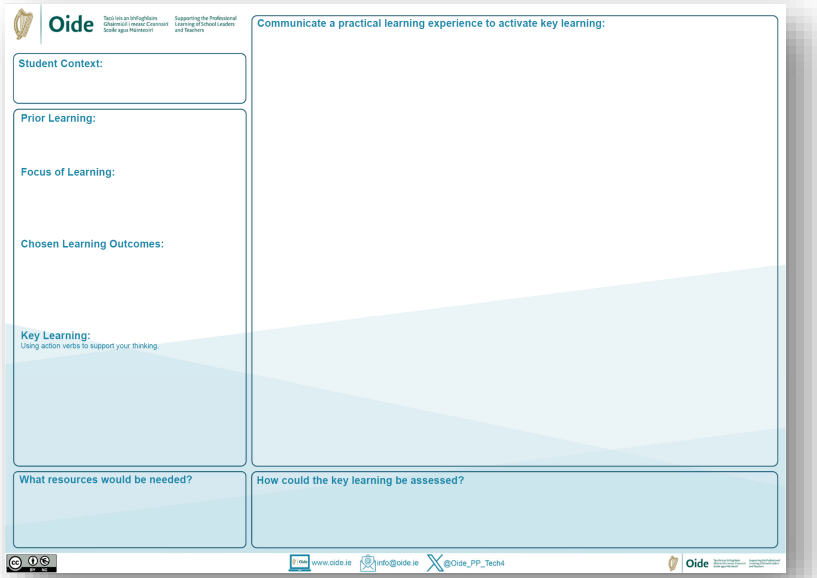
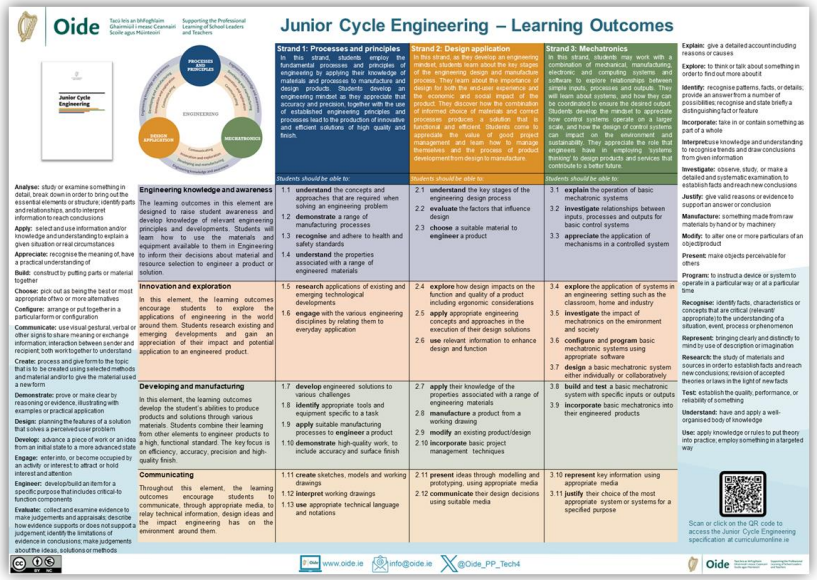
Reflection Point

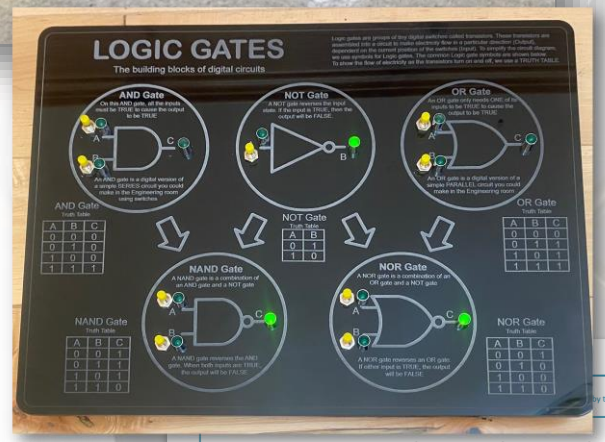
How did you find this process?

What will be your next steps when you return to school?

