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Ghairmiúil i measc Ceannairí
Scoile agus Múinteoirí

Supporting the Professional
Learning of School Leaders
and Teachers

Engineering

PLE Day 2023 - 2024

Meet the Team



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Francis O'Farrell
Professional Learning Leader



Fergal Murphy
Professional Learning Leader



Ciarán Callaghan
Professional Learning Leader



Barry Nolan
Senior Leader





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Supporting the Professional
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An Roinn Oideachais
Department of Education

www.gov.ie/education



Coimisiún na Scrúduithe Stáit
State Examinations Commission

www.examinations.ie

NCCA 

www.ncca.ie



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www.oide.ie

Key Websites / Online information



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www.curriculumonline.ie

www.ncca.ie

www.oide.ie

 [@Oide_PP_Tech4](https://twitter.com/Oide_PP_Tech4)

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Oide Mailing List

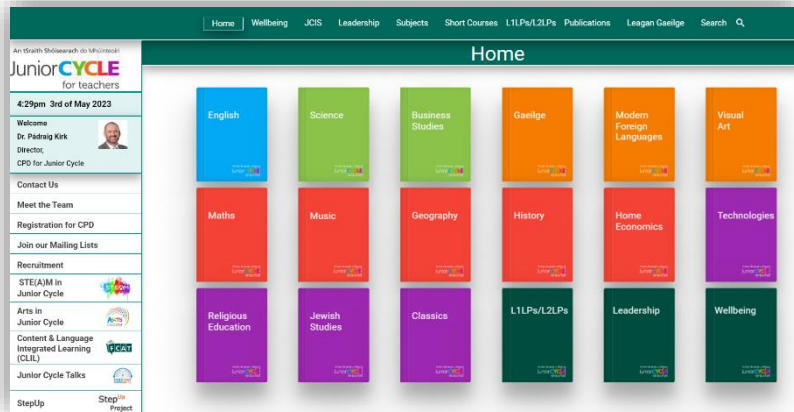


Junior Cycle Engineering Supports

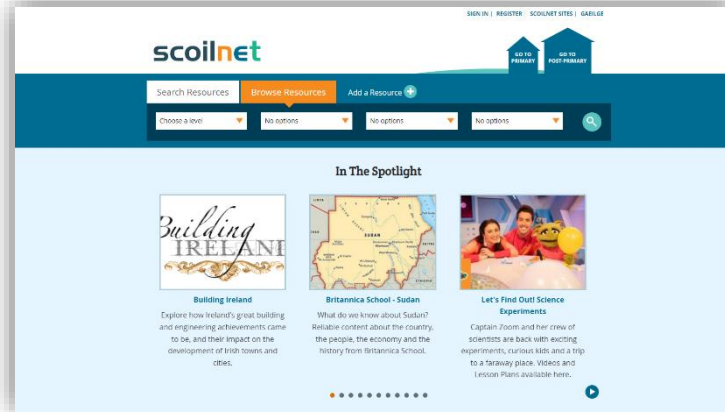


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Supports into the future



www.jct.ie



www.scoilnet.ie



www.oide.ie

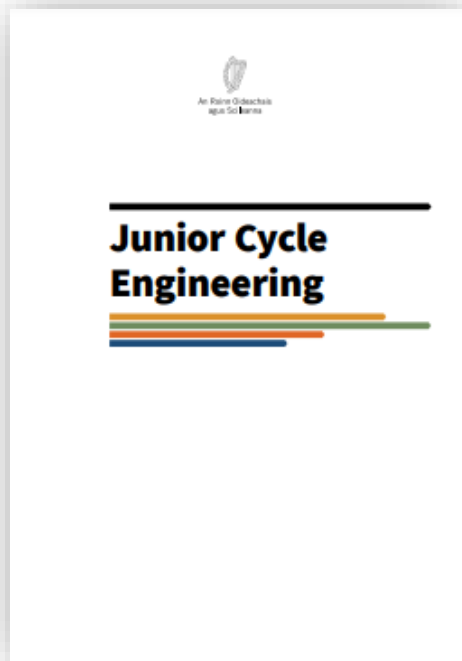
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Supporting the Professional
Learning of School Leaders
and Teachers

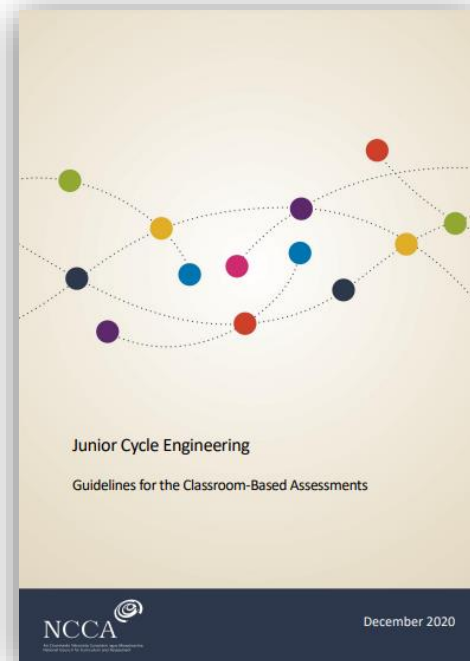
Key Documents



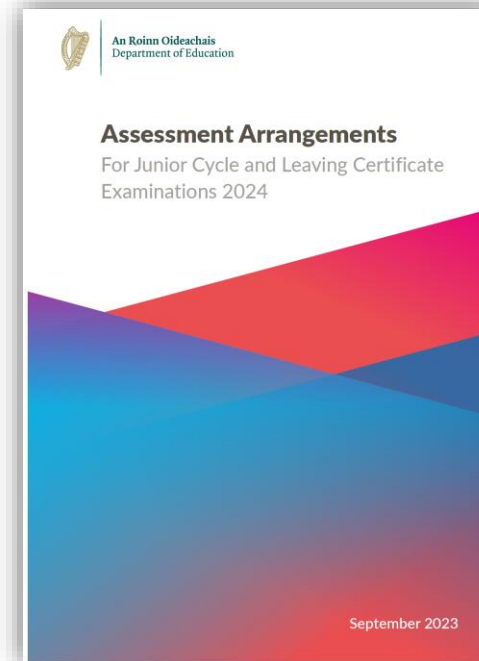
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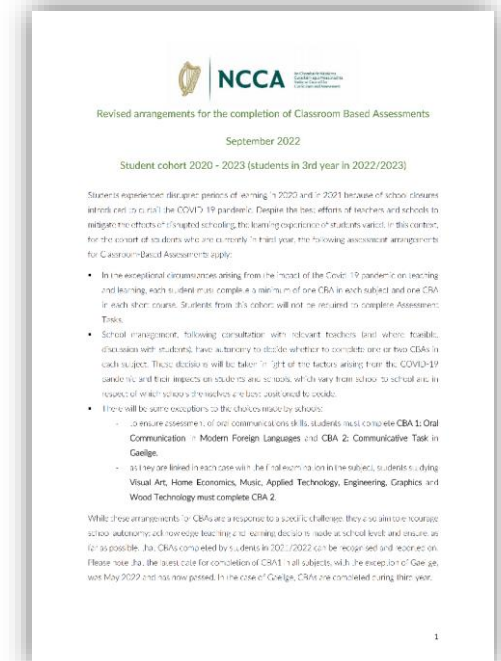
Subject
Specification,
NCCA



Assessment
Guidelines,
NCCA



Assessment
Arrangements
2023/2024,
Dept. of Education



CBA
Key Dates
2023/2024,
NCCA



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

on skill in the subject. Every opportunity to ng skills in the classroom should be taken. Sketching erials, tools, joints, design ideas, processing e integrated into everyday classroom practice.

n all three strands of the Wood Technology . Careful planning allows opportunities for about tools, materials and to develop design and with the practical aspects of the subject.

unities to investigate the identification of ustification for the use of each, based on their

mpleted using a straight edge to demonstrate g and interpretation of drawing views.

are fully exposed to all aspects of the Wood he three years. All the craft skills such as marquetry need and integrated into classroom teaching and

able-top holder to store coasters were often a very reativity. Candidates should be encouraged to be linking.

coursework erred with varying degrees of frequency in the or the 2022 examinations. Where they occurred, they

presented both a *My Design Journey* folio and an ted coursework, as required.

techniques were used by candidates to produce their nted in A4 or A3 format with good use of ICT skills communicate their design solution.

enge in each design brief to develop and present their ases there was good evidence of creativity and

if solid woods in the construction of their artefacts. iditates' knowledge and understanding of the if different solid woods.

high level of craft, skills and techniques in their xcellence in areas such as traditional jointing,

29

and lamination were exhibited by many

of modern technologies such as CNC routers and hance their finished artefacts for final presentation.

embled and fittings were appropriately selected and

ome surface preparation of their chosen materials urface finish to their artefacts.

ated in the selection of a surface finish depending Candidate. For example, most candidates whose ic and safe applied finish.

ork ring that candidates demonstrate their levels of (ing and reporting on their coursework.

ork component in Wood Technology, the int should be carefully read and all instructions

Design Journey folio and an artefact. Candidates their folio in line with the instruction given in the

freehand sketches is an essential communication ogy. Emphasis should be placed on the ing skills to communicate design solutions. Well- ned freehand sketches should be shaded, rendered it takes time and practice to develop the necessary

design decisions in the folio section *My Preferred* ded clear considerations and justifications of their uld be placed on describing the justifications for the

learning proved challenging for most candidates. good work and showed what they had learned el be improved. Candidates should discuss their gpts they have taken from completing their more easily to them if such evaluation and their way of working throughout the three years of

30

ed to reflect on what they have learned and to include a learning journey over the course of their engagement with

read each of the design briefs carefully. Consideration elements and constraints presented within each brief in the solution.

iven to the selection of sustainable and appropriate s and techniques when planning the construction of the rd sustainable use of materials contributes to the k practice in Wood Technology.

uraged to use a range of crafts, skills and techniques in and construction of their artefact. Traditional jointing king skills like scroll-saw work, carving, woodturning, laminating should be an integral part of their completed

ments created using a CNC router or laser cutter are implement the manipulative skills demonstrated in the cannot be used as a replacement for the demonstration of hand tools. It is also recommended that the design ents or embellishments should be presented.

allowed at the end of the process for good surface an appropriate surface finish prior to the artefact. A y be achieved by carefully following the application if finish.

Submit authentic coursework, duly validated by the class rities. All coursework must be the candidate's own d in school under the supervision of their teacher.

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

Engineering, page 35.



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

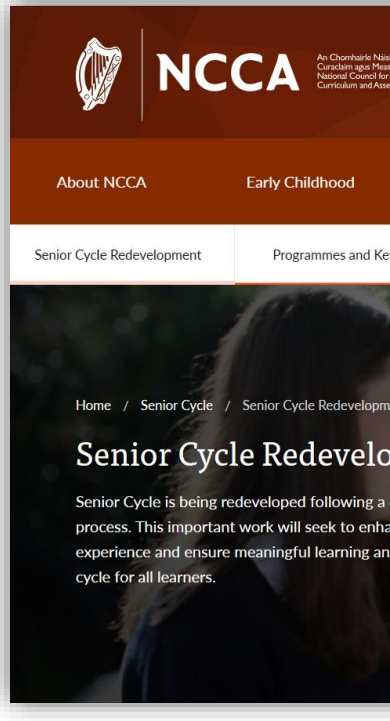
Engineering

English

Geography

LCVP Link Modules

Physical Education



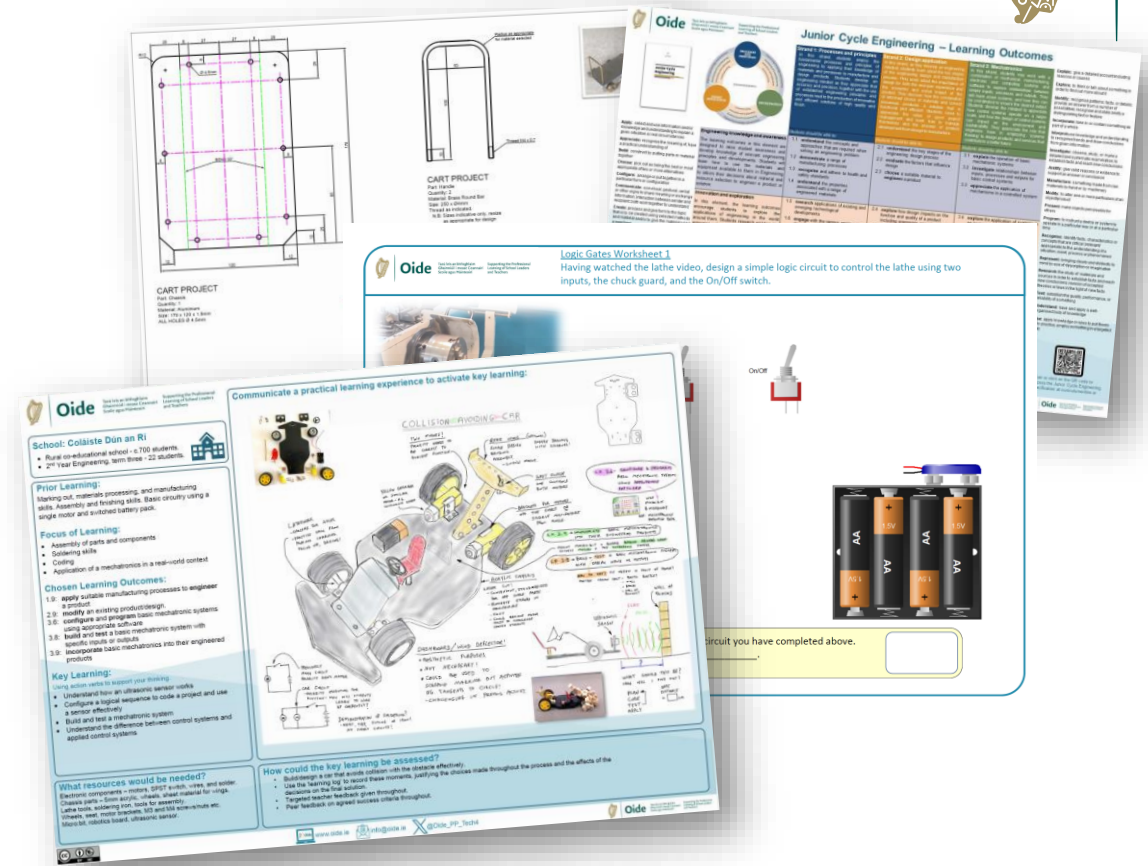
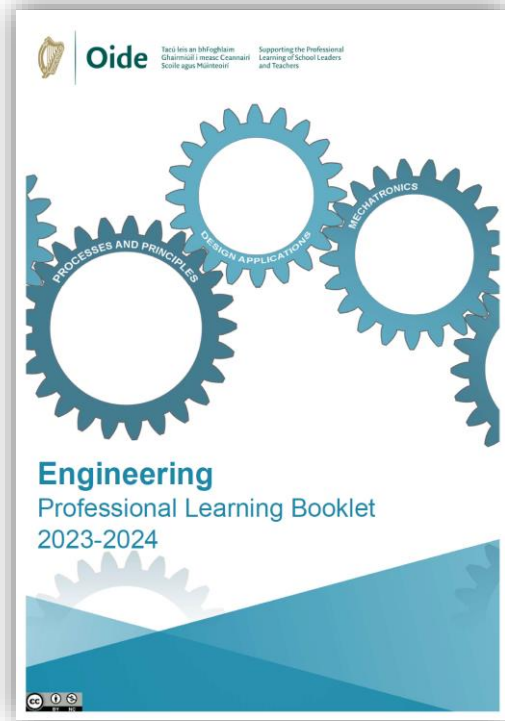
Further tranches will be introduced on an annual basis.

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



Professional Learning Booklet





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You to Everyone 15:57

  Professional Learning Booklet - ...
2.94 MB

  ...

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

Over today's three sessions - we will...



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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



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10 minutes

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



- 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

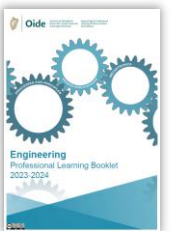




Reflection Point



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Mechatronics Video Reflection Sheet

What is the purpose of the system?

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

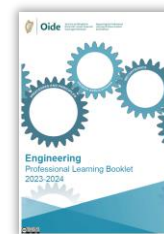


What component(s) are used in the system?

Explain how the system performs the function.



What are the benefits of using this system?



