An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

JUNIOR CYCLE FOR TEACHERS

An tSraith Shóisearach do Mhúinteoirí

Junior Cycle Engineering Activities

Classroom activities for the physically distanced classroom for the school year 2020/2021

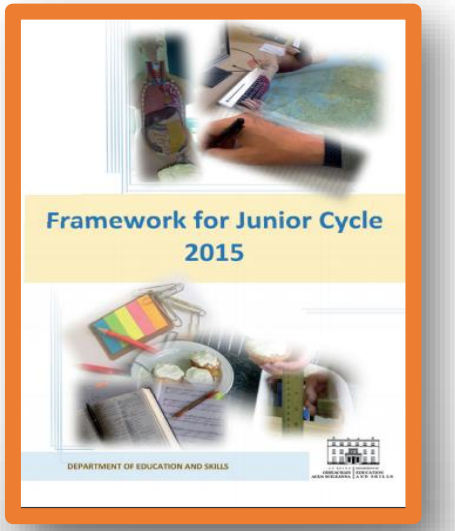
Introduction

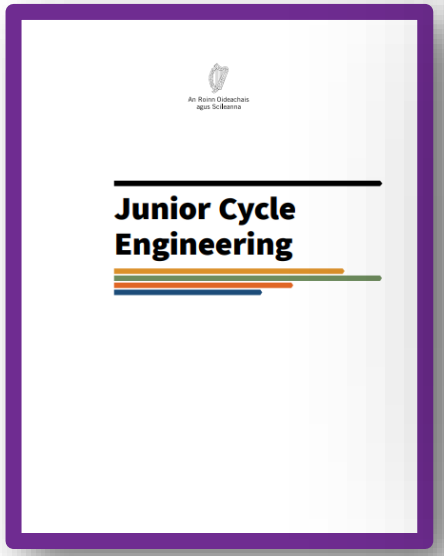
Junior Cycle for Teachers (JCT) is a dedicated continuing professional development (CPD) support service of the Department of Education and Skills. Junior Cycle for Teachers aims to inspire, support and empower teachers in the transformation of Junior Cycle education in Ireland. Responsibility for the four Junior Cycle Technologies subjects (Applied Technology, Engineering, Graphics and Wood Technology) within JCT lies with the dedicated Technologies team, commonly known as JCt4.

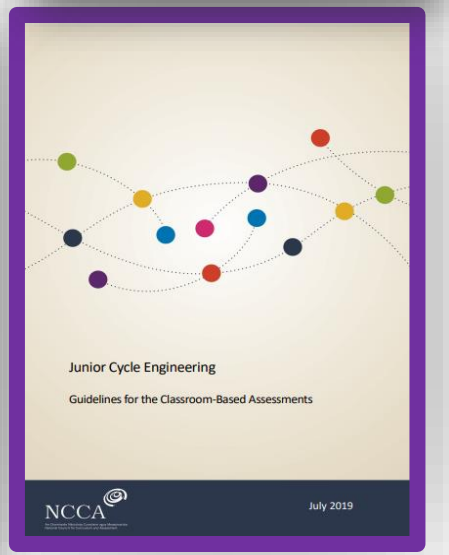
In the development of this resource, the JCt4 team aim to create rich learning experiences to complement the Junior Cycle specifications, particularly in the wider context of students and teachers returning to school with COVID-19 procedures in place. The resources created are not designed to be used in a linear fashion, but rather to support the creation of learning experiences that work for individual schools in their individual contexts. Potential links with other subjects and potential to explore these topics in other areas of learning within Junior Cycle are encouraged throughout and again, teachers would be encouraged to adapt and explore these links to suit their own students' and school context.

As you explore this resource, you may identify potential links with other subjects and potential to explore these topics in other areas of learning within Junior Cycle. Please let us know your experience of using these resources on social media via **@JCt4ed** and **@JCforTeachers**