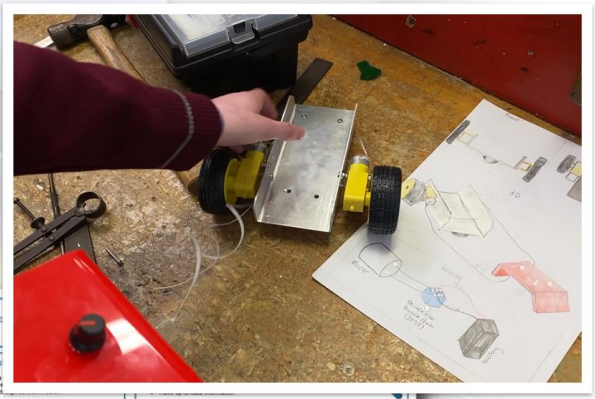


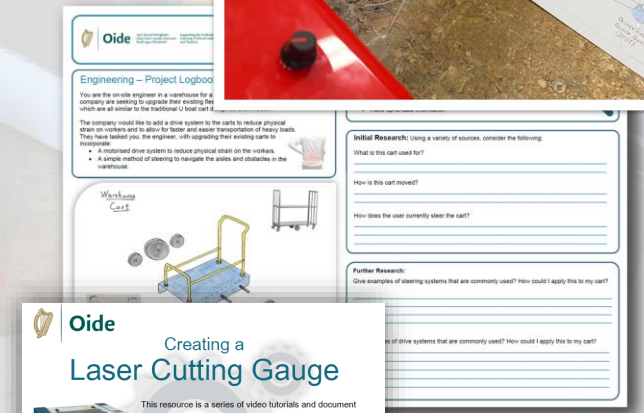


Resources



Click or scan the QR code to access the resources from today's session

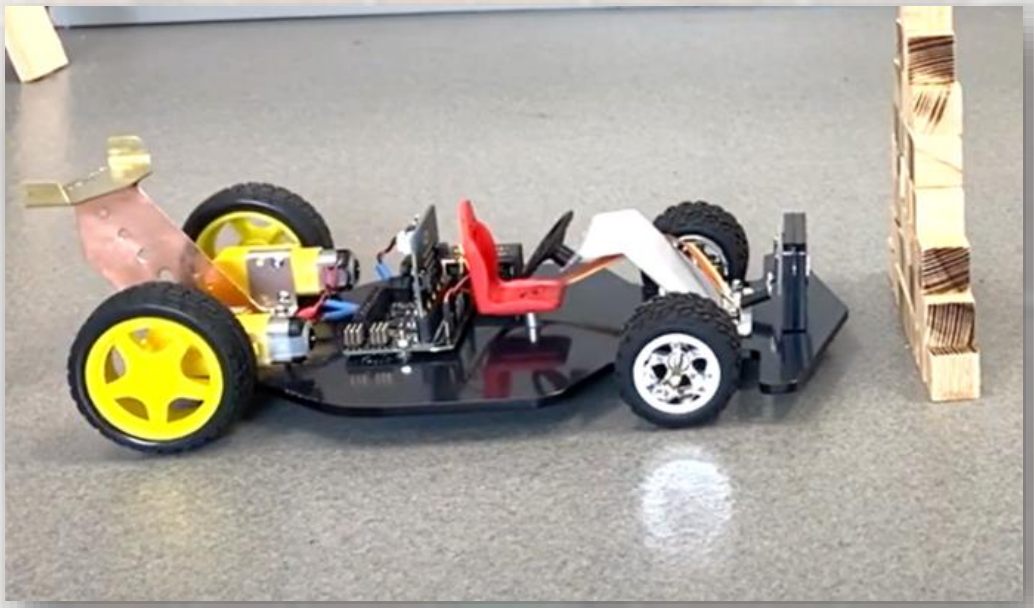


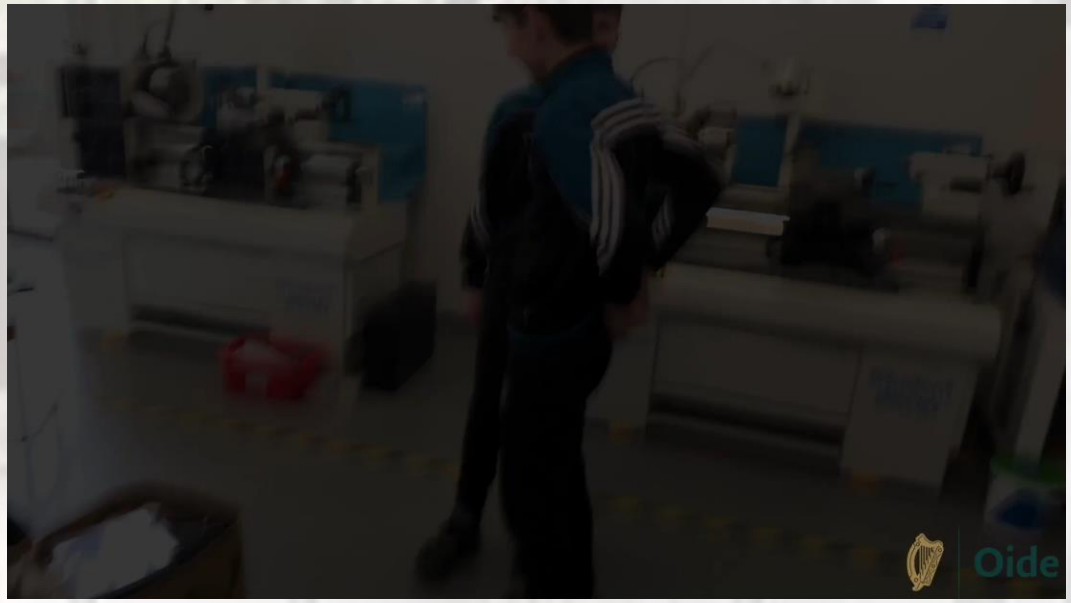


In this session - we will…

Appreciate the role that logic gates play in everyday engineering and other applications