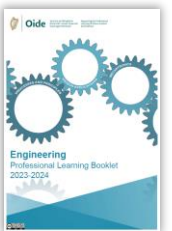


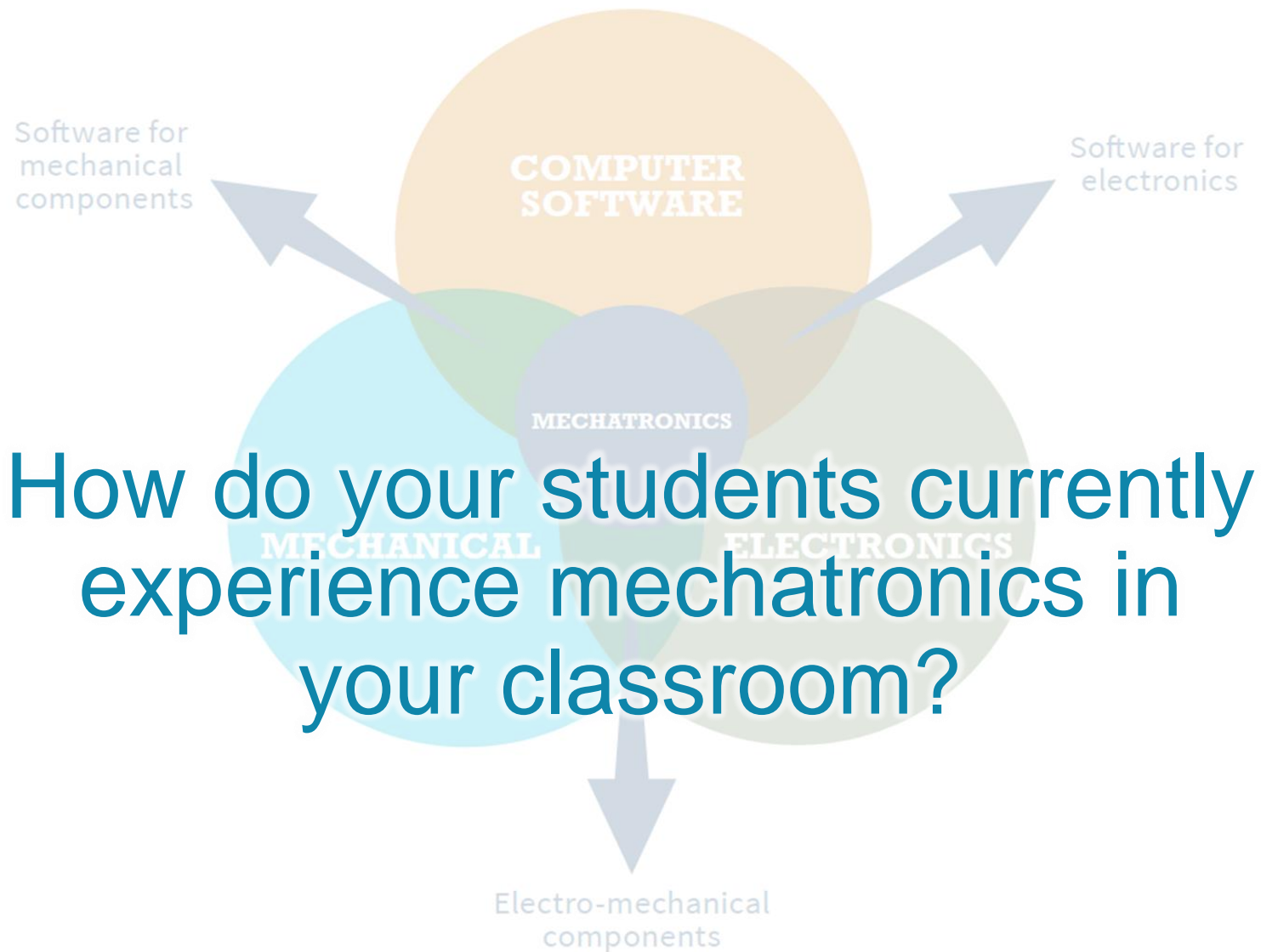
Reflection Point



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





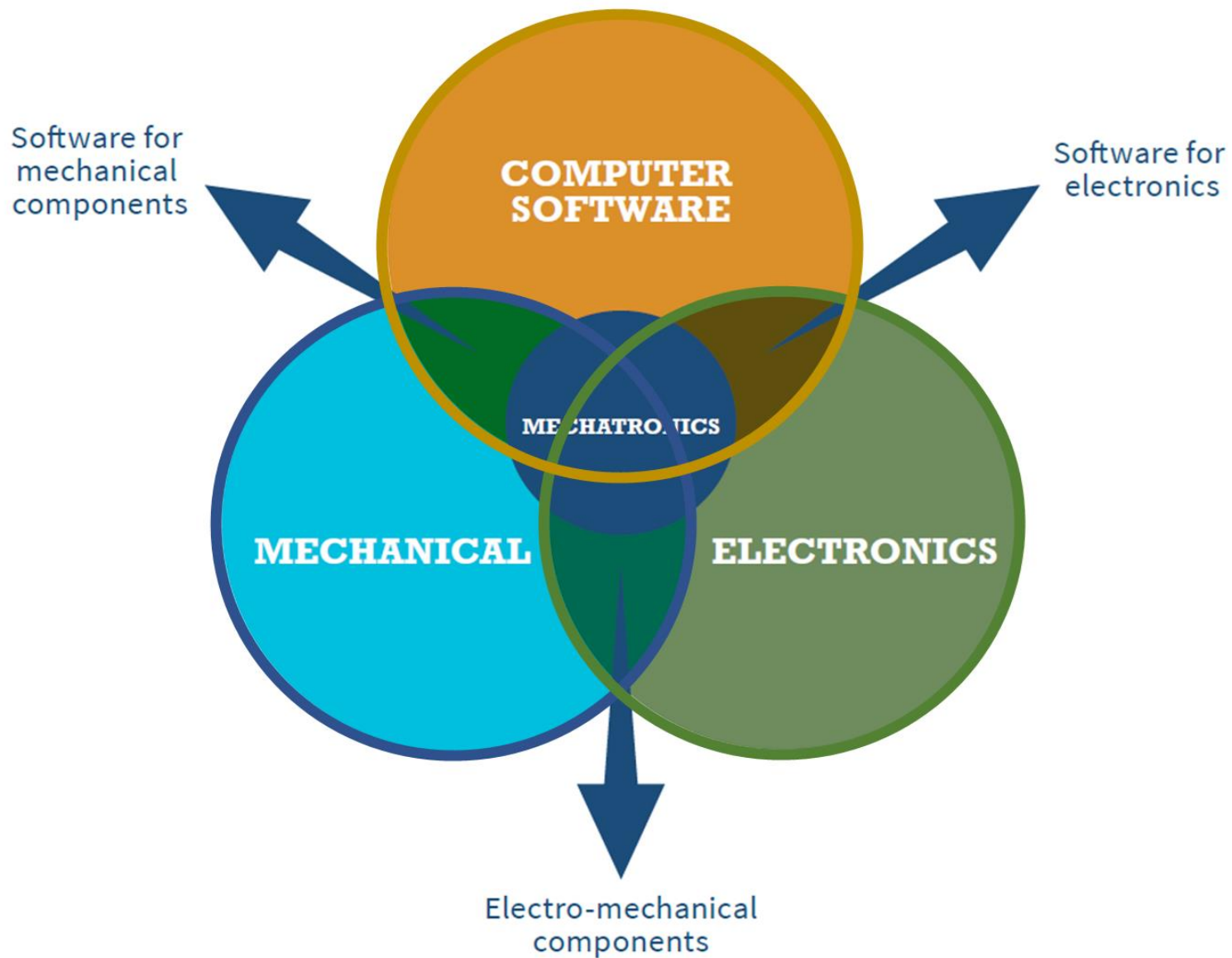
Reflect:



Reflect



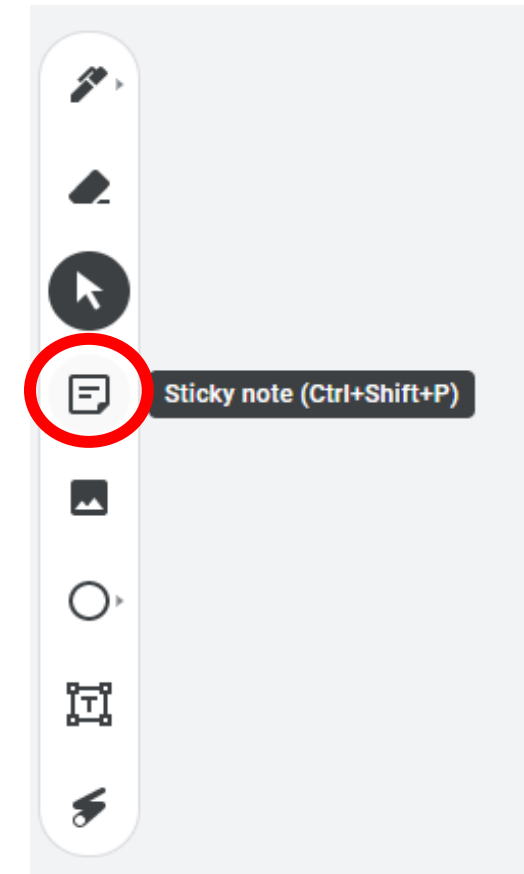
2 minutes



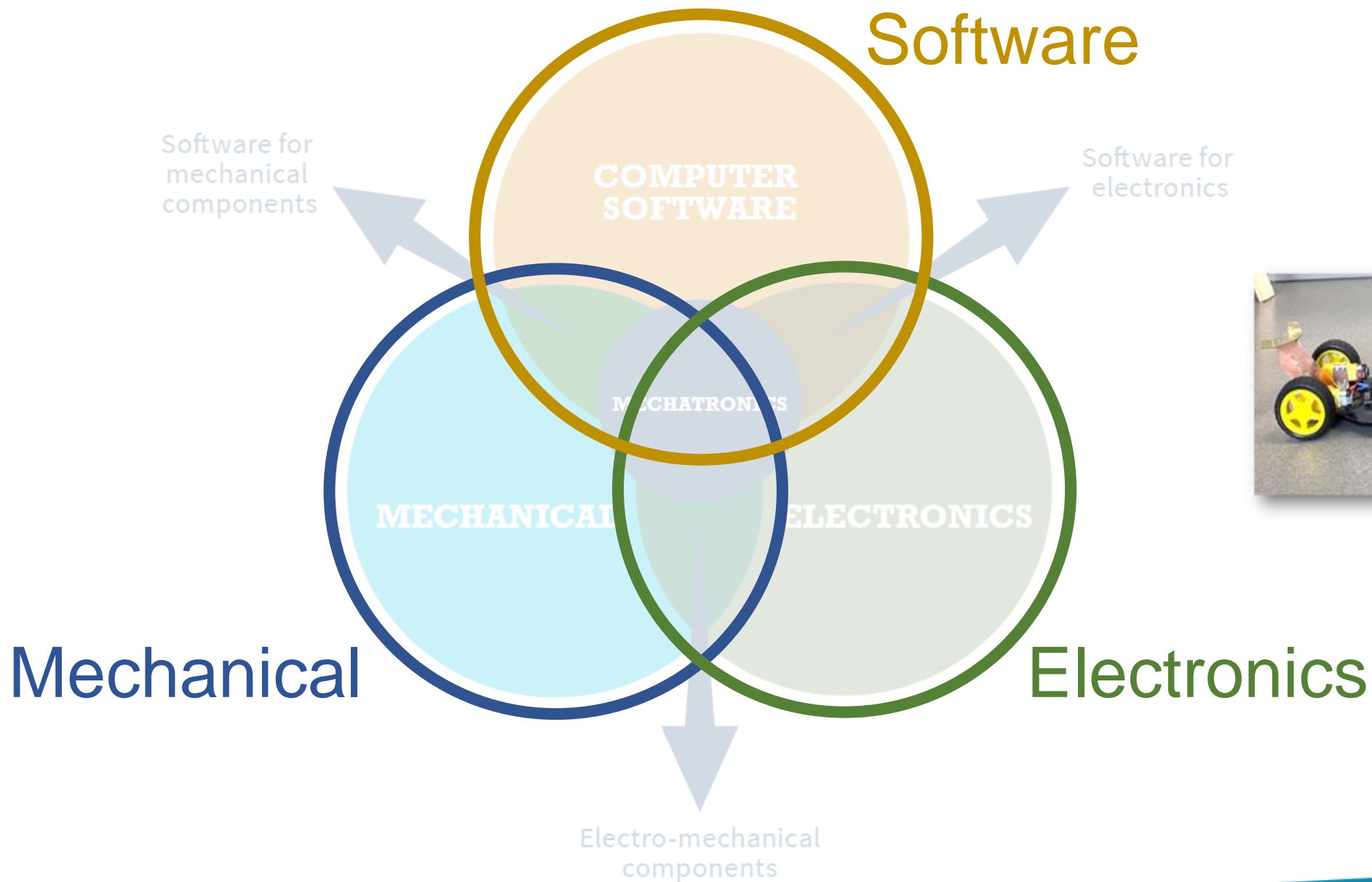


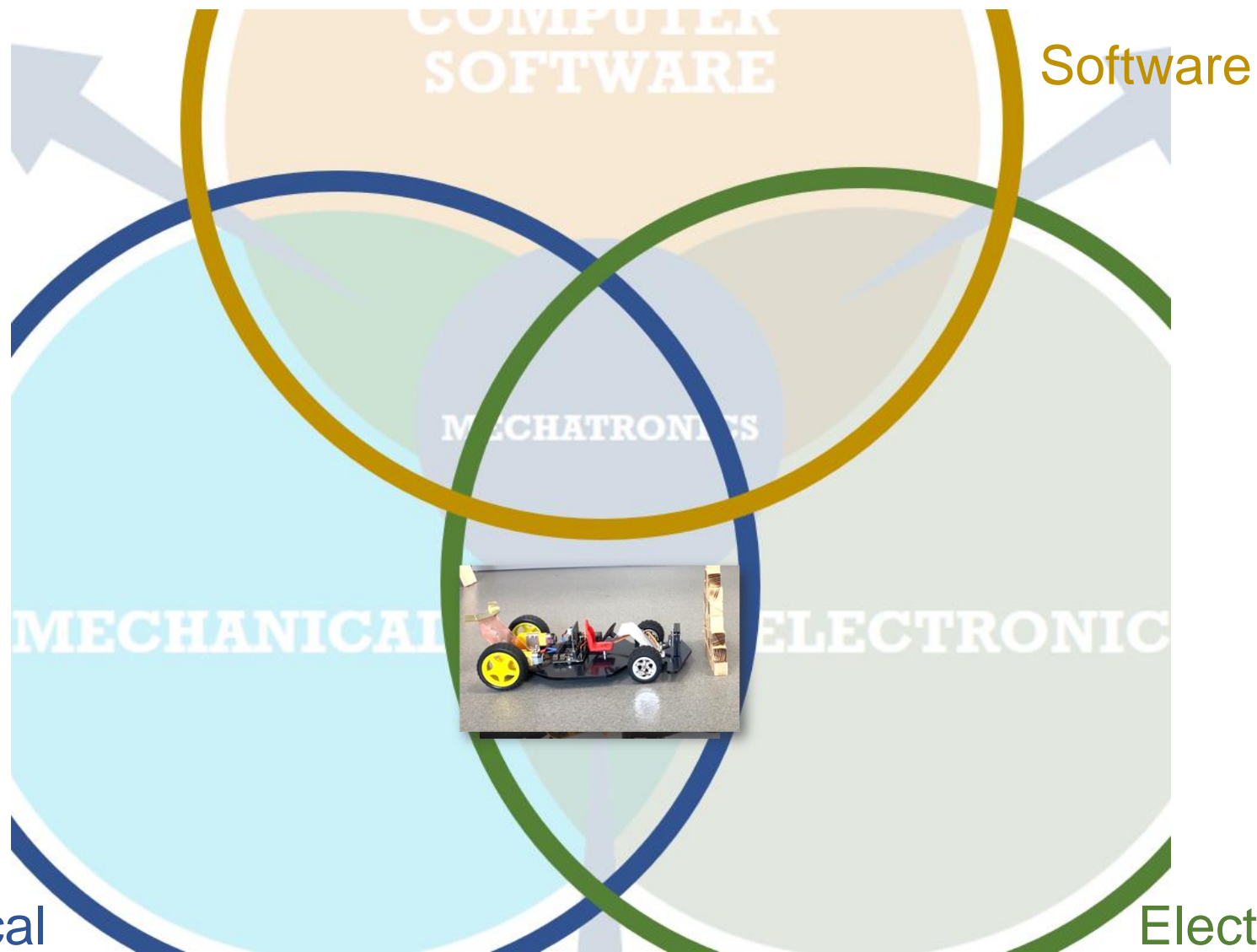
Using the pre-loaded examples, or using sticky notes as shown on the right:

- 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



https://jamboard.google.com/d/1_DVI2jujIUHk18ZGX5GyXvkCkQ7y1s5K3JAI7a0zCyE/edit?usp=sharing





Mechanical

Electronics

Mechatronics in the Engineering Room



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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.

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.

Communicate a practical learning experience to activate key learning:



COLLISION AVOIDING CAR

TWO MOTORS!
POLARITY NEEDS TO BE CORRECT TO ACHIEVE FUNCTION

REAR WING (OPTIONAL)
SIMPLE DESIGN BENDING ASSEMBLY - SATCH MOUNT.
SHARE DRAWING WITH STUDENTS!

SPST SWITCH
ONE CONTROLS BOTH MOTORS

YELLOW GEARBOX OR SIMILAR MOTOR - E.G. CONTINUOUS SCREW

BRACKETS FOR MOTORS
OFF THE SHELF OR STUDENT MANUFACTURE FROM ANGLE.

LATHWORK FOR AXLES
- SPACERS FOR AXLES
- PRACTISE SKILL FROM PREVIOUS LEARNING. PAGING OFF, DRILLING!

ACRYLIC CHASSIS
LASER CUT!
- CONVENIENT, STANDARDISED FOR OFF SHELF PARTS!
- ELIMINATE ERRORS IN MANUFACTURE
- FAST
- COULD REMOVE MOTOR HOLES TO CHALLENGE CERTAIN STUDENTS

DASHBOARD / WIND DEFLECTOR!
• AESTHETIC PURPOSES.
• NOT NECESSARY!
• COULD BE USED TO SCRAPOLD MARKING OUT ACTIVITIES E.G. TANGENTS TO CIRCLE!
- CHALLENGING IN PREVIOUS ACTIVITY.

PREVIOUSLY MADE CIRCUIT DIDN'T MATTER.

CAR CIRCUIT ESSENTIAL FOR POLARITY FUNCTION - HOW WILL STUDENTS LEARN TO WIRE UP CORRECTLY?