Contents





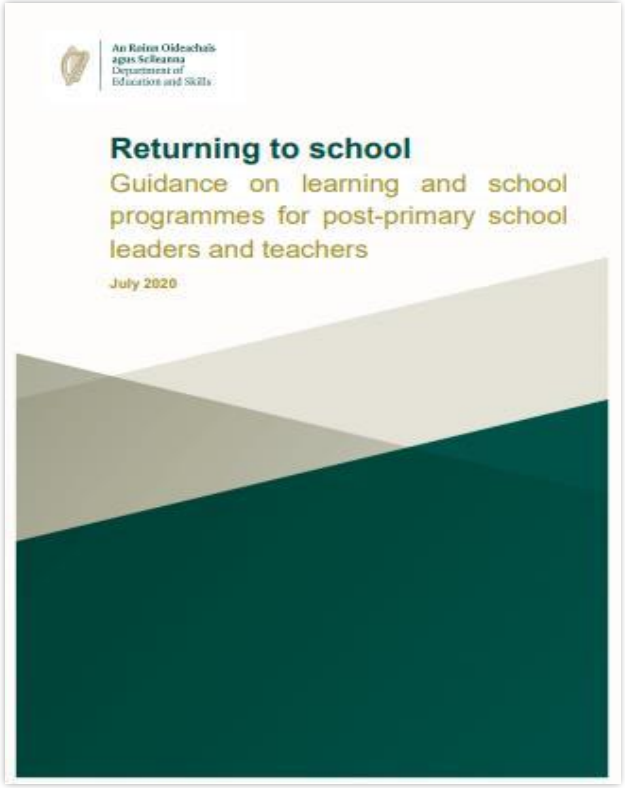


Key documents underpinning this resource

Click for documents

Identifying the starting points of learning

Students will have a variety of needs as they return to school and teachers will need to provide learning experiences to meet those needs. Accordingly, teachers will be need to be alert to where their students are at; they will need to take time to evaluate students' needs, and may need to and wish to consolidate previous learning before introducing new learning. Key to this is an approach which builds on students' strengths. In that regard, some important questions for teachers and subject departments are:



Adapted from pages 13 and 14

Have I reflected on the learning progress students have made?

Have I identified a range of formative assessment measures to assess the progress that students have made?

Have we as a subject department reviewed subject specifications and identified learning outcomes that are priorities for the return to school?

Have cross curricular learning opportunities been identified and planned collaboratively to maximise learner outcomes?

Preparation for teaching and learning

Building on their assessment of students' learning as outlined above, teachers will make key decisions about what students learn, the sequence in which they learn, the pace at which they learn and the activities and experiences through which they learn. Teachers and schools are best placed to make these decisions and to exercise their professional judgement and the autonomy they have in this context. The following questions may support teachers to reflect on their preparation for teaching and learning:

Has my lesson planning taken account of collaborative decisions about teaching and learning including decisions about essential learning, the sequencing of learning, the pace at which students learn and the activities and experiences through which they learn?

Do the planned learning experiences provide for social interaction and collaboration between students?

Do the planned tasks assess the learning outcomes or objectives that have been prioritised over a series of lessons?

Are planned learning tasks and activities accessible to all students, including those with special and additional educational needs?

Adapted from pages 13 and 14

Learning Approaches

It is essential that, right from the start of the school year, a broad range of active learning experiences is provided for all students. This should include:

Adapted from pages 13 and 14

- Prioritising practical lessons to enable students to demonstrate skills and knowledge developed during engaging with learning from home
- Providing learning experiences based on pair work and group work that support student interaction and engagement in meaning-making; this will help in achieving learning outcomes/objectives across the curriculum, particularly in the areas of language, mathematics, business, science and technology and the arts
- Integrating digital technologies in a responsive and innovative way into teaching, learning and assessment
- Questioning, tasks and student-teacher conferencing; these are practical and effective assessment approaches that will be helpful in identifying the priority areas in which students' learning needs to be progressed

Key Skills

In light of the school closure and related health requirements, many schools have already adopted creative and innovative ways to introduce incoming first years to the school. Where students have not had the usual supports when moving from primary to post-primary school, the Key Skills of Junior Cycle such as Managing Myself, Managing Information and Thinking, and Staying Well should be prioritised through the school's induction and wellbeing programmes.