Logic Gates



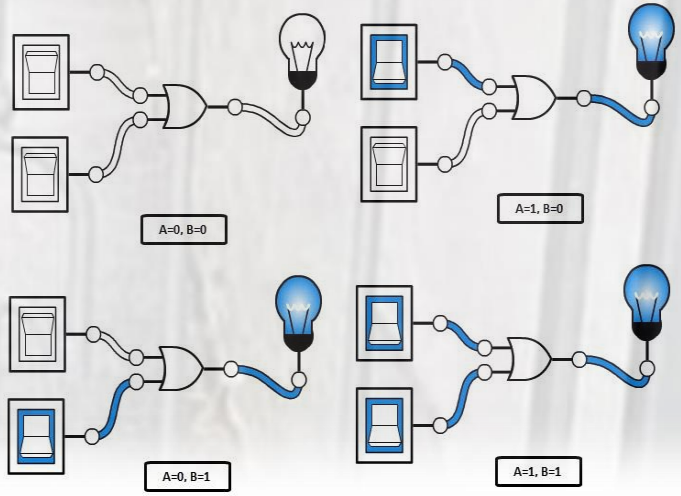


How could the car make the decision?

Logic gates are used to construct logical circuits that give electronics the ability to ‘make decisions’

What are logic gates?

- A logic gate is a device that acts as a building block for digital circuits
- They perform basic logical functions that are fundamental to digital circuits
- In a circuit, logic gates will make decisions based on a combination of digital signals coming from its inputs
- Most logic gates have two inputs and one output



Reference: Whatis.com

Reflection Point

Oide

How do your students currently experience the concept of logic gates in your classroom?

Reflect:

3 minutes

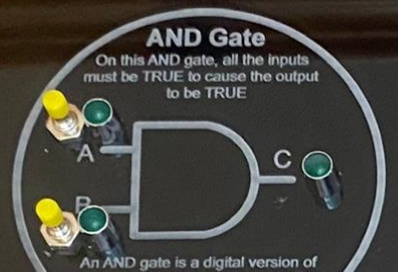
LOGIC GATES

The building blocks of digital circuits

Logic gates are groups of tiny digital switches called transistors. These transistors are assembled into a circuit to make electricity flow in a particular direction (Output), dependent on the current position of the switches (Input). To simplify the circuit diagram, we use symbols for Logic gates. The common Logic gate symbols are shown below. To show the flow of electricity as the transistors turn on and off, we use a TRUTH TABLE.

AND Gate

On this AND gate, all the inputs must be TRUE to cause the output to be TRUE



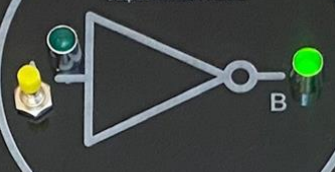
An AND gate is a digital version of a simple SERIES circuit you could make in the Engineering room using switches

AND Gate
Truth Table

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

NOT Gate

A NOT gate reverses the input state. If the input is TRUE, then the output will be FALSE.

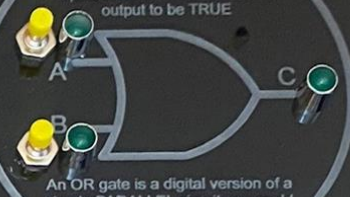


NOT Gate
Truth Table

A	B
0	1
1	0

OR Gate

An OR gate only needs ONE of its inputs to be TRUE to cause the output to be TRUE



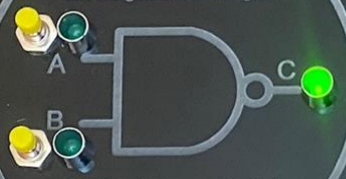
An OR gate is a digital version of a simple PARALLEL circuit you could make in the Engineering room

OR Gate
Truth Table

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

NAND Gate

A NAND gate is a combination of an AND gate and a NOT gate



A NAND gate reverses the AND gate. When both inputs are TRUE, the output will be FALSE