DEMONSTRATION OF SOLDERING!
- NEAT, TIDY, TIMING OF IRON!
NO SHORT CIRCUITS!

L.O. 3.6 - CONFIGURE & PROGRAM BASIC MECHATRONIC SYSTEMS USING APPROPRIATE SOFTWARE
USE MICRO:BIT & MAKECODE. REF: MECHATRONICS RESOURCE BOOK.

L.O. 3.9 - INCORPORATE BASIC MECHATRONICS INTO THEIR ENGINEERED PRODUCTS

MOUNT MICRO:BIT + BOARD BEHIND DRIVERS SEAT
CONNECT MOTORS + THE ULTRASONIC SENSOR

L.O. 3.8 - BUILD + TEST A BASIC MECHATRONIC SYSTEM WITH SPECIFIC INPUTS OR OUTPUTS

HOW TO TEST? PUT OBJECT IN FRONT OF SENSOR?
MAYBE CRASH TEST - PLASTIC BOTTLE!
- WALL
- BOXES
- WALL OF BLOCKS!

Ultrasonic Sensor
ECHO PULSE

WALL OF BLOCKS

WHAT SHOULD THIS BE? HOW WILL I FIND OUT?
SAFE DISTANCE = cm

PLAN CODE TEST APPLY

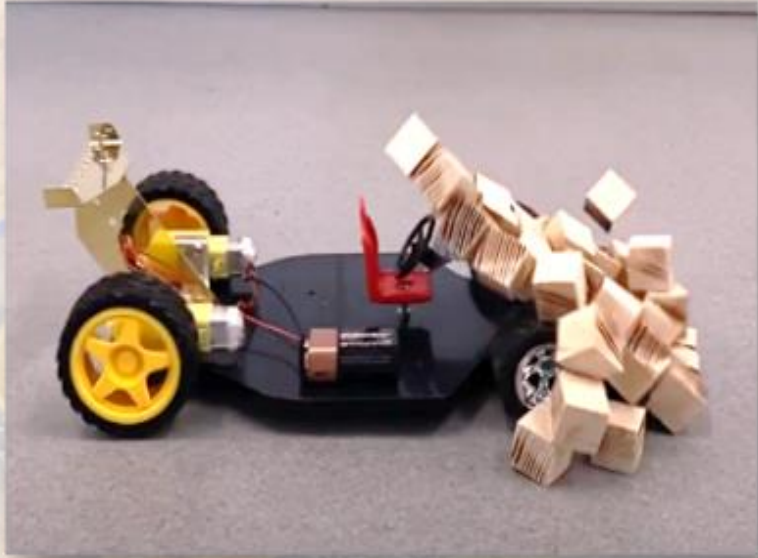
How could the key learning be assessed?

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



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

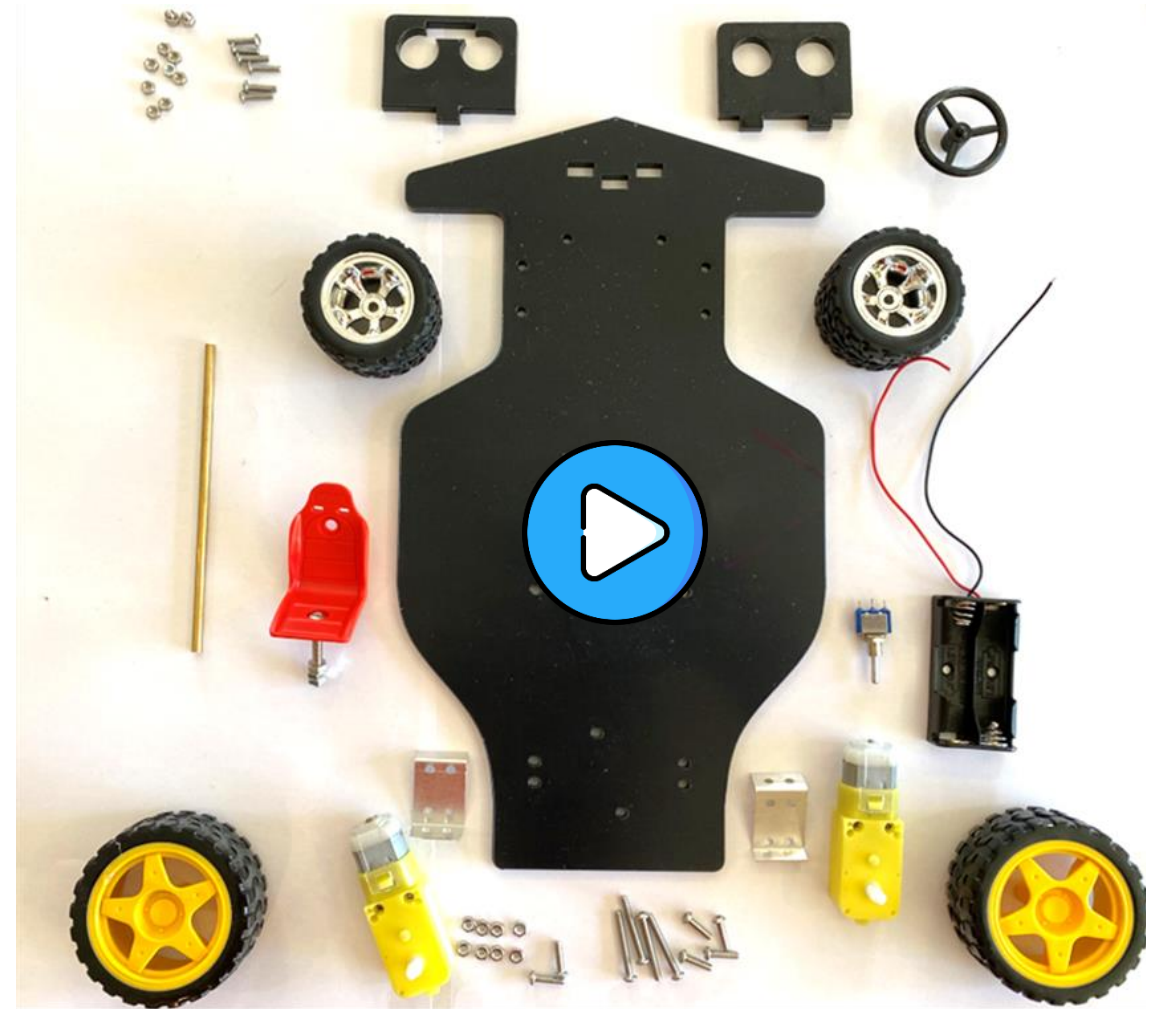
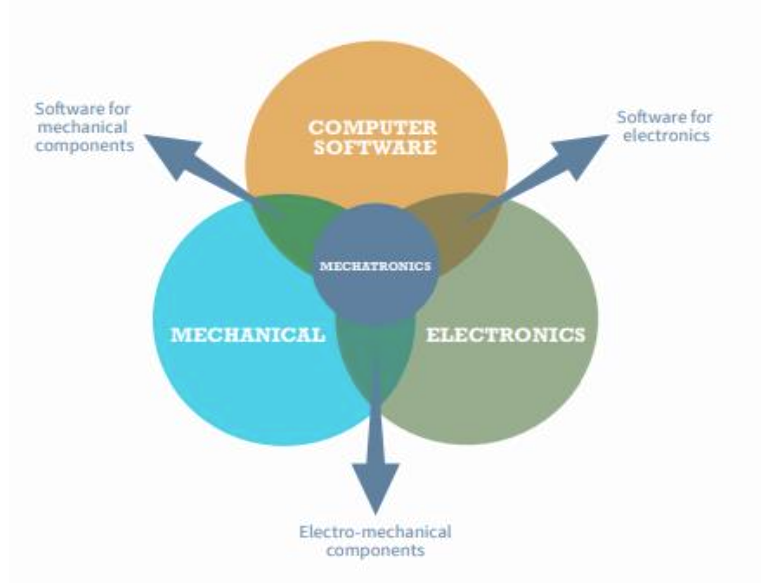
Learner Experience One



Oide

Task: Car with basic drive system

Classroom footage of students engaging with the task



The Learner Experience

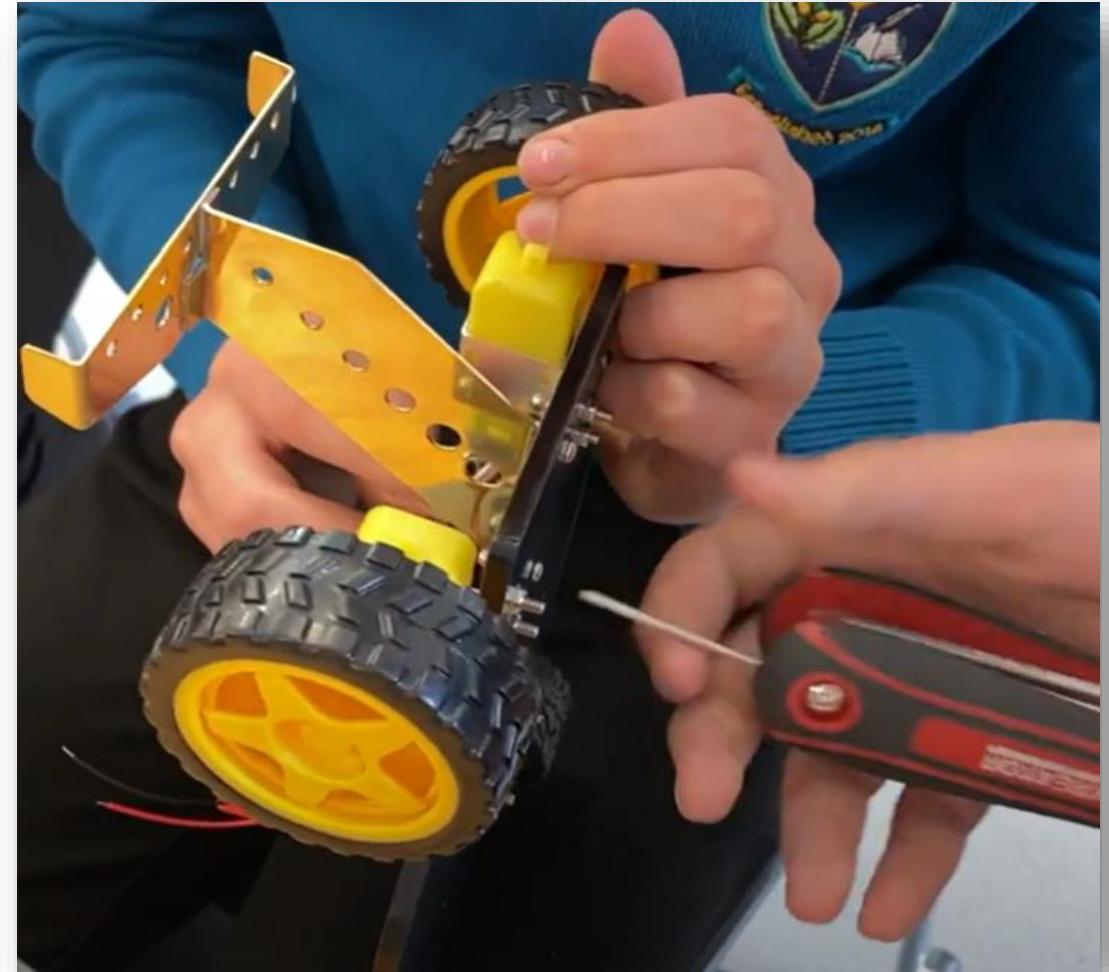
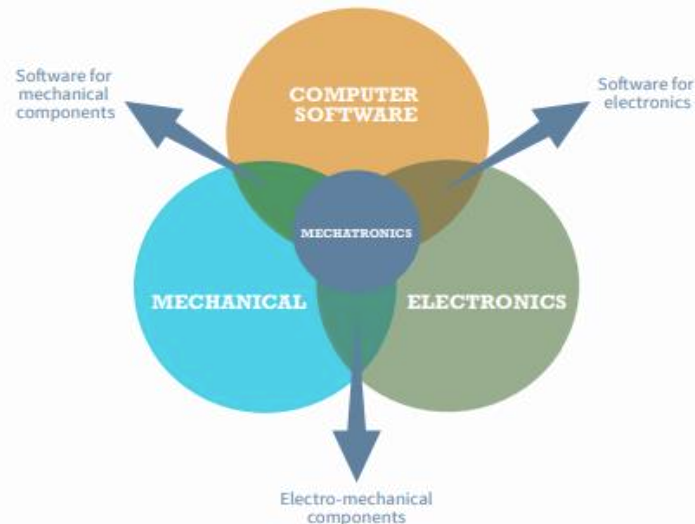


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Having watched the students' progress through the car activity, consider:

What new learning did the students gain from the activity?

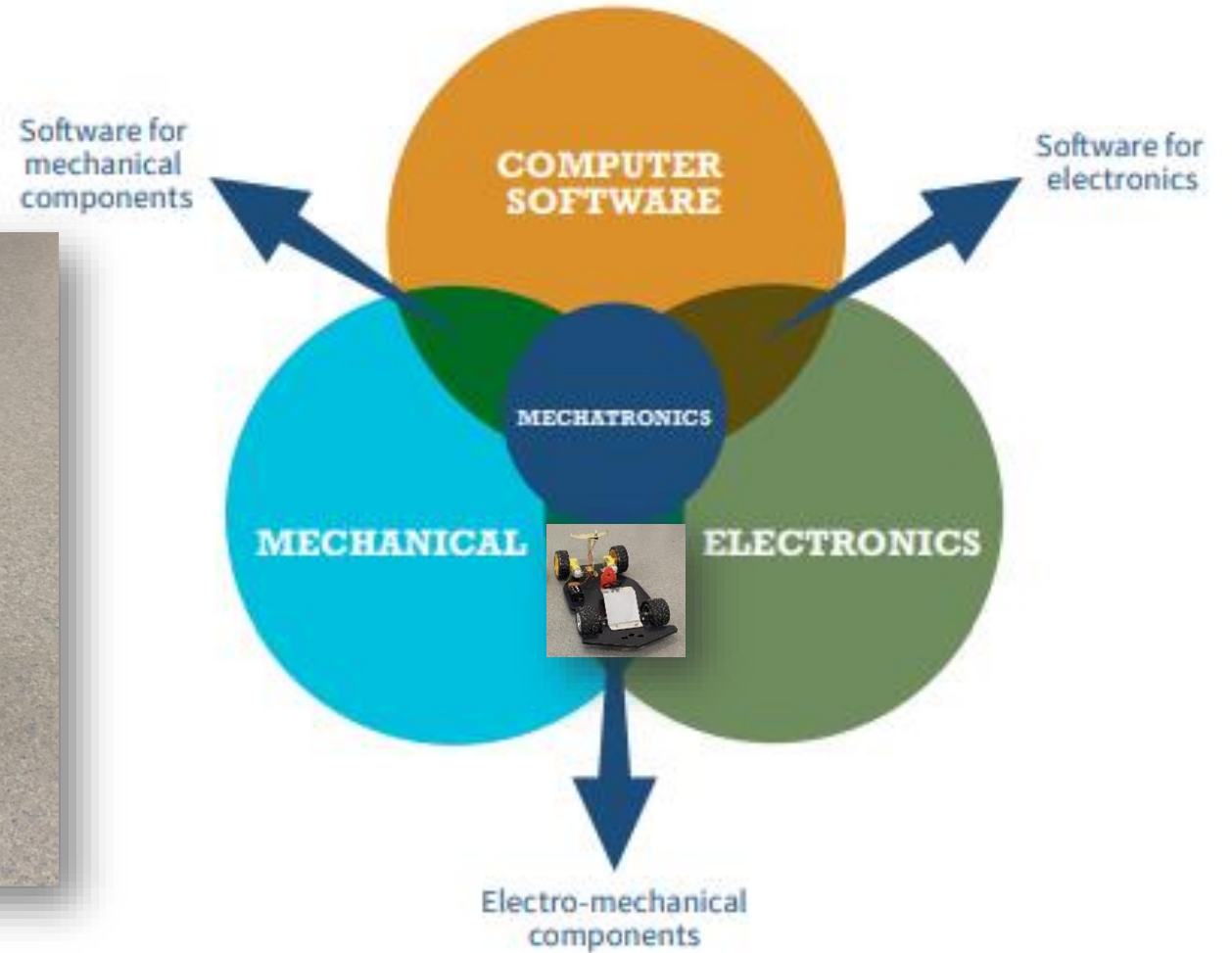
What opportunities for further learning could be incorporated into the activity?