Adapted from Page 10

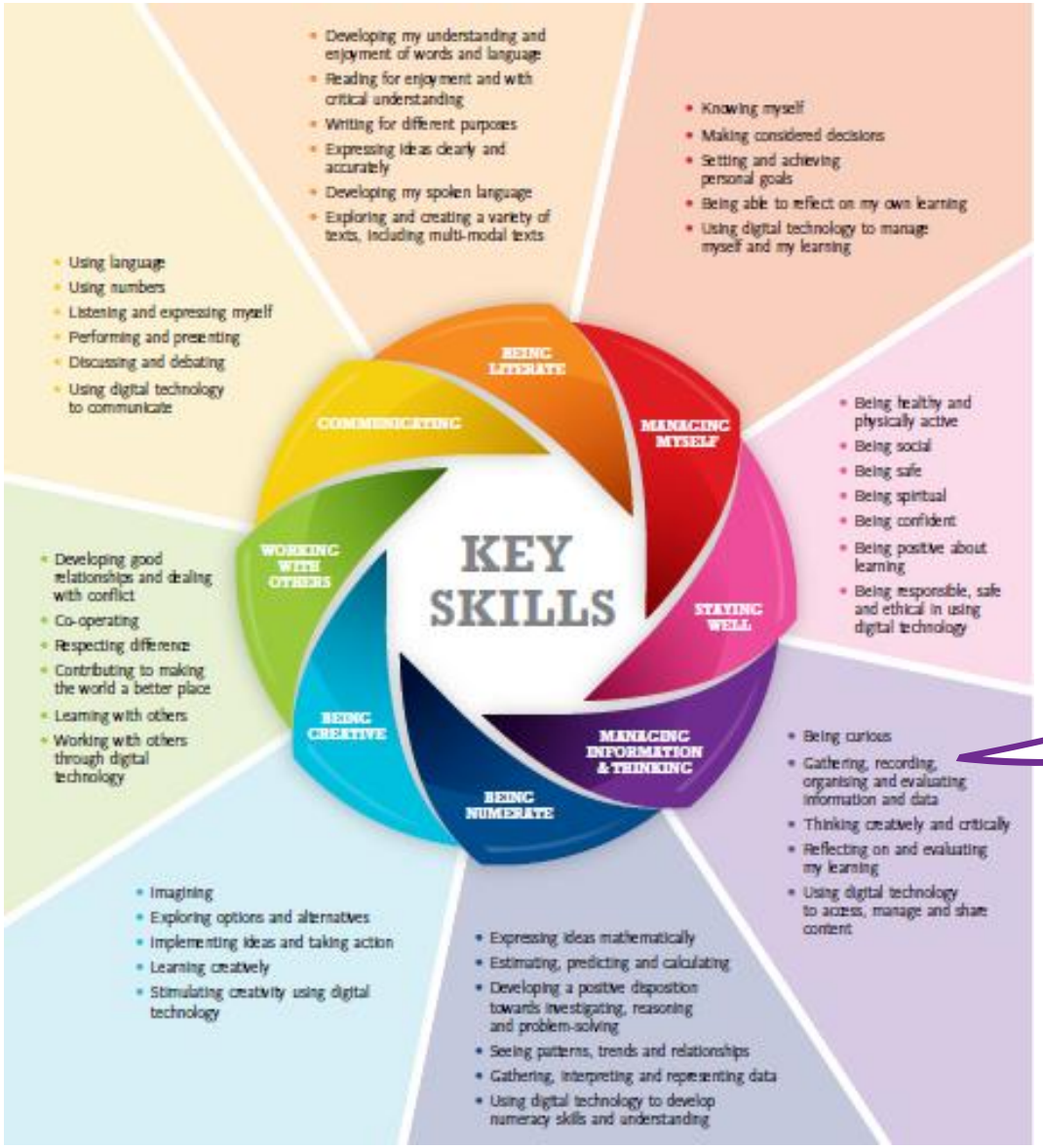
Managing Myself

Managing Information and Thinking

Staying Well

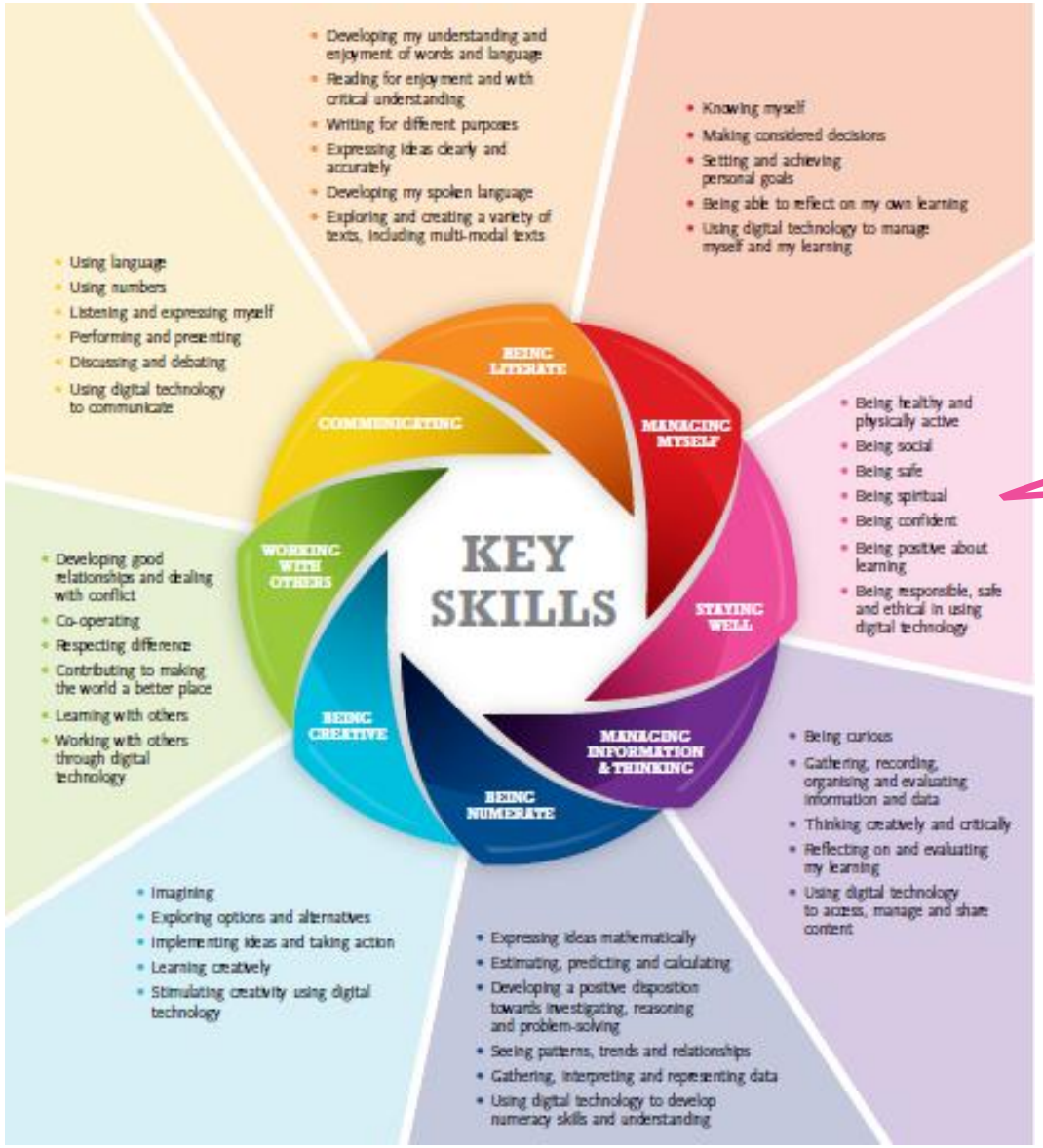
Managing Myself

- Knowing myself
- Making considered decisions
- Setting and achieving personal goals
- Being able to reflect on my own learning