NAND Gate
Truth Table

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

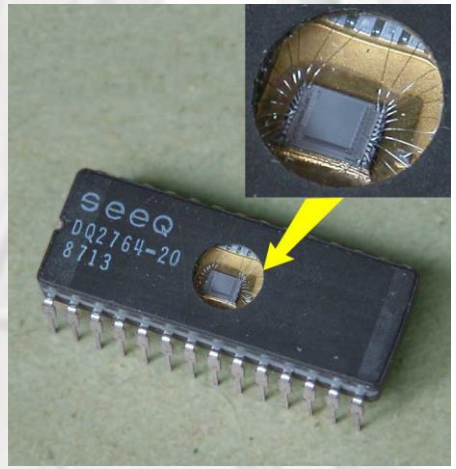
NOR Gate

A NOR gate is a combination of an OR gate and a NOT gate

A NOR gate reverses an OR gate. If either input is TRUE, the output will be FALSE

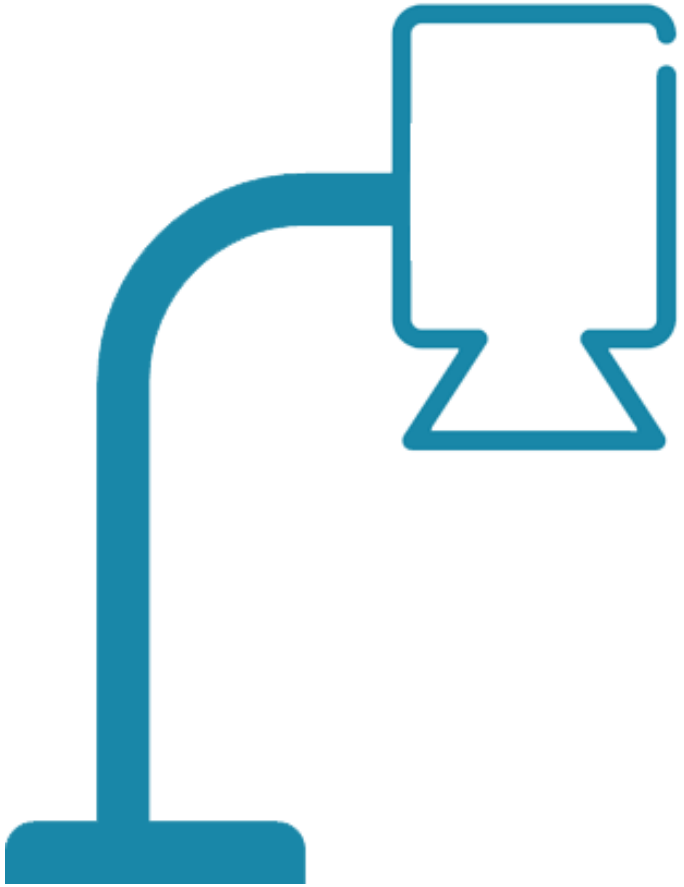
NOR Gate
Truth Table

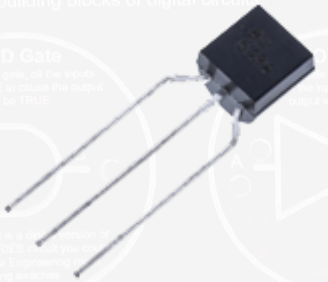
A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