The Learner Experience



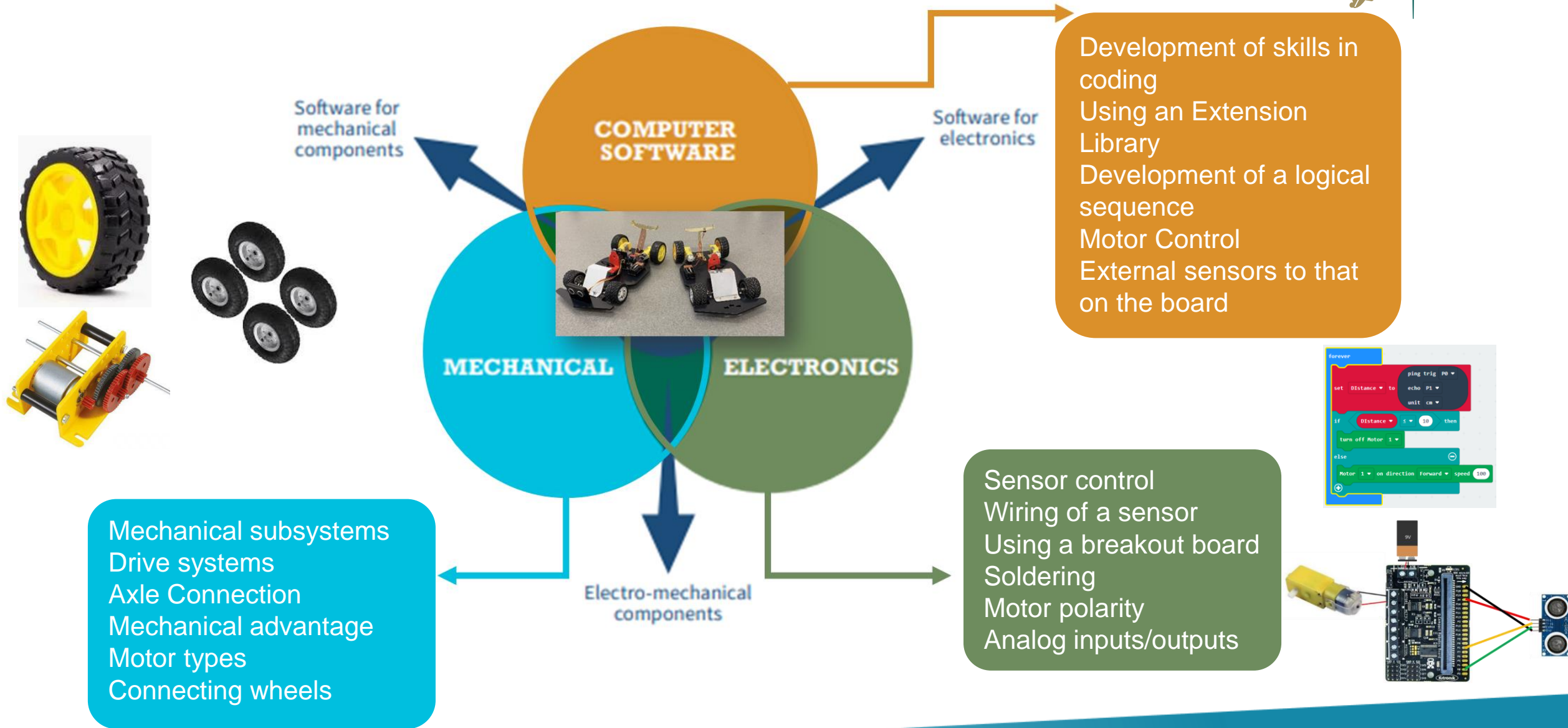
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The Learner Experience



Oide





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



Potential Code for the project

Write out your plan

Go to [Makecode.org](https://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](https://makecode.org)
microbit.org



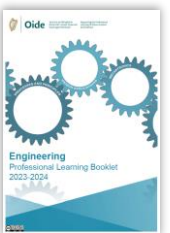
Task 1:



Sketch



10 minutes
Individually



Pg. 6



Potential Code for the project

Using Makecode, the code here can make the project work

```
forever loop
  ping trig P0
  set Distance to echo P1 unit cm
  if Distance <= 7 then
    turn off Motor 1
    turn off Motor 2
  else
    Motor 1 on direction Forward speed 100
    Motor 2 on direction Forward speed 100
```

The image shows a Scratch-style Makecode script for a robot project. The script is contained within a blue 'forever' loop block. Inside the loop, there is a red 'ping' block with 'P0' selected for the trigger pin, 'P1' for the echo pin, and 'cm' for the unit. This is followed by a 'set Distance to' block. Below that is an 'if' block with a condition 'Distance <= 7'. If the condition is true, two green 'turn off Motor' blocks are executed, one for Motor 1 and one for Motor 2. If the condition is false, two green 'Motor on' blocks are executed, one for Motor 1 and one for Motor 2, both set to 'Forward' direction and '100' speed. The script is displayed over a background image of a robot with two yellow wheels and a black body.

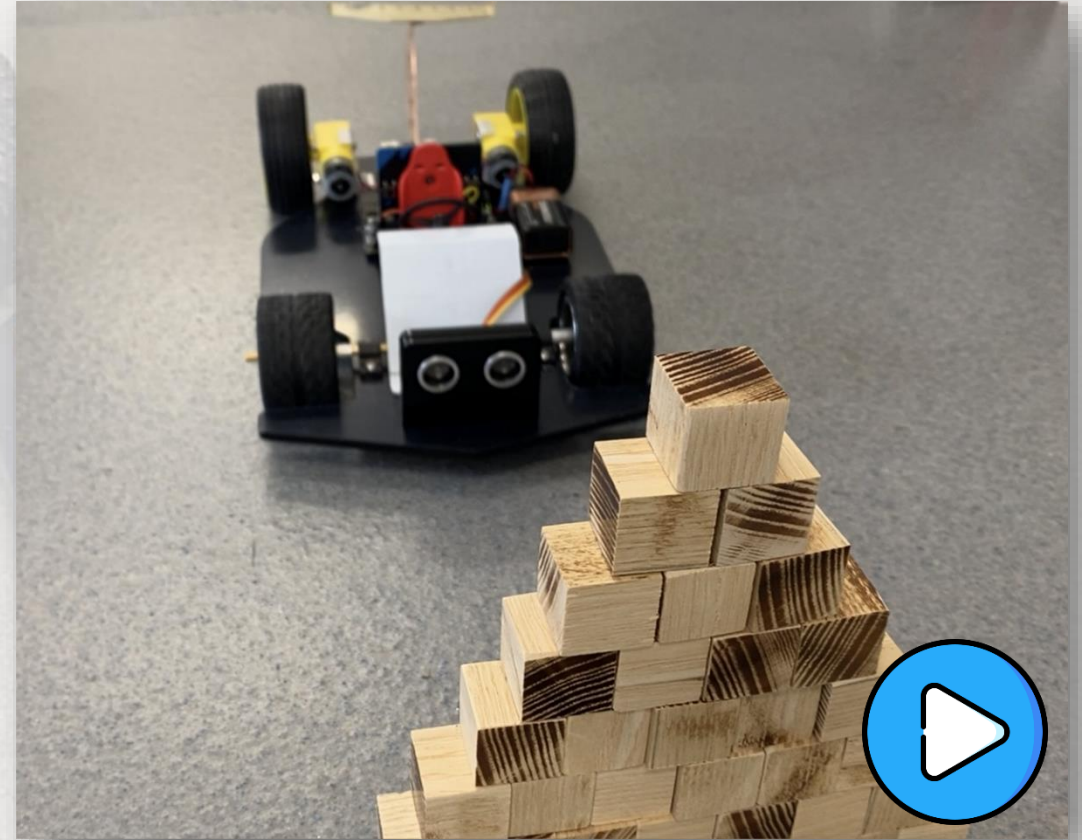
The Learner experience



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Project: Collision Avoiding Car

Student Experience Part 2

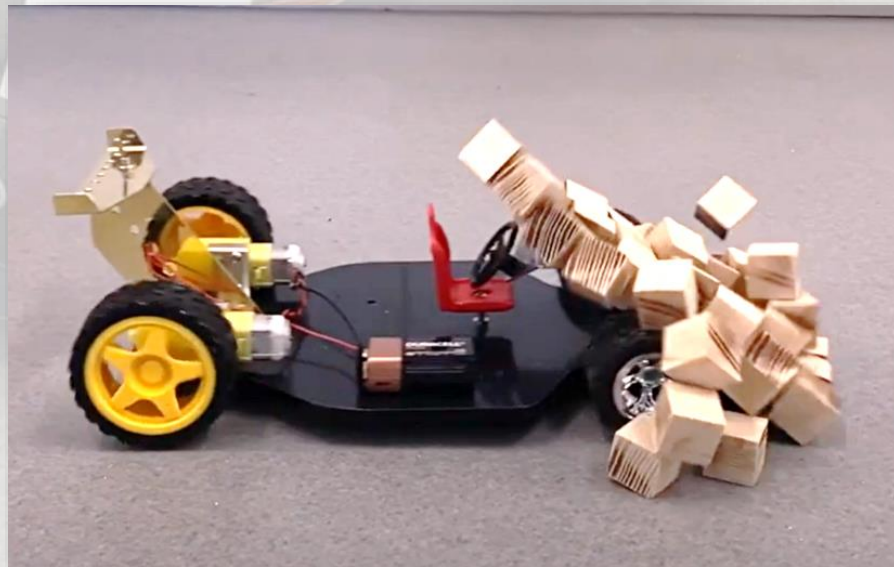


Learner Experience



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



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15 minutes

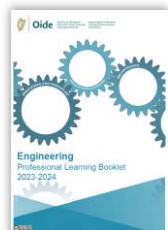
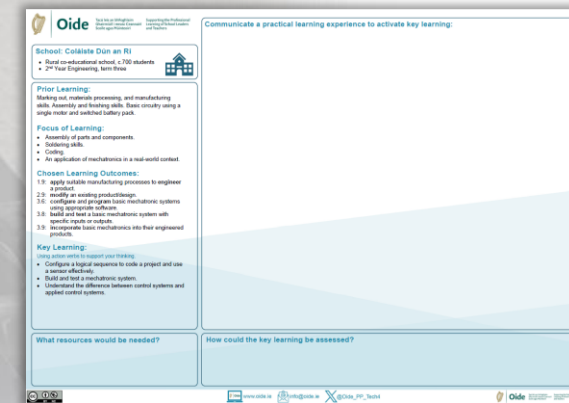


Individual Activity:

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?



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Open floor discussion:

Share a brief overview of your plan with the group

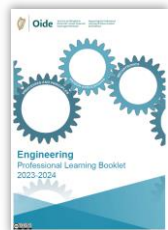
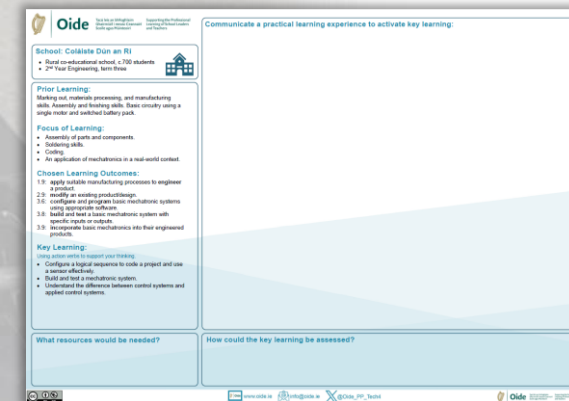


15 minutes

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



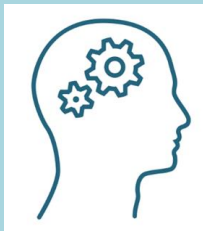
Reflecting on your colleagues' ideas or feedback, what opportunities are there for developing the student learning in your room?



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



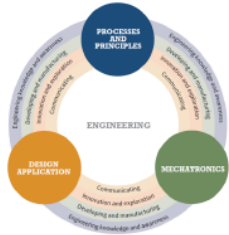
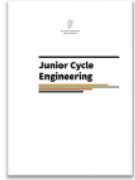
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Supporting the Professional Learning of School Leaders and Teachers

Junior Cycle Engineering – Learning Outcomes



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

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.

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.

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.

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.

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.

Students should be able to:

- 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

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.

Students should be able to:

- 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

Strand 3: Mechantronics

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:

- 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

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.



www.oide.ie

info@oide.ie

[@Oide_PP_Tech4](https://twitter.com/Oide_PP_Tech4)



Oide

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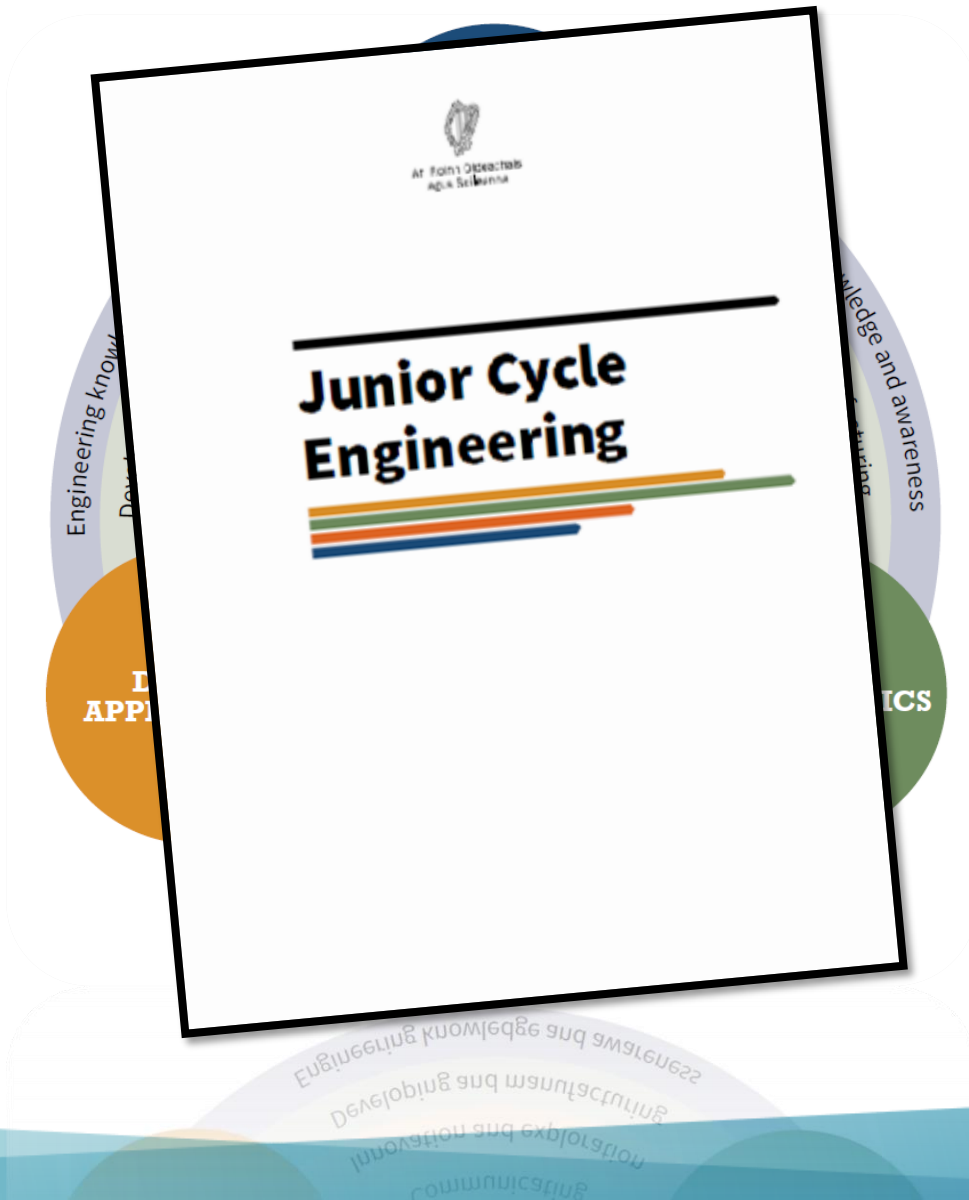
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Supporting the Professional Learning of School Leaders and Teachers

The Engineering Specification



Oide

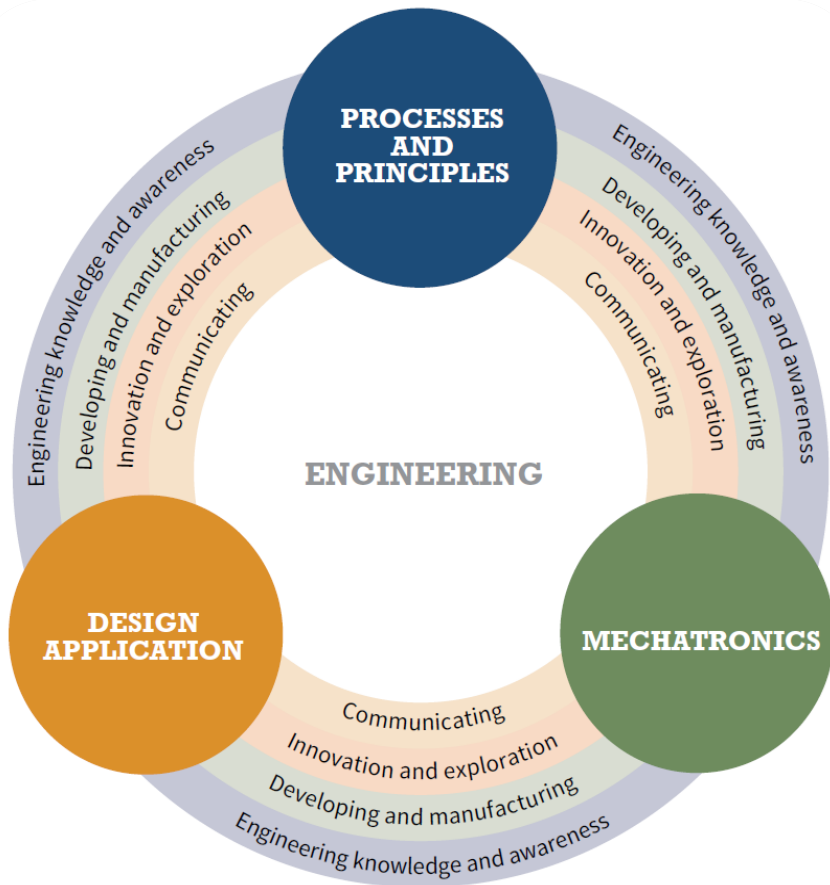


The elements are consistent throughout the strands, so that there is a **systematic development of students' fundamental knowledge, understanding and key skills** as they progress through the course. This structure supports an **integrated, non-linear approach** to teaching and learning

The Engineering Specification



Oide



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



Oide

Unit of Learning: Warehouse Cart

Task: Steering and Drive System

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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 skills such as hand tools, assembly/threading, and basic circuitry.