- Using digital technology to manage myself and my learning



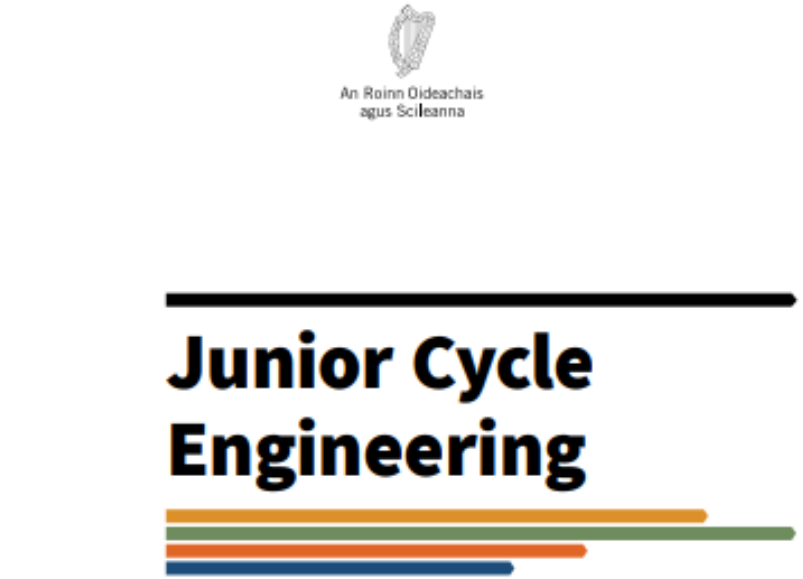
Managing Information and Thinking

- Being curious
- Gathering, recording, organising and evaluating information and data
- Thinking creatively and critically
- Reflecting on and evaluating my learning
- Using digital technology to access, manage and share content