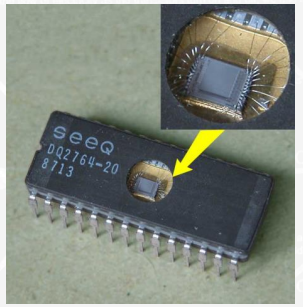


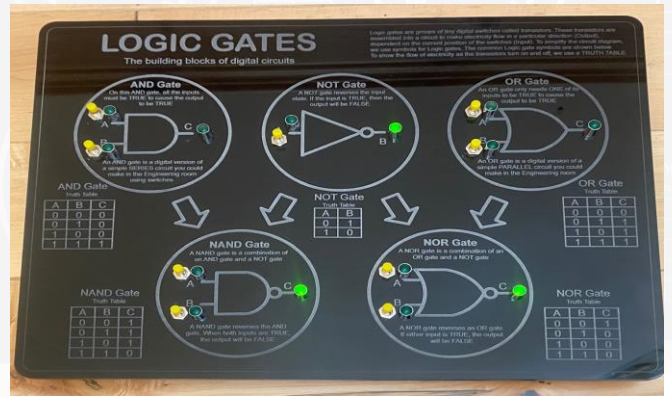
Visualiser Activity

Switches, transistors and logic gates

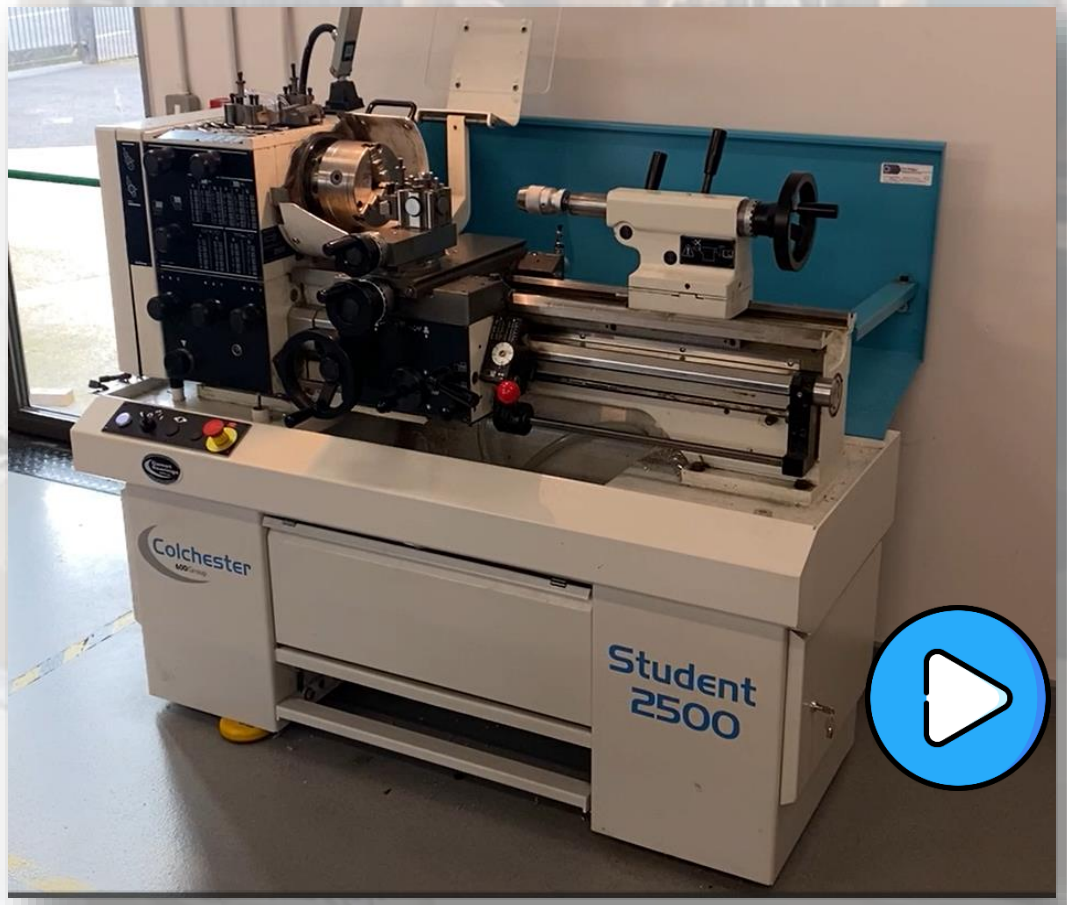