Focus of Learning:
The teacher has identified mechanisms and simple mechatronics as areas of key learning in this unit, also design and communication skills.

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:

- Research and investigate the applications and engineering concepts behind common steering systems.
- 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.

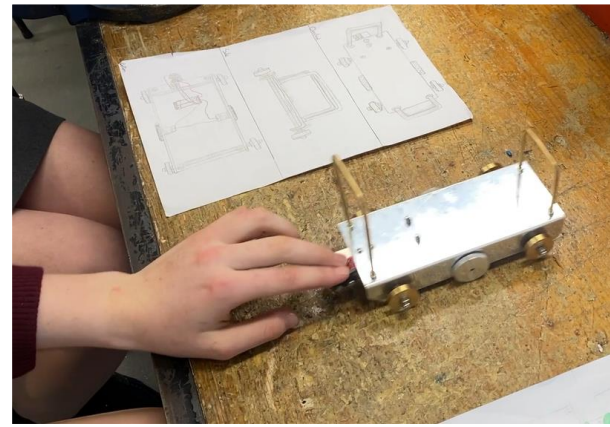
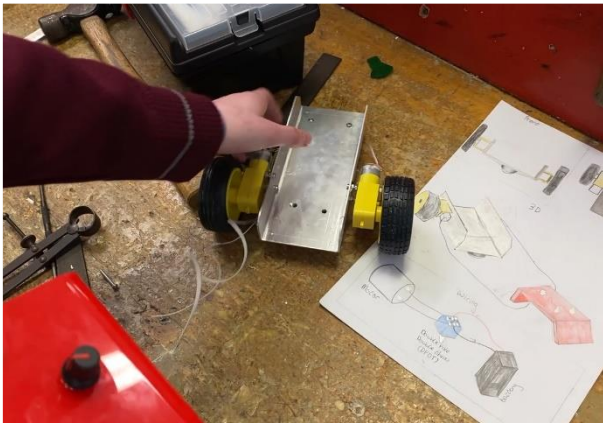
What resources would be needed?
Electronic components - motors, switches, wires, solder, etc.
Chassis, wheels, brass or steel rod.
Selection of standard wheels, soldering iron, tools for assembly, Screws/nuts etc. as required.
Drills, lathes, threading tools, etc.

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 to achieve function.
- Correctly wire and assemble electronic components to achieve function.
- A folio that documents the student's progression through the challenge and the decisions made have effected the chosen design.

Communicate a practical learning experience to activate key learning:

www.oide.ie info@oide.ie [@Oide_PP_Tech](https://www.facebook.com/Oide_PP_Tech)



Student Context



Oide

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:

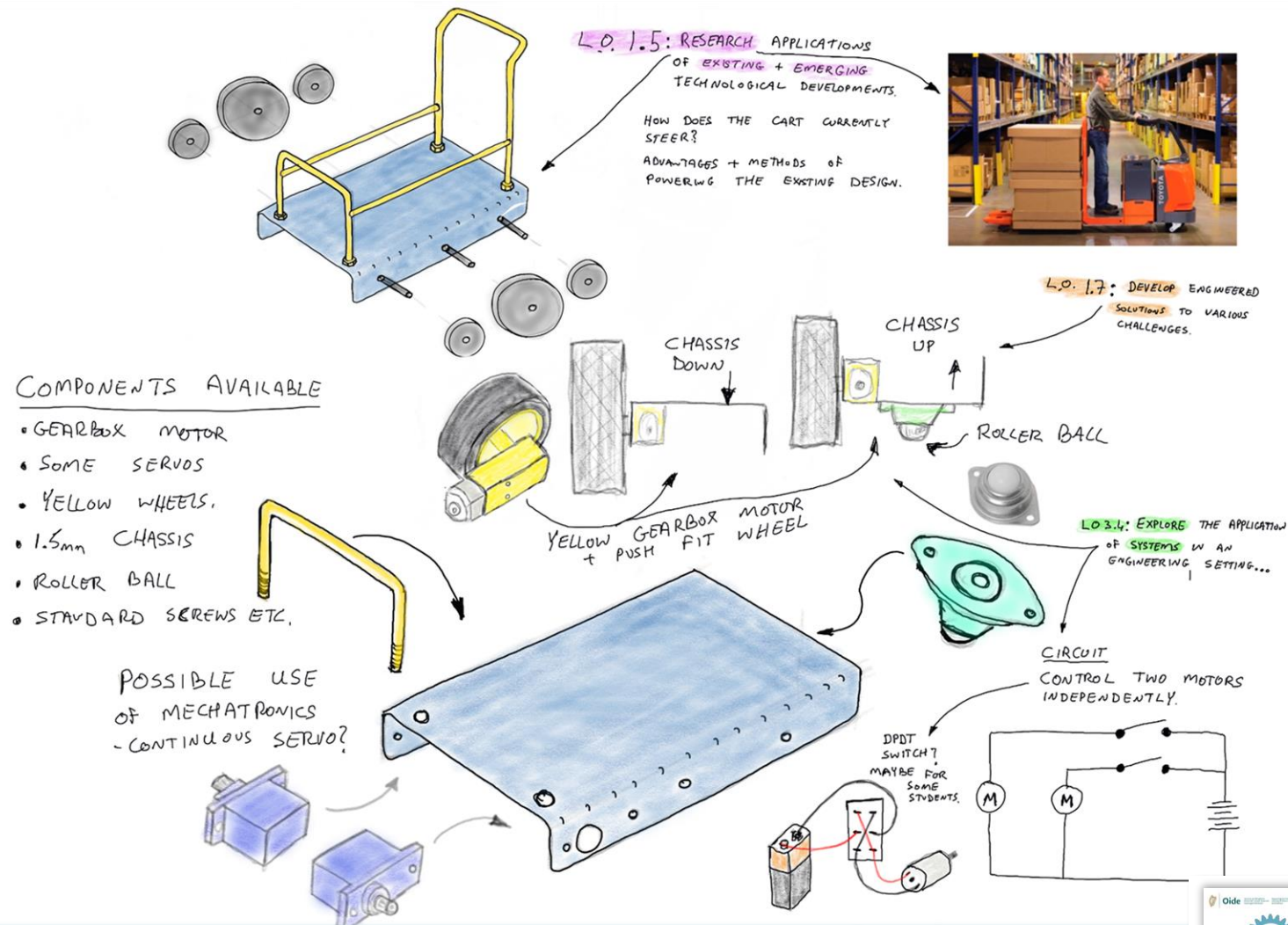
Using action verbs to support your thinking.

- 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.

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.

Communicate a practical learning experience to activate key learning:



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 components function.
- A folio that documents the student's progression through the challenge and the decisions that affected the chosen

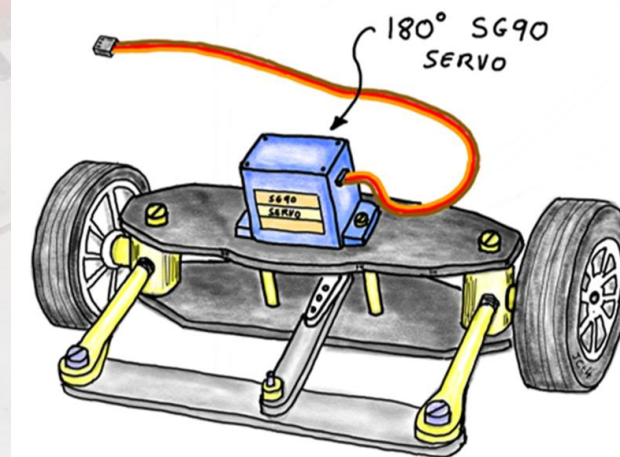
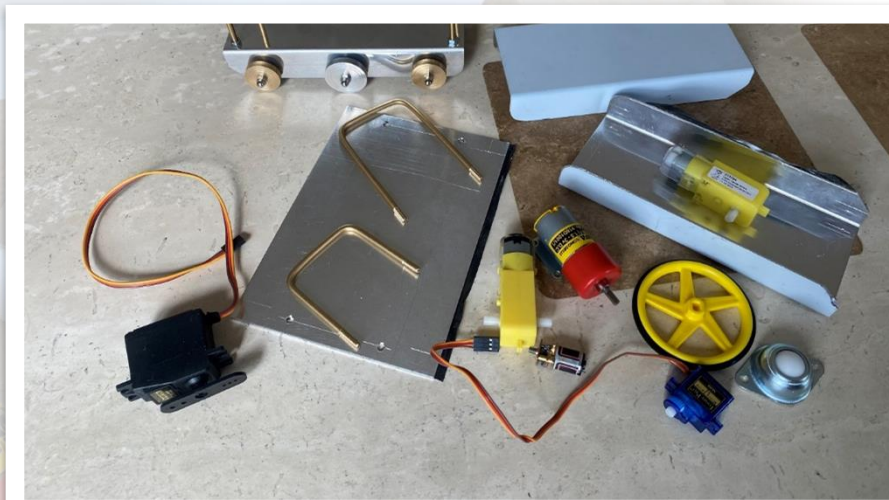


Personal Reflection



Oide

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





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



10 minutes

Actions:

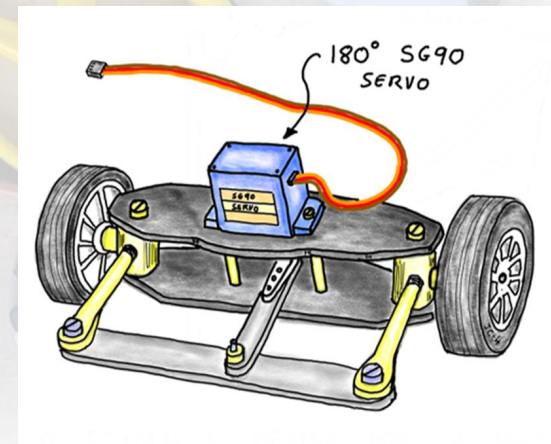
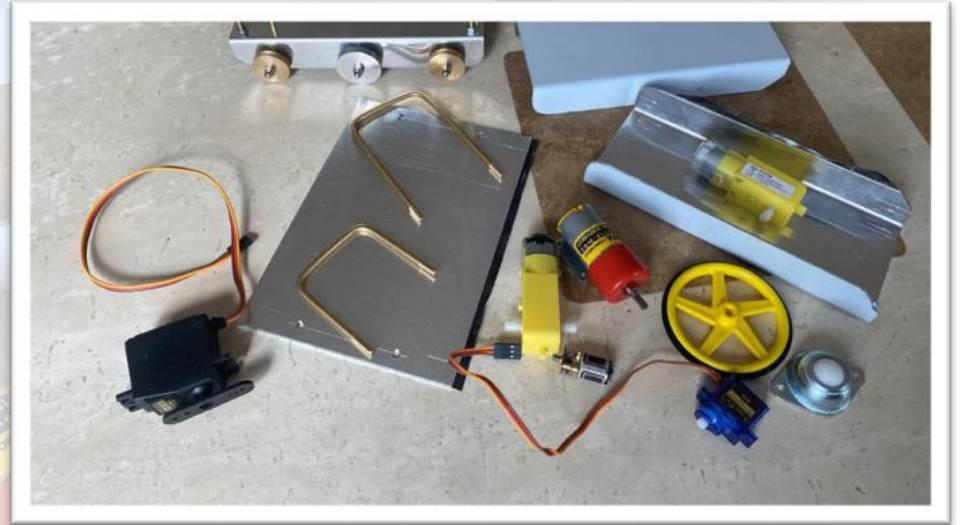
- Monitor the time (10 minutes)
- Reporter to collate notes on the discussion
- Report the main points to the full room

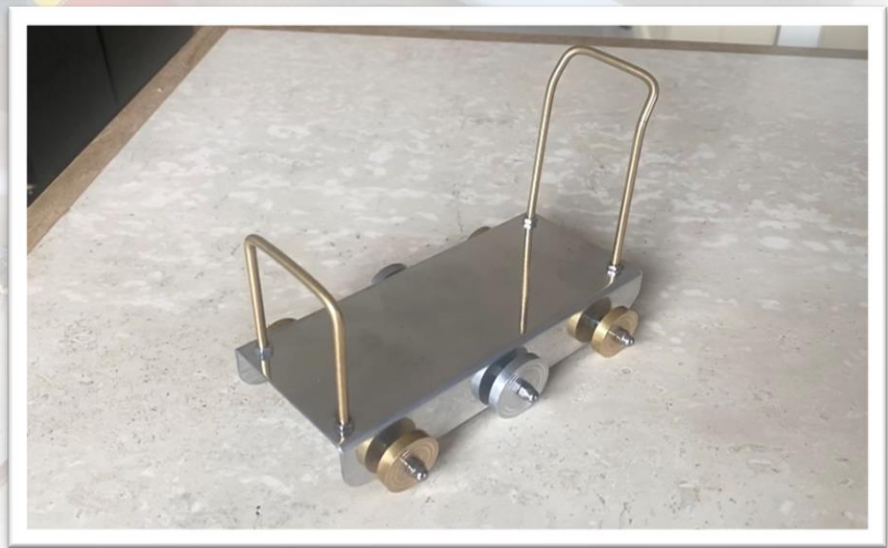
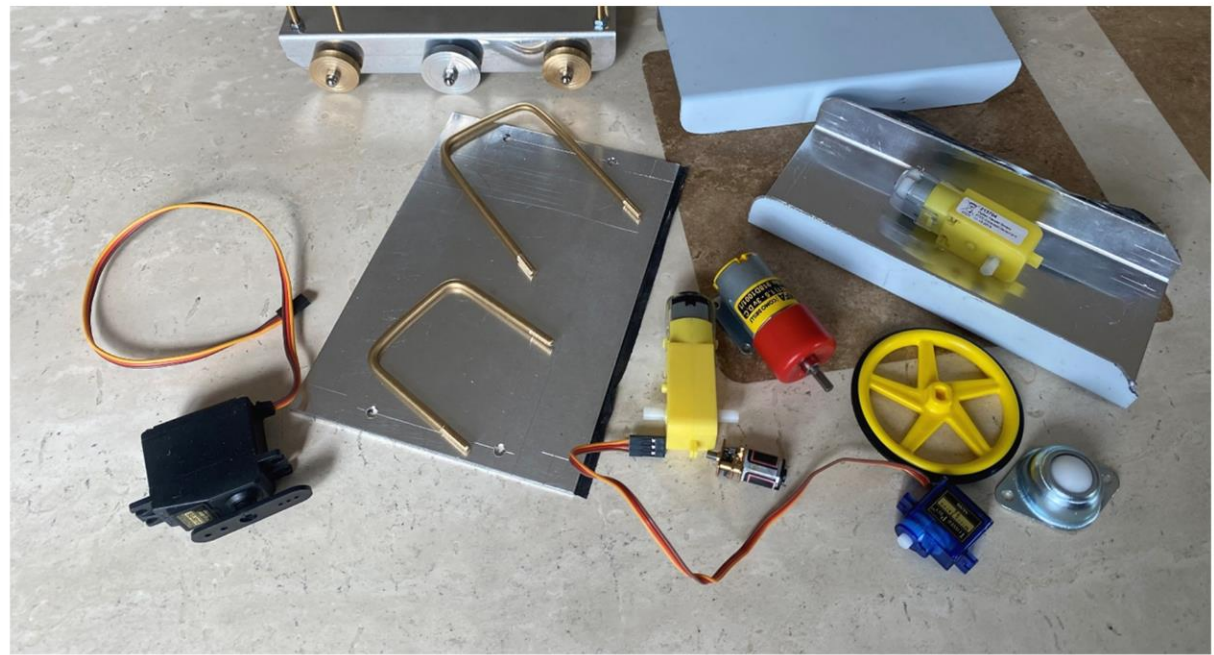
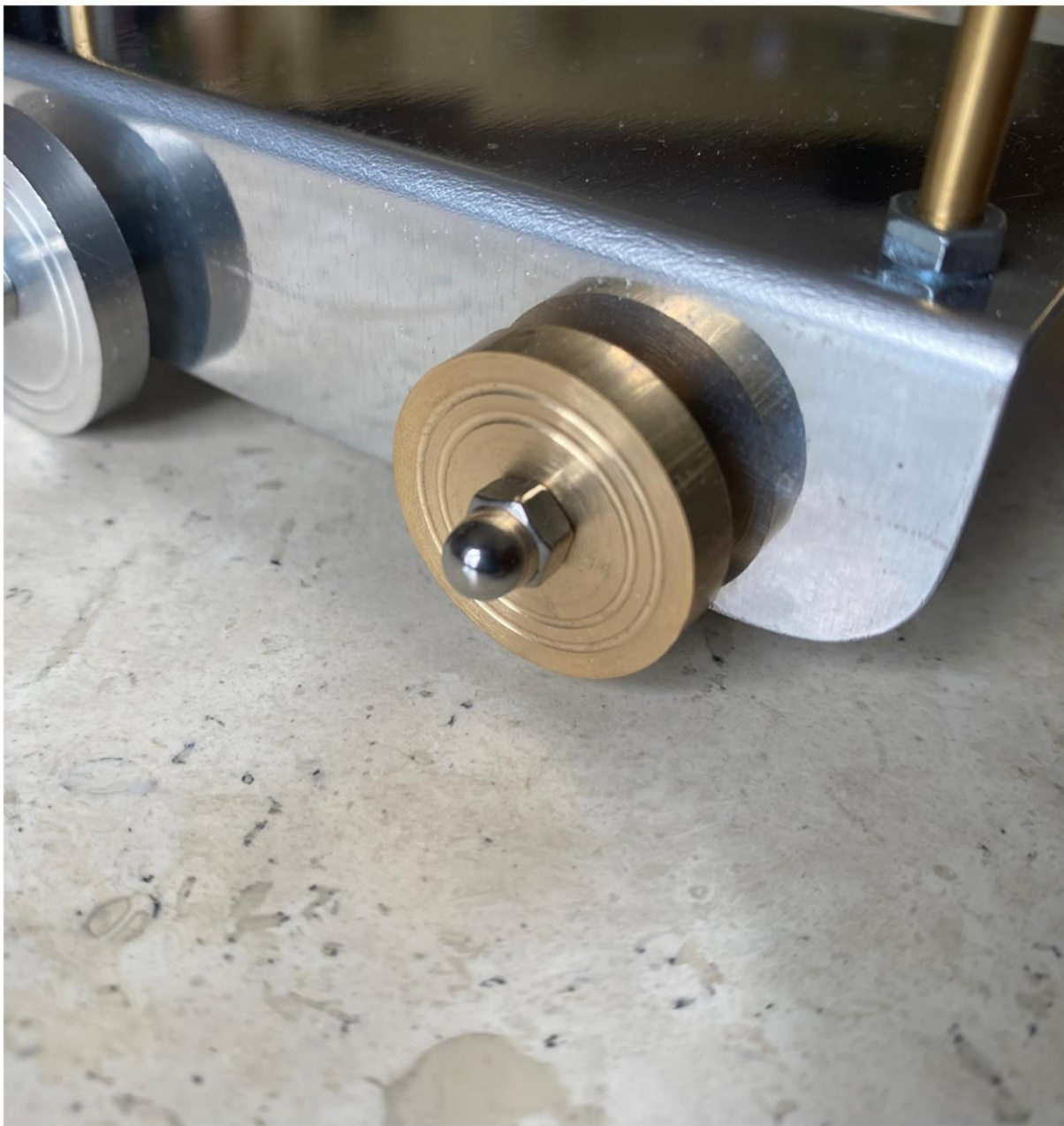


Feedback



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





Learner Experience

Resource: Student Context and Initial Research Sample videos



2nd Year Group





Oide

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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 all



Success Criteria for Research- My research should:

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



The compar strain on wo They have t incorporate:

- A mo
- A sir warel

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?