Staying Well

- Being healthy and physically active
- Being social
- Being safe
- Being spiritual
- Being confident
- Being positive about learning
- Being responsible, safe and ethical in using digital technology



Click here for the Junior Cycle Engineering specification

The following classroom activities for Junior Cycle Engineering aim to develop the Key Skills of **Managing Myself**, **Managing Information and Thinking** and **Staying Well**. Teachers are best placed to adapt these activities to suit their students' prior learning, local context and needs.

Engineering focuses on developing students' understanding of, and skills in, the applications and impact of technologies in the world around them. This will be achieved through three interconnected contextual strands: **Processes and principles, Design application** and **Mechatronics.**

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

The achievement of learning outcomes should be planned in a way that is active and stimulating.

- adapted from the Junior Cycle Engineering specification, page 9

Engineering

Resource 1

Focus: Introduction to digital technologies in the Engineering room to support collaboration while developing the Key Skills of Managing Myself, Managing Information and Thinking and Staying Well.

Suggested Year Group: First-year

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Focus: Introduction to digital technologies in the Engineering room to support Collaboration while developing the Key Skills of Managing Myself, Managing Information and Thinking and Staying Well.

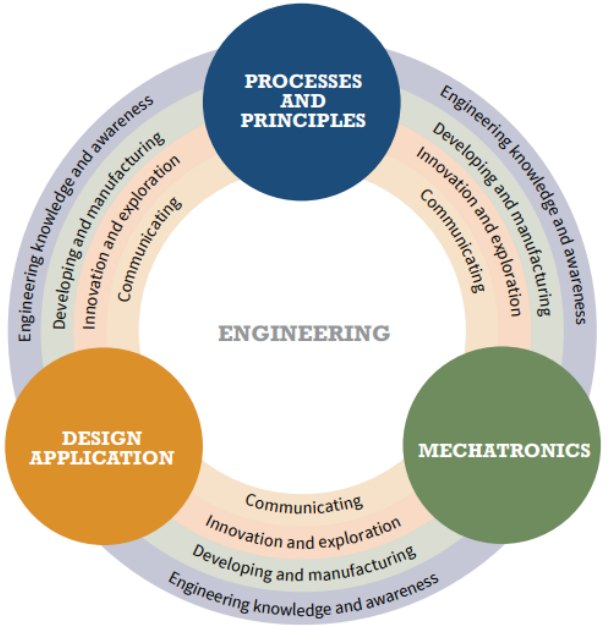
Suggested Year Group: First-year

Note to Teachers:

The following resource is designed to align with the Engineering strands, elements and learning outcomes. Contained within this resource are suggestions for a range of possible learning experiences, developed across the three strands.
The suggested activities can be used in isolation following a period of instruction or as a combination of activities. The depth and time allocated is dependant on a teacher's plan for learning and their students' prior knowledge and understanding.

Possible strands and elements which could be explored for the suggested activities in this resource are:

- **Strands:** Processes and Principles, Design Application
- **Elements**: Communicating, Engineering Knowledge and Awareness



When deciding on the learning outcomes you can engage in with these activities, you should consider class context, focus of learning and the action verbs you would like to develop with your students. The proposed list is merely a suggestion of the strands and elements which are relevant to the outlined activities that follow.

Introduction

The generation of ideas and solving problems is often achieved in Engineering by working together and sharing ideas. When students experience these collaborative approaches in the classroom, they may develop the required problem-solving skills for the real world of Engineering.

Nature of Tasks

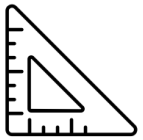
Students are asked to develop safe protocols within the Engineering room. By adhering to these protocols and engaging in manufacturing and design activities it can enhance opportunities for collaboration. Blended learning approaches can be used to support communication and feedback.

Developing collaboration through student activities

1 Health and Safety

Students are asked to **identify** some health and safety issues which currently exist in the Engineering room and **explore** new procedures for hand tools, machines, cleaning and classroom behaviour.