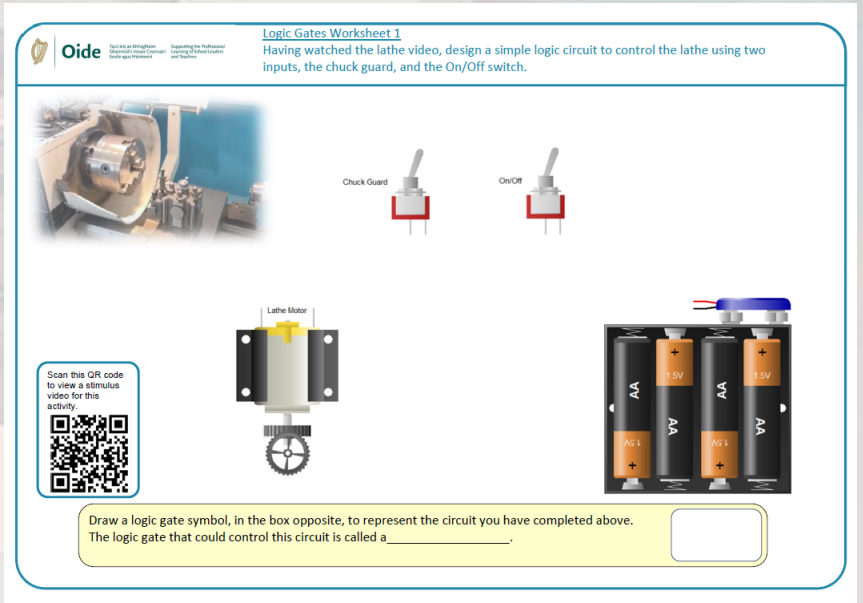


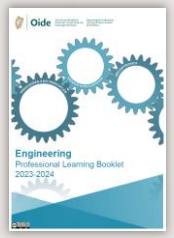


Learner Experience: Logic Gates in the Engineering Room



Logic Gate Activity One: Circuit Design