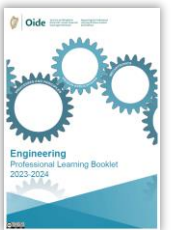
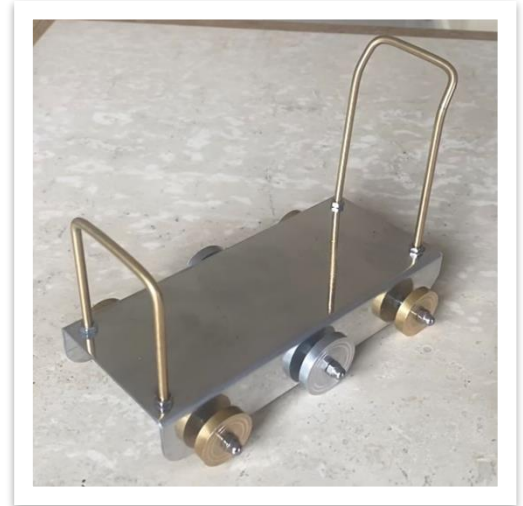


List examples of drive systems that are commonly used? How could I apply this to my cart?

Reflection Point: What am I being asked to do?



Oide



Pg.10



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 all similar to the traditional U boat cart design as shown below.

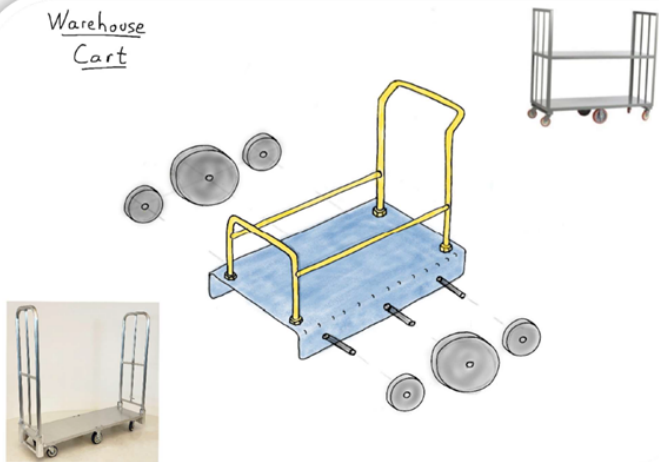


The company would like to add a drive system to the carts to reduce physical strain on workers and to allow for faster and easier transportation of heavy loads. They have tasked you, the engineer, with upgrading their existing carts to incorporate:



- 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.

Warehouse
Cart

**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?





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?

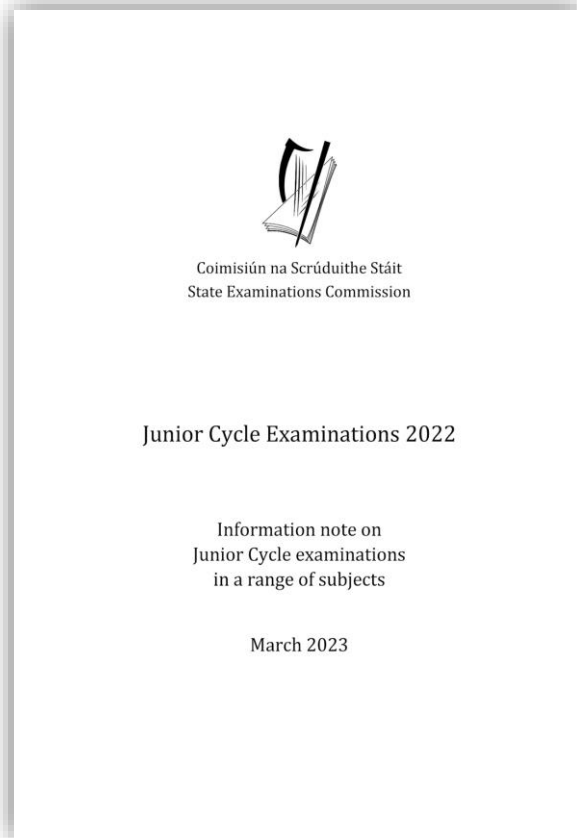
On reflection, have I created a solution that meets the needs of this project/brief? If so, how? If not, why?



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



Oide



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

on skill in the subject. Every opportunity to ng skills in the classroom should be taken. Sketching trials, tools, joints, design ideas, processing

and lamination were exhibited by many

‘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

achievement to full effect when engaging with the written examination.

29

35

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

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Engineering Challenge



Oide

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



Oide



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



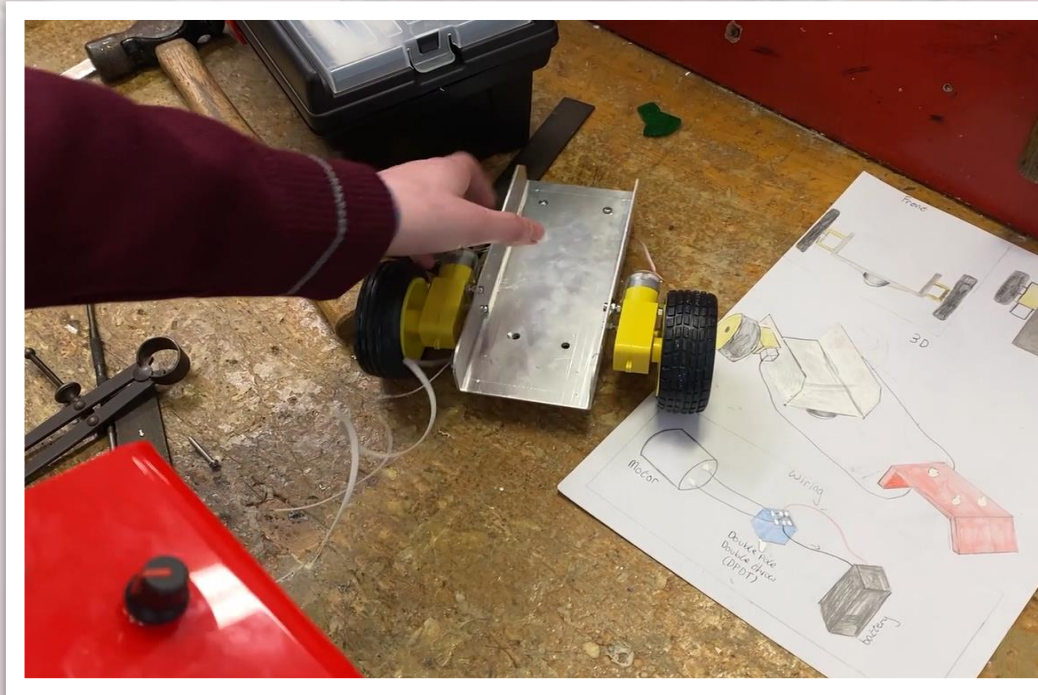
Learner Experience



Oide



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



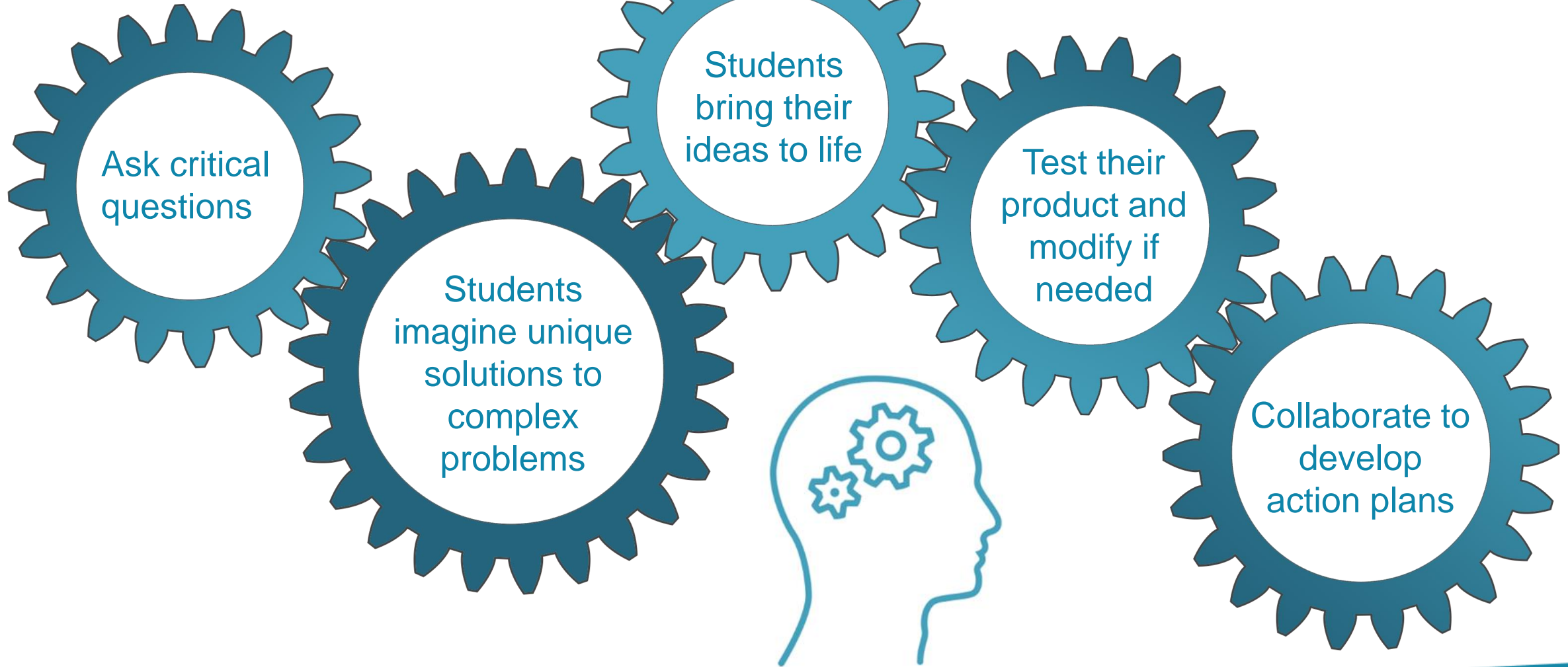
How are the students behaving as engineers in this learning experience?



Behaving as Engineers



Oide



<https://www.engineeringpassion.com/developing-the-engineering-mindset/>
<https://raeng.org.uk/media/brijknt3/thinking-like-an-engineer-full-report.pdf>

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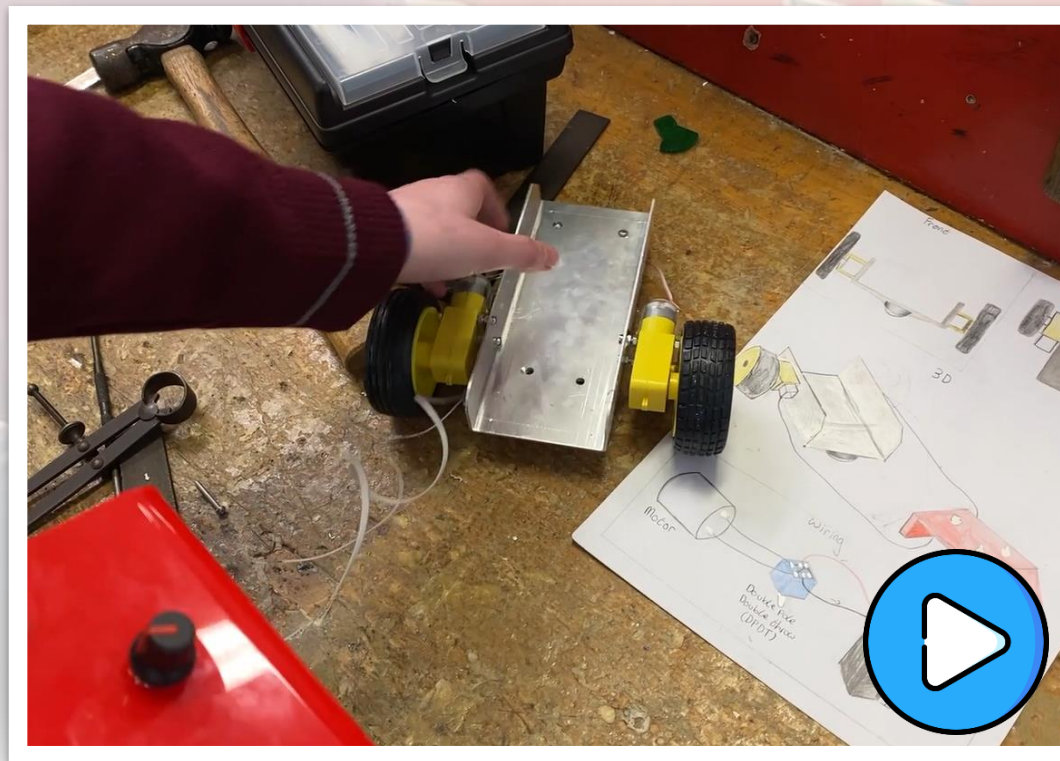
Learner Experience

Project: Warehouse Cart

Task: Steering and Drive System



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College

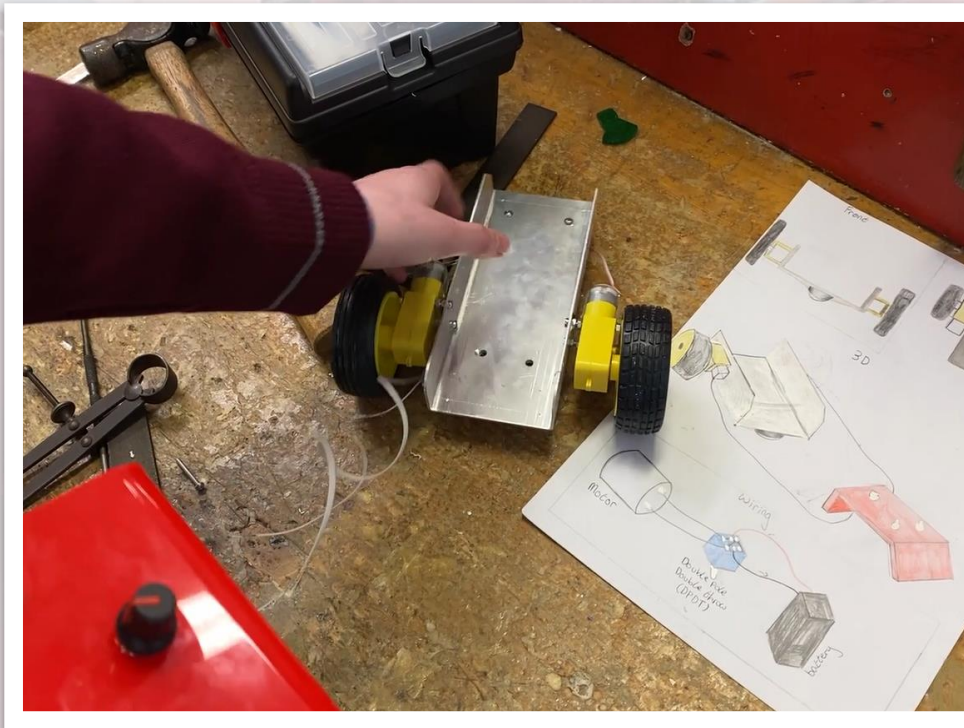




Learner Experience



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



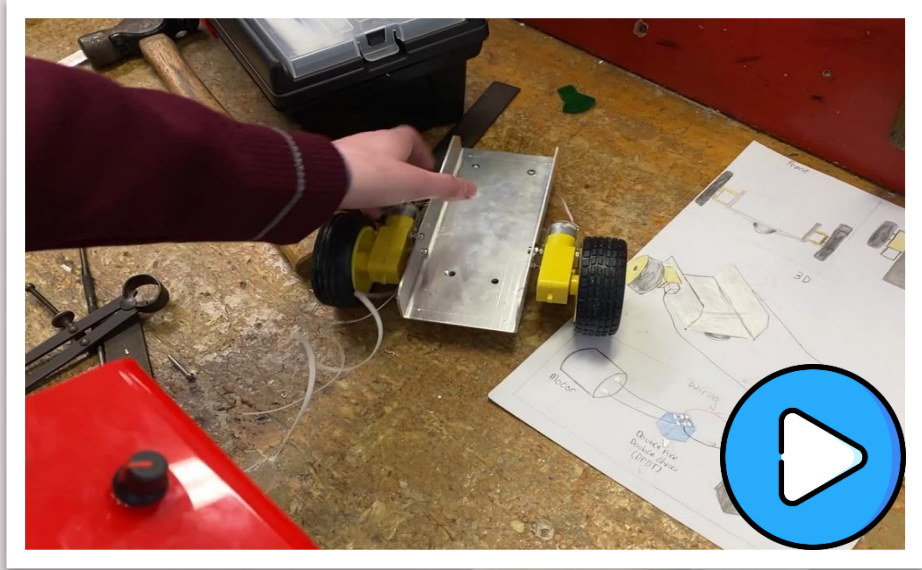
How are the students behaving as an engineers in this learning experience?