Working Drawing Skills



Develop an understanding to **interpret** working drawings. Teachers could use a visualiser to further **explain** some intricate areas to mark out.

Design Application

Begin the design process. **Create** a model or a prototype, physically or digitally. Students could **use** cardboard, polystyrene, foamboard or 3D software such as Tinkercad.

3 Assessment and Feedback

Students could **create** an audio presentation to **communicate** the key design features of the prototype, share ideas on a digital platform and offer feedback. This could be a teacher led or a peer-to-peer led discussion.

Peer/Group Work

Students can **develop** ideas to work in their groups safely and efficiently. Students could incorporate Padlet into their activity to **communicate** shared ideas to solve common problems with new approaches.

2 Research Development

For the purposes of research, **create** a classroom approach to allow students to give feedback in their virtual learning space and share their final comments on a mood board. Consider a virtual Think-Pair-Share.

Manufacture and Finishing

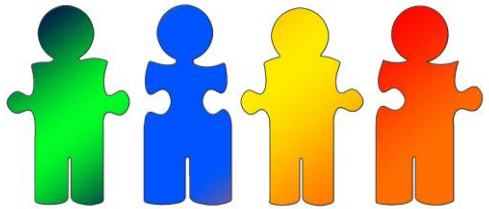
Students could develop success criteria to enhance student engagement. During the manufacturing process, a focus could be placed on accuracy, precision and high-quality finish.

What Learning Outcomes can/did you identify that will support the Key Skills which are focused on in this resource? Which activities will support those Learning Outcomes?

❶ Health and Safety

Students can consider creating new protocols for hand tools, machines, groupwork and digital technology to enhance the student experience and their health and safety in the Engineering room.




What images could I select to highlight some of the new safety protocols?

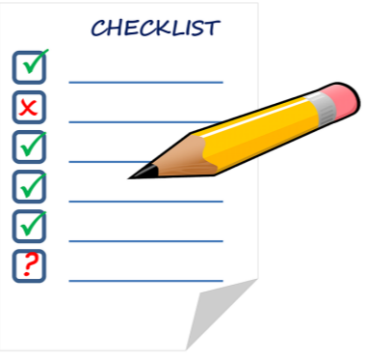
What prior knowledge do my students have in relation to health and safety?

Are there other images necessary for hand tool and machine safety in this new learning environment?

Student Approach: At this point, students could work as individuals and then share their ideas with their group digitally to begin developing collaboration skills while maintaining physical distancing guidelines.

Teacher and Students could develop a common safety statement and a set of guidelines to ensure everyone approaches health and safety with a clear goal.

How could students apply their knowledge of health and safety in Engineering to other classrooms and settings?



How can the teacher encourage students to understand the protocols and continue to practice them regularly?

Note to Teachers:
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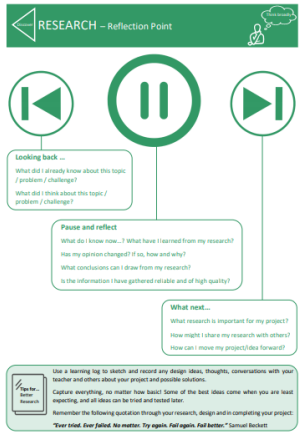
❷ Research and Development

Research allows students to pursue their interests, to learn something new, to enhance their problem-solving skills and to challenge themselves in new ways within your classroom and your school community.

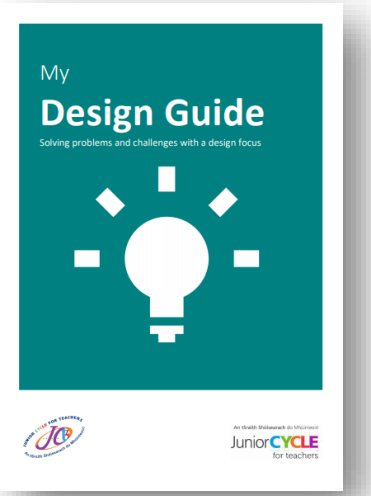
Consider a virtual 'Think-Pair-Share'. This could be done in various forms using Breakout rooms, shared PowerPoint/Google Slides, Zoom meets, Wakelet, Flipgrid, Popplet, Pear Deck and more

*Consider new possibilities by using **'My Design Guide'** when conducting research in the Engineering Classroom.*



Consider approaches to student presentations in the classroom. This could be done in various forms such as PowerPoint, Oral