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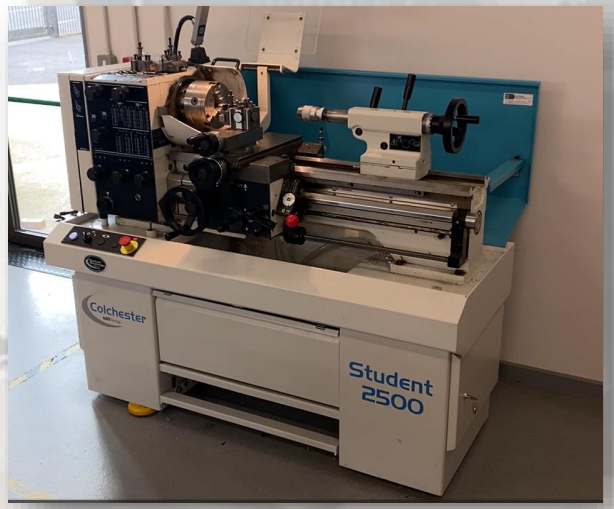
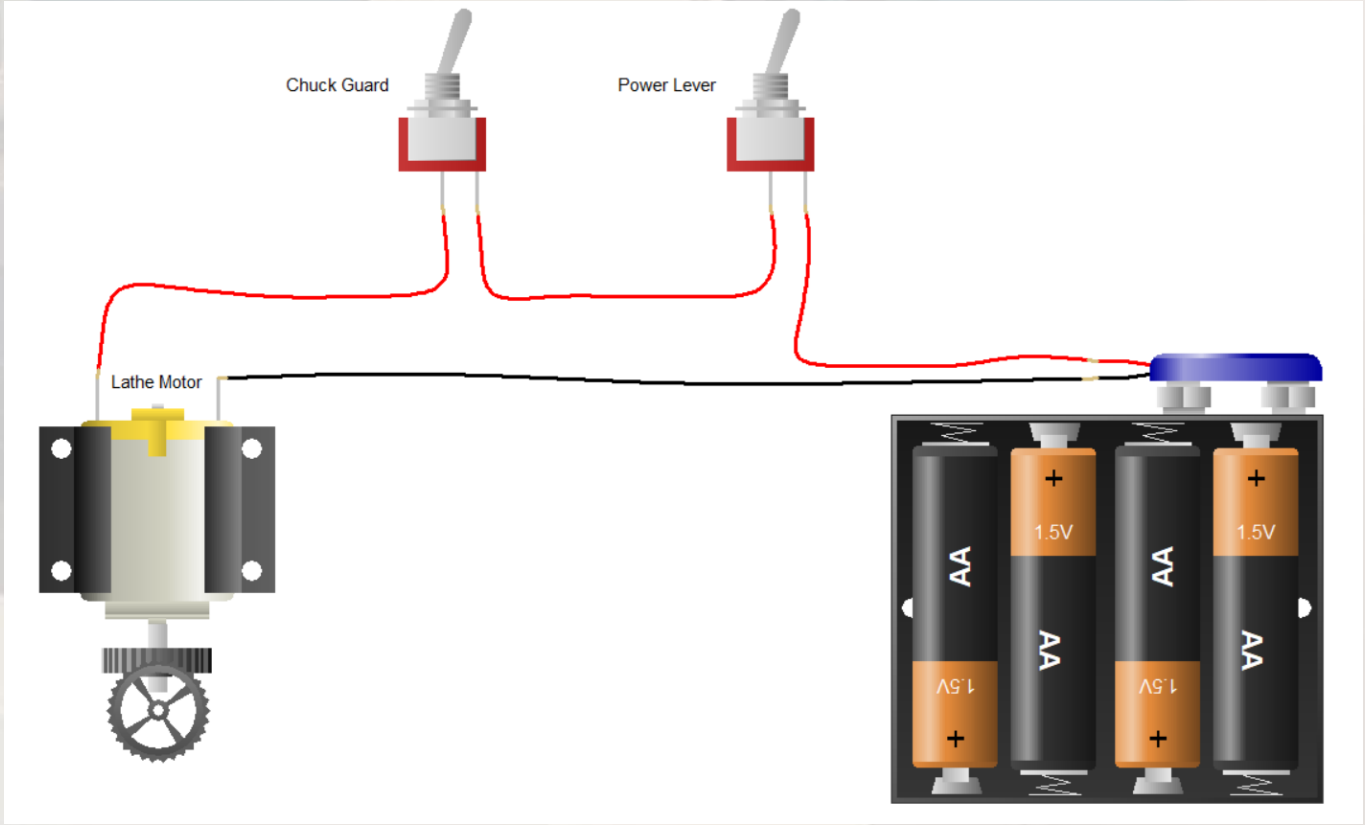
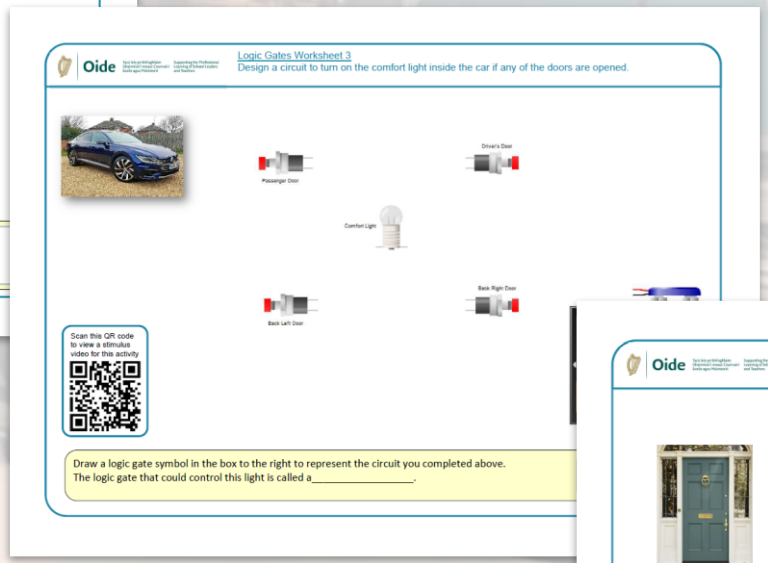
Logic Gates in the Engineering Room