Teacher Experience

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



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



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



Oide

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

The screenshot shows a digital planning tool with the following sections:

- Student Context:** A text input field.
- Prior Learning:** A text input field.
- Focus of Learning:** A text input field.
- Chosen Learning Outcomes:** A text input field.
- Key Learning:** A text input field with the subtext "Using additional resources to support your thinking".
- What resources would be needed?:** A text input field.
- How could the key learning be assessed?:** A text input field.
- Communicate a practical learning experience to activate key learning:** A large text area for notes.

At the bottom, there are social media icons for Oide, a website link, and a Twitter handle @Oide_PP_Tech.

PROCESSES
AND
PRINCIPLES

MECHATRONICS

Planning:



Reflect



5 minutes

Putting a Plan in Place



Oide

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Communicate a practical learning experience to activate key learning:

Student Context:

Prior Learning:






Form of Learning:

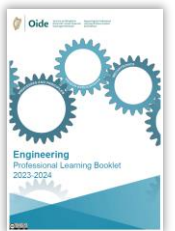
Chosen Learning Outcomes:

Key Learning:
Using action verbs to support your thinking.

What resources would be needed?

How could the key learning be assessed?

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Pg. 13



Putting a plan in place

Identify the focus of the student learning:

Electronics

Assembly

Marking Out

Coding

Material Properties

Forces & Motion

Mechanisms

Communication

Mechatronics

Interpreting a Drawing

Health and Safety

Soldering

Design

Bench Skills

Machine Tools

The screenshot shows a web-based planning form for Oide. It includes sections for 'Student context', 'Prior Learning', 'Focus of Learning', 'Chosen Learning Outcomes', 'Key Learning', 'What resources would be needed?', and 'How could the key learning be assessed?'. The form is currently blank, with a large white area for notes on the right side.

Planning:



Reflect




5 minutes

Putting a Plan in Place



Oide

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Communicate a practical learning experience to activate key learning:

Student Context:






Prior Learning:

Focus of Learning:

Key Learning:
Using action verbs to support your thinking.

What resources would be needed?

How could the key learning be assessed?

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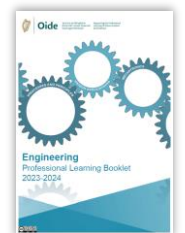
Planning:



Reflect



8 minutes




Pg. 13

Putting a Plan in Place



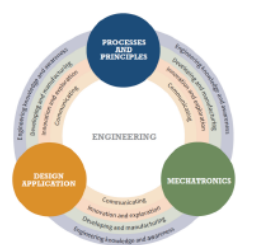
Oide

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




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Junior Cycle Engineering – Learning Outcomes



	Strand 1: Processes and principles	Strand 2: Design application	Strand 3: Mechatronics	
<p>Apply: select and use information and/or knowledge and understanding to explain a given situation or real circumstances</p> <p>Appreciate: recognise the meaning of, have a practical understanding of</p> <p>Build: construct by putting parts or material together</p> <p>Choose: pick out as being the best or most appropriate of two or more alternatives</p> <p>Configure: arrange or put together in a particular form or configuration</p> <p>Communicate: use visual, gestural, verbal or other signs to share meaning or exchange information; interaction between sender and recipient; both work together to understand</p> <p>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</p> <p>Demonstrate: prove or make clear by reasoning or evidence, illustrating with examples or practical application</p> <p>Design: planning the features of a solution that solves a perceived user problem</p> <p>Develop: advance a piece of work or an idea from an initial state to a more advanced state</p> <p>Engage: enter into or become occupied by an activity or interest; to attract or hold interest and attention</p> <p>Engineer: develop/build an item for a specific purpose that includes critical-to-function components</p> <p>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</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>Students should be able to:</p> <ol style="list-style-type: none"> 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 1.5 research applications of existing and emerging technological developments 1.6 engage with the various engineering disciplines by relating them to everyday application 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 1.11 create sketches, models and working drawings 1.12 interpret working drawings 1.13 use appropriate technical language and notations 	<p>Students should be able to:</p> <ol style="list-style-type: none"> 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 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 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 2.11 present ideas through modelling and prototyping, using appropriate media 2.12 communicate their design decisions using suitable media 	<p>Students should be able to:</p> <ol style="list-style-type: none"> 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 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 3.8 build and test a basic mechatronic system with specific inputs or outputs 3.9 incorporate basic mechatronics into their engineered products 3.10 represent key information using appropriate media 3.11 justify their choice of the most appropriate system or systems for a specified purpose
			<p>Explain: give a detailed account including reasons or causes</p> <p>Explore: to think or talk about something in order to find out more about it</p> <p>Identify: recognise patterns, facts, or details; provide an answer from a number of possibilities; recognise and state briefly a distinguishing fact or feature</p> <p>Incorporate: take in or contain something as part of a whole</p> <p>Interpret: use knowledge and understanding to recognise trends and draw conclusions from given information</p> <p>Investigate: observe, study, or make a detailed and systematic examination, to establish facts and reach new conclusions</p> <p>Justify: give valid reasons or evidence to support an answer or conclusion</p> <p>Manufacture: something made from raw materials by hand or by machinery</p> <p>Modify: to alter one or more particulars of an object/product</p> <p>Present: make objects perceivable for others</p> <p>Program: to instruct a device or system to operate in a particular way or at a particular time</p> <p>Recognise: identify facts, characteristics or concepts that are critical (relevant/appropriate) to the understanding of a situation, event, process or phenomenon</p> <p>Represent: bringing clearly and distinctly to mind by use of description or imagination</p> <p>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</p> <p>Test: establish the quality, performance, or reliability of something</p> <p>Understand: have and apply a well-organised body of knowledge</p> <p>Use: apply knowledge or rules to put theory into practice; employ something in a targeted way</p>	



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.

Putting a Plan in Place



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Student Context:

Prior Learning:

Focus of Learning:

Chosen Learning Outcomes:

Key Learning:

Using action verbs to support your thinking.

What resources would be needed?

Communicate a practical learning experience to activate key learning:

How could the key learning be assessed?

Planning:



Reflect



15 minutes



Pg. 13



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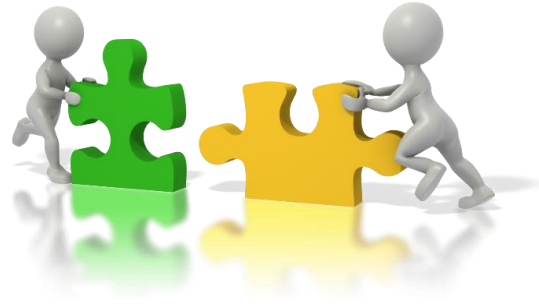
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Reflection Point



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How did you find this process?

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

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Communicate a practical learning experience to activate key learning:

Student Context:	
Prior Learning:	
Focus of Learning:	
Chosen Learning Outcomes:	
Key Learning: Using action verbs to support your thinking	
What resources would be needed?	How could the key learning be assessed?

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Junior Cycle Engineering – Learning Outcomes

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

Strand 2: Design application
In this strand, the design process in engineering contexts is derived from the key phases of the engineering design and manufacture process. They learn about the importance of design for both the end-use experience and the economic and social impact of the product. They discover how the combination of material choice, form, and correct processes produces a solution that is functional and without compromise. They appreciate the value of good design management and learn how to compare alternatives and the process of product development from concept to production.

Strand 3: Mechatronics
In this strand, students may work with combinations of mechanical, mechatronics, electronic and computing systems and software to explore technology, systems, remote tools, processes and outputs. They will learn about systems, and how they may be combined to ensure the desired output. Students develop the practice to appreciate how control systems operate on a large scale and how the design of control systems can impact on the environment and sustainability. They appreciate the role that engineers have in improving systems through the design process and review how controls contribute to a better future.

Explain: give a detailed account/understanding of reasons or causes
Explore: to learn or gain 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 factor/feature
Incorporate: take in or contain something as part of a whole
Interpret: use knowledge and/or 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 to be used by machinery
Modify: to alter one or more particulars of an object/product
Predict: make a judgment/forecast for others
Program: to instruct a device or system to perform in a particular way or at a particular time
Recognise: identify facts, characteristics or concepts that are critical (relevant) to the understanding of a situation, event, process or phenomenon
Represent: bring/put down and describe to mind to use in 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 skill to put theory into practice; employ something in a targeted way

Students should be able to:

Engineering knowledge and awareness

- 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 engineering materials

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 information interaction between an end user and the engineer to understand the 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

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 the chosen changes
- 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

Communicating

In 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

Students should be able to:

Design application

- 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

Design process for manufacturing

- 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

Mechatronics

- 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 mechatronics in a controlled system

Design process for mechatronics

- 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
- 3.8 build and test a basic mechatronic system with specific inputs or outputs
- 3.9 incorporate basic mechatronics into their engineered products
- 3.10 represent key information using appropriate media
- 3.11 justify their choice of the most appropriate system or systems for a specified purpose

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LOGIC GATES

The building blocks of digital circuits

Logic gates are formed of two digital components called transistors. These transistors are wired together to create a circuit that can perform logical operations. The circuit is called a logic gate. The circuit is made up of several logic gates. The circuit is made up of several logic gates. The circuit is made up of several logic gates.

AND Gate
On the AND gate, all the inputs must be TRUE to produce the output as TRUE.

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

NOT Gate
A NOT gate inverts the input. If the input is TRUE, then the output will be FALSE.

A	B
0	1
1	0

OR Gate
An OR gate is a digital version of a switch. If either input is TRUE, then the output will be TRUE.

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

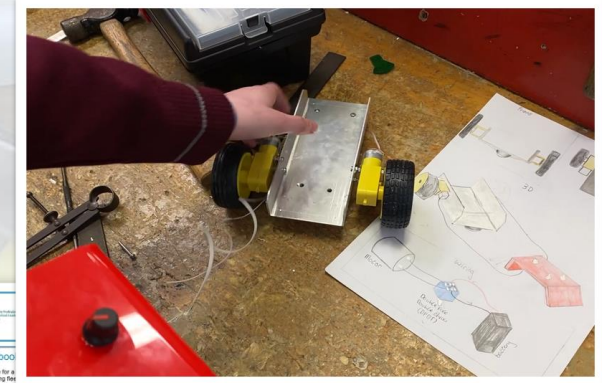
NAND Gate
A NAND gate is a combination of an AND gate and a NOT gate.

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

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



Oide Engineering - Project Logbook

You are the on-site engineer in a workshop for a company are seeking to upgrade their existing forklifts which are all similar to the traditional Crown cart 4.

The company would like to add a time 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 produce in the warehouse.

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?

Oide Creating a Laser Cutting Gauge

This resource is a series of video tutorials and document files. In this resource, we explore the benefits of using laser gauges to determine power and speed settings for cutting and engraving using a laser cutting machine. We also explore how to create a laser gauge for use with materials in the Engineering room.

Scan the QR codes or click the images below to access the associated resources

1. Introduction to Colour Mapping on the Laser Cutting Machine
2. Preparing the Laser Design Illustration
3. Setting Up the Laser Design Illustration
4. Colour Map Settings for the Laser Cutting Machine
5. Setting up the Laser Design Illustration
6. Colour Map Settings for the Laser Cutting Machine
7. Colour Mapping Reference Sheet
8. Laser Design Illustration File
9. Laser Design Illustration File

Scan the QR code to access a resource for this activity.

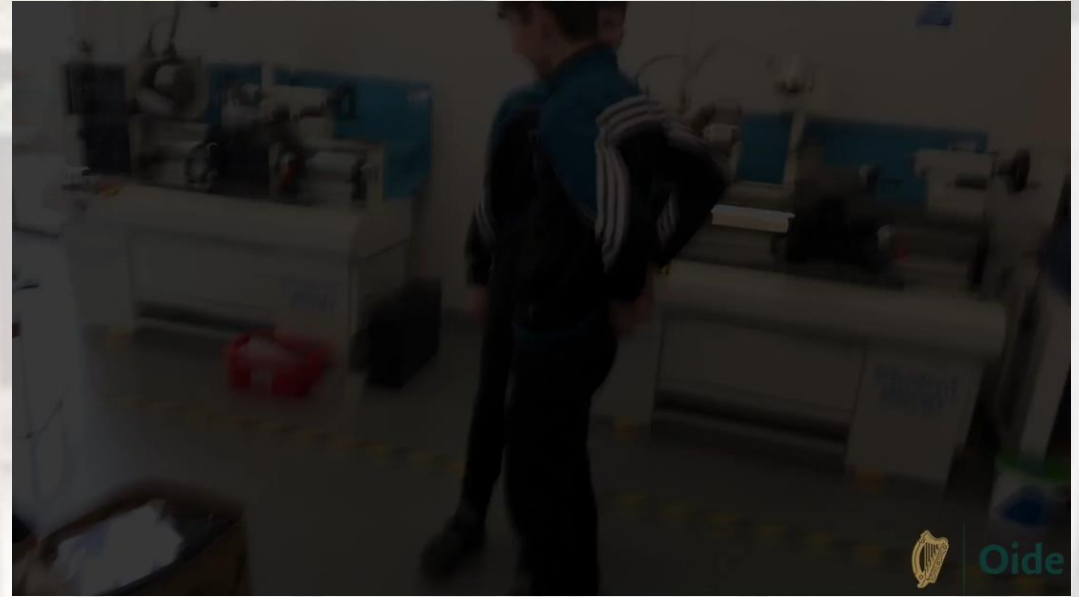
Could you represent this circuit using a symbol, or a group of symbols? Sketch your solution in the box opposite.



In this session - we will...



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



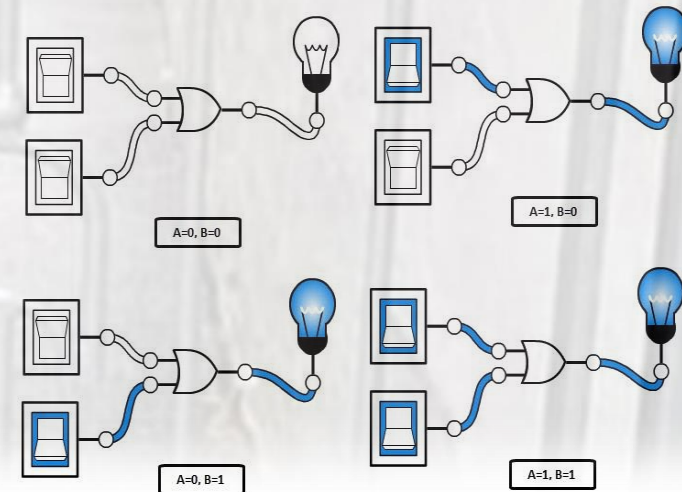
How could the car make the decision?

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

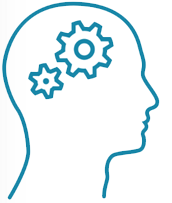


Reflection Point



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

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.