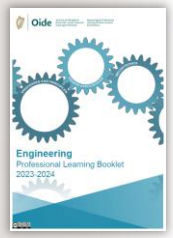




Potential “AND” logic gate to control the lathe

Other potential learning experiences





Pg. 15-16

Logic Gates

How could you use this resource to further support student learning in the area of logic gates in your Engineering room?

Group Discussion

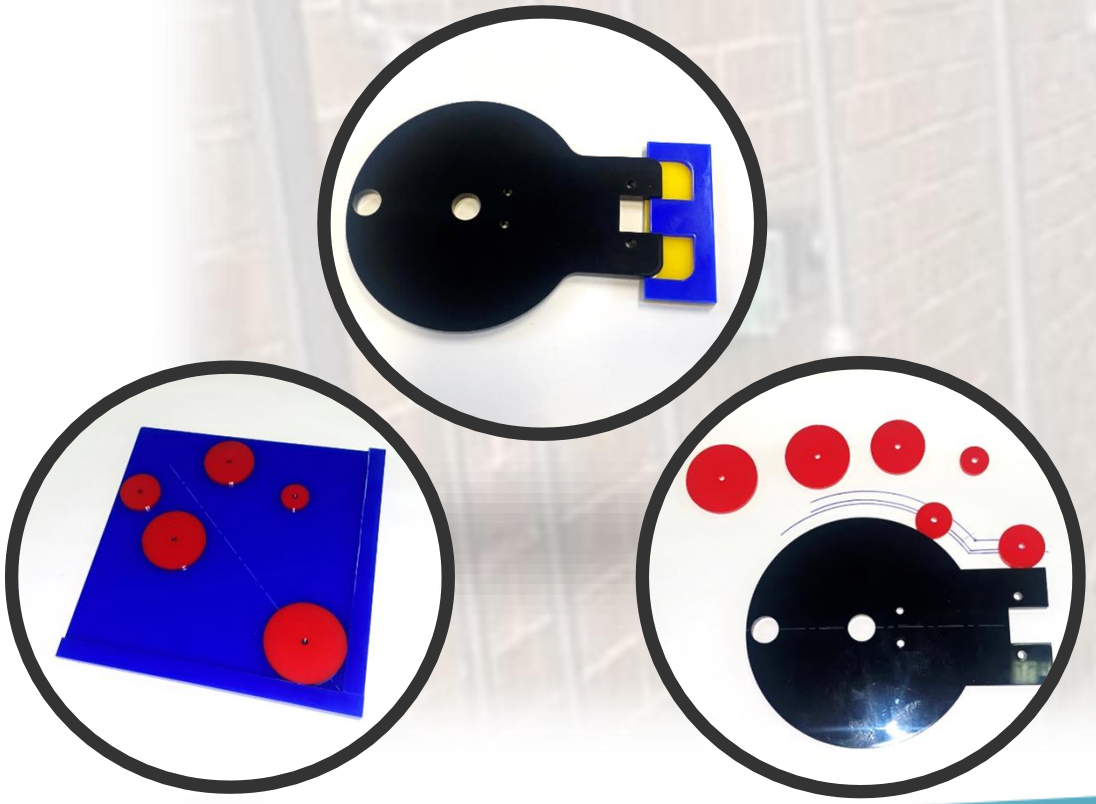
5 minutes

Using the Laser Cutter to Create Teaching and Learning Resources

Oide

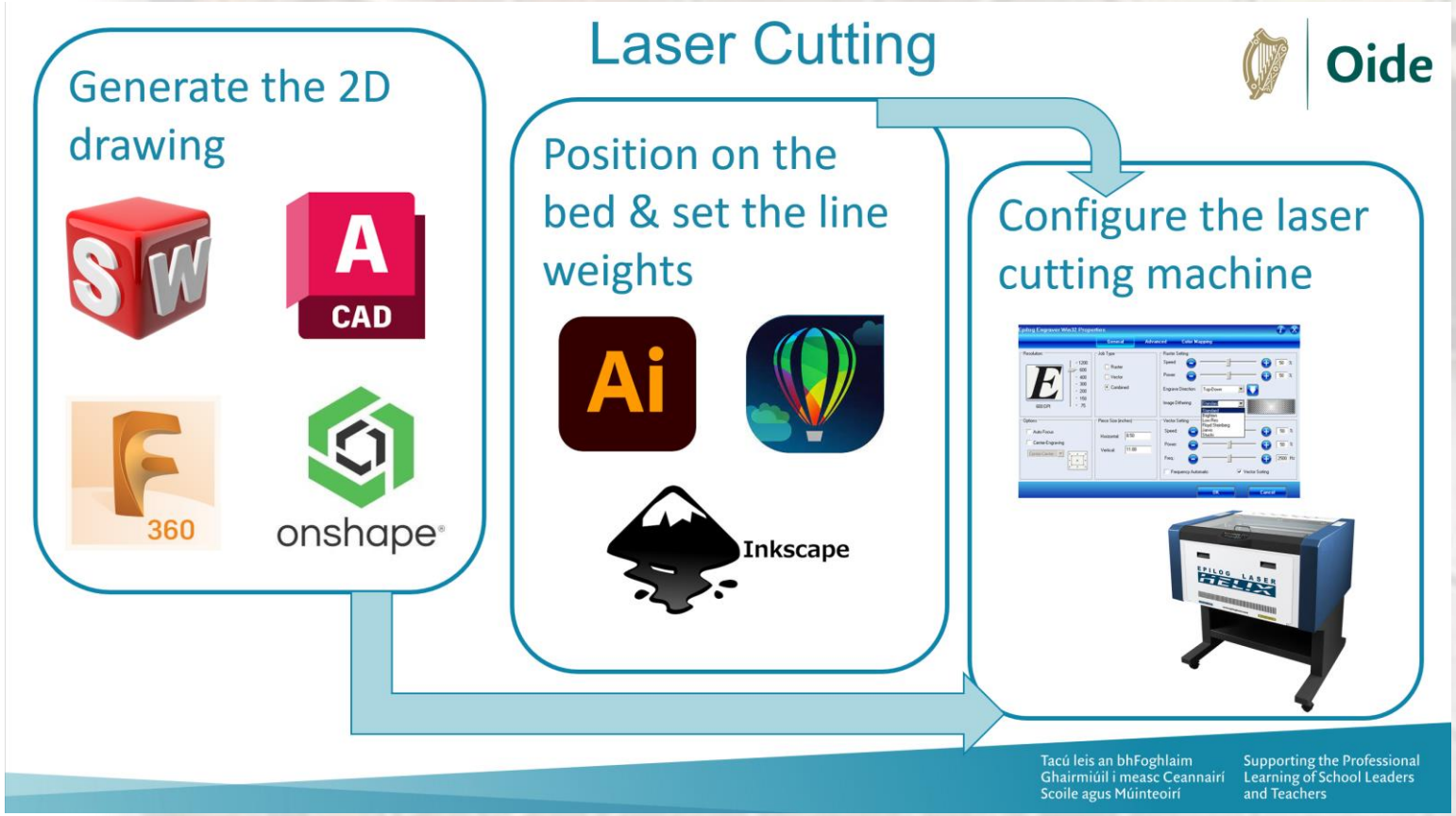
Engineering Online Learning Event 2023:

Supporting Pedagogical Practices in Junior Cycle Engineering with Innovative Use of Laser Technology



Using The Laser Cutter to Create Teaching and Learning Resources

Oide



Feedback

Oide

Please take a few moments to give us your feedback on today's PLE session

Your feedback helps us evaluate the day and guides the design of future events

Click or scan the QR code to access the feedback form for today's session

Oide

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí

Supporting the Professional Learning of School Leaders and Teachers

Engineering

PLE Day 2023 - 2024

Thank you for your participation in today's session