A NOT gate is a digital version of a simple INVERTER circuit you could make in the Engineering room using switches

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 using switches

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

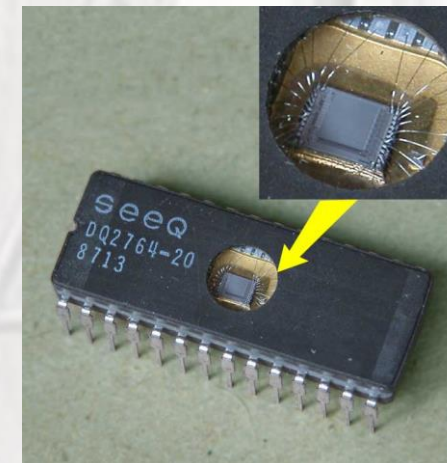
A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

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

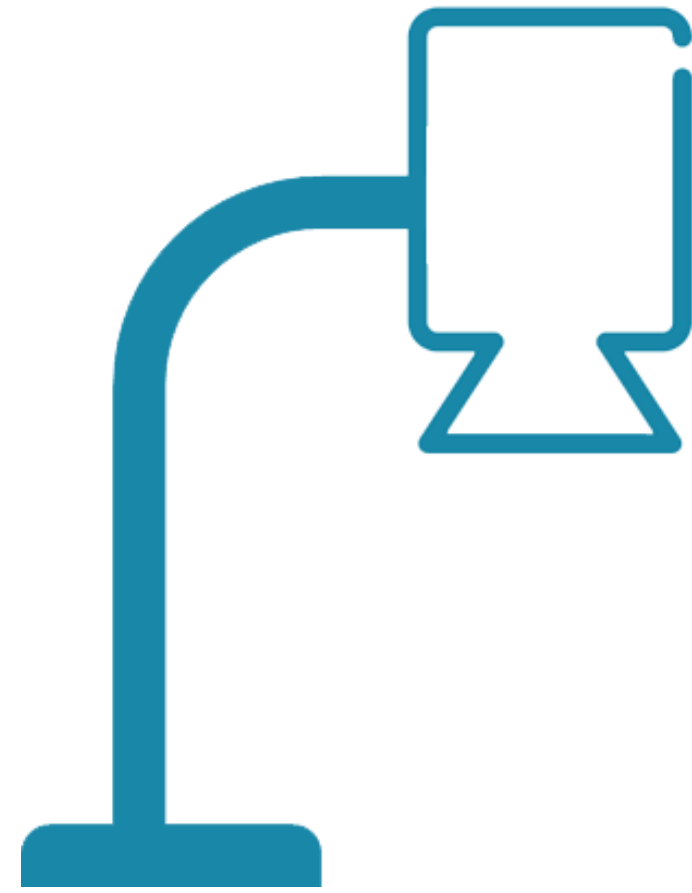
A	B	C
0	0	1
0	1	0
1	0	0
1	1	0





Visualiser Activity

Switches, transistors and logic gates



LOGIC GATES
The building blocks of digital circuits

AND Gate
On the AND gate, all the inputs must be TRUE to obtain the output to be TRUE.

OR Gate
On the OR gate, if any input is TRUE, the output will be TRUE.

NOT Gate
A NOT gate takes one input and produces the opposite output.

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

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

Truth Tables

AND Gate Truth Table

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

OR Gate Truth Table

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

NOT Gate Truth Table

A	B
0	1
1	0

NAND Gate Truth Table

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

NOR Gate Truth Table

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

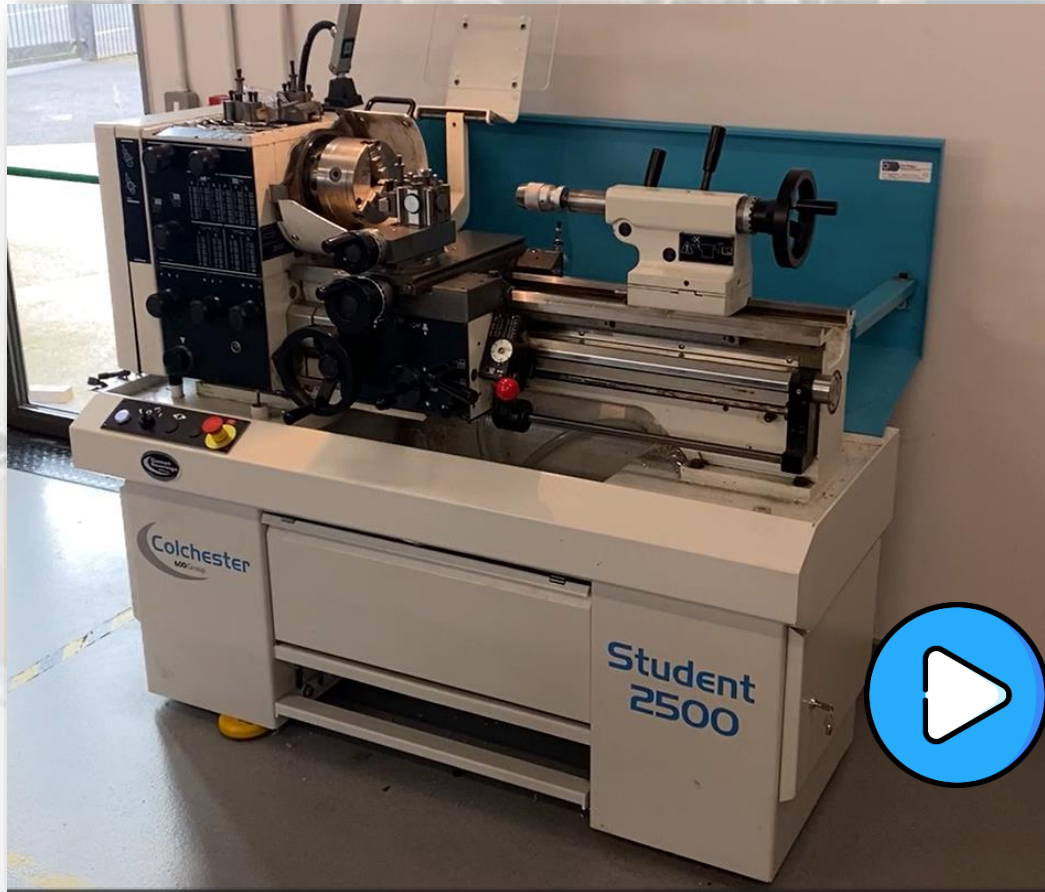
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Logic gates are groups of two digital electronic components. These transistors are assembled on a silicon chip and are known as ICs. The circuitry on the chip is made up of logic gates. The transistors in logic gates are connected to form a circuit. To check the size or accuracy of the transistors built on a chip, we use a TRUTH TABLE.

Learner Experience: Logic Gates in the Engineering Room




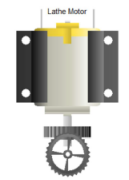


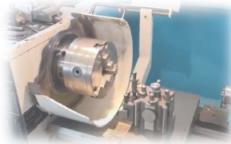
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Logic Gate Activity One: Circuit Design

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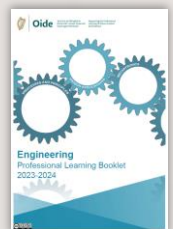

Logic Gates Worksheet 1
Having watched the lathe video, design a simple logic circuit to control the lathe using two inputs, the chuck guard, and the On/Off switch.



Scan this QR code to view a stimulus video for this activity.



Draw a logic gate symbol, in the box opposite, to represent the circuit you have completed above. The logic gate that could control this circuit is called a _____.

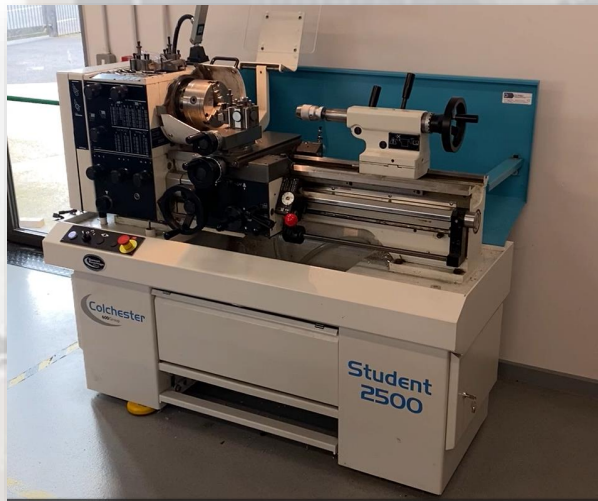


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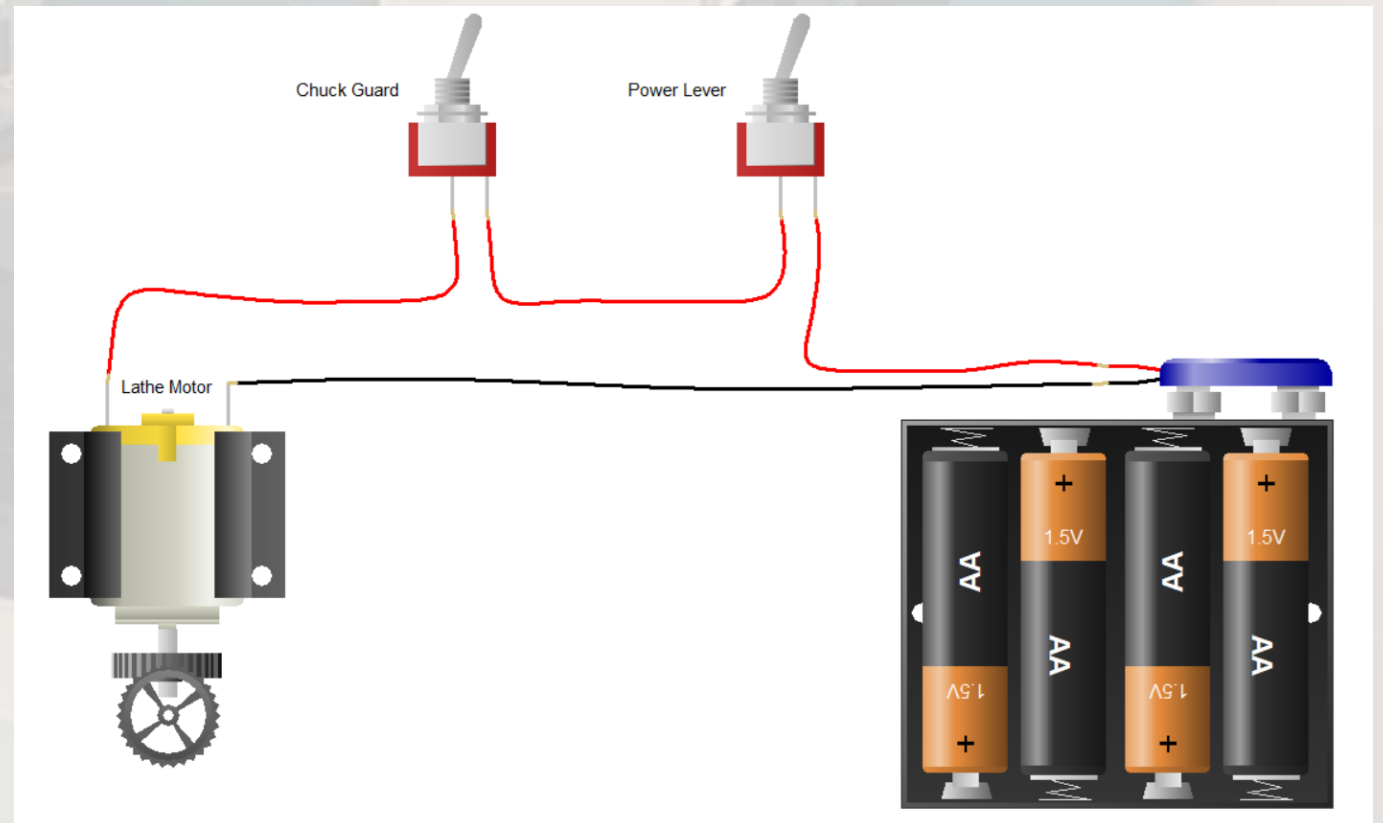
Logic Gates in the Engineering Room



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Potential “AND” logic gate to control the lathe



Other potential learning experiences



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Oide Supporting Professional Learning of School Leaders and Teachers

Logic Gates Worksheet 2
Design a logic circuit to safely operate the drill when required by the student.










Scan this QR code to view a stimulus video for this activity.

Could you represent this circuit using a symbol, or a group of symbols? Sketch your solution in the box opposite.

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Logic Gates Worksheet 3
Design a circuit to turn on the comfort light inside the car if any of the doors are opened.




Scan this QR code to view a stimulus video for this activity.


Draw a logic gate symbol in the box to the right to represent the circuit you completed above. The logic gate that could control this light is called a _____.

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Logic Gates Worksheet 4
Alarms, such as typical home alarms use simple logic gates to operate. Draw a suitable circuit using a logic gate(s) to sound the siren if either the front or back door is opened.




Input A – Front Door



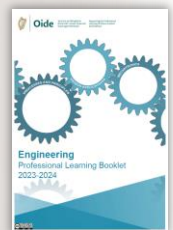
Input B – Back Door



Output C – Alarm Siren



Scan this QR code to view a stimulus video for this activity.



Pg. 15-16

Logic Gates



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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

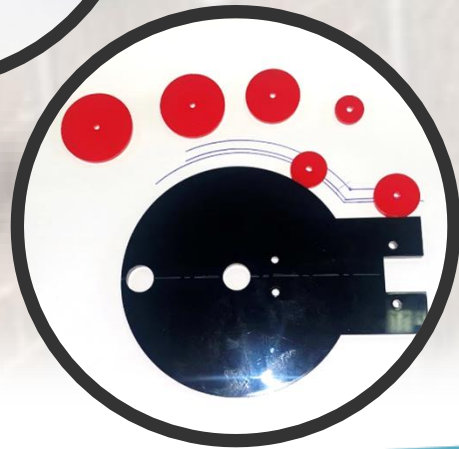
Using the Laser Cutter to Create Teaching and Learning Resources



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Engineering Online Learning Event 2023:

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



Resources to Support Teachers



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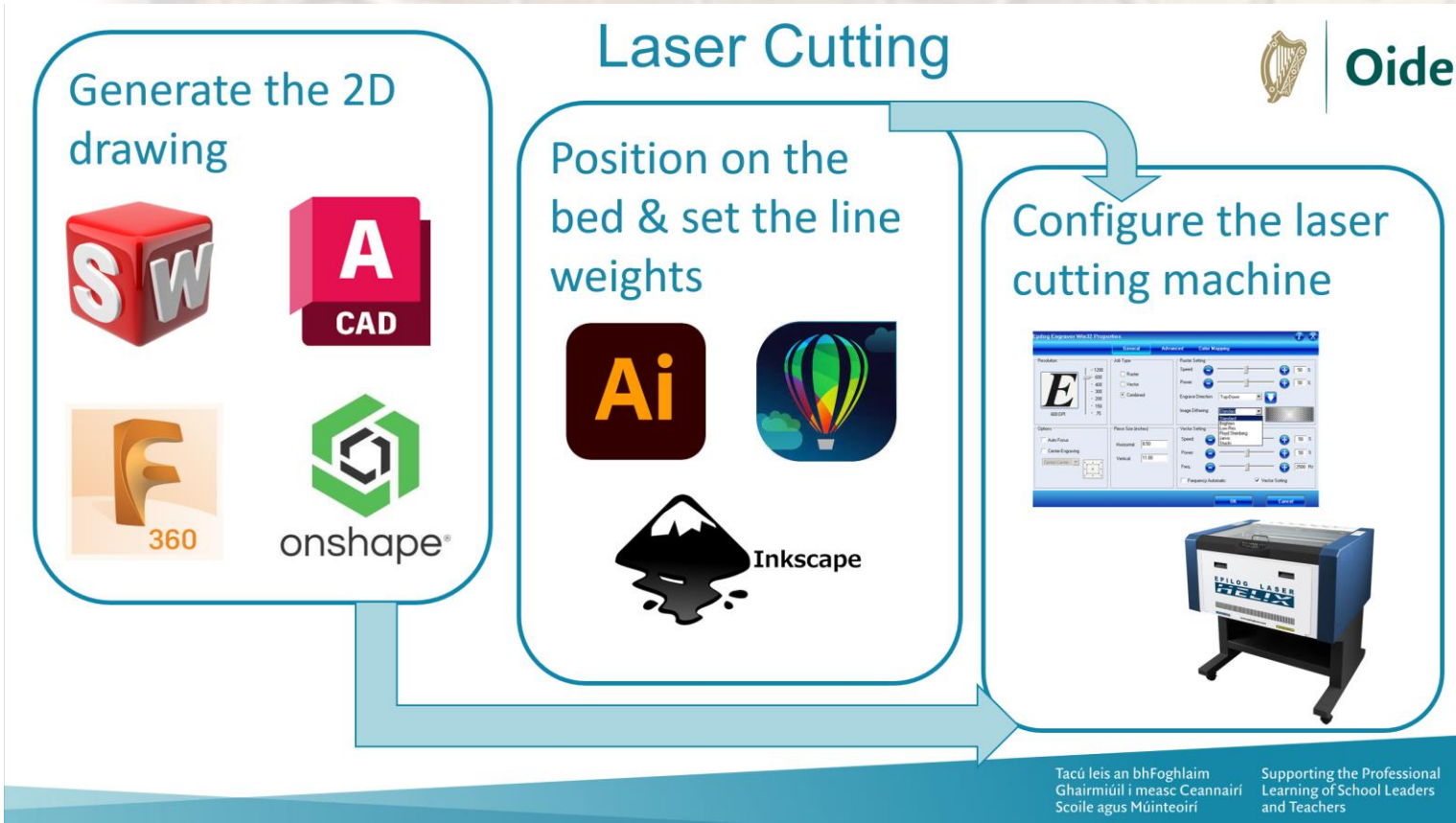
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Supporting the Professional Learning of School Leaders and Teachers

Using The Laser Cutter to Create Teaching and Learning Resources



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Creating a Laser Cutting Gauge

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2. Preparing the Laser Gauge in Illustrator
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4. Colour Map Settings for the Raster Engraving on the Laser
5. Setting up the Laser Gauge for Vector Cutting in Illustrator
6. Colour Map settings for Vector Cutting on the Laser
7. Colour Mapping Reference Guide
8. Laser Gauge Raster Engraving File
9. Laser Gauge Vector Cutting File

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Supporting the Professional Learning of School Leaders and Teachers

Feedback



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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



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Supporting the Professional
Learning of School Leaders
and Teachers

Engineering

PLE Day 2023 - 2024

***Thank you for your participation
in today's session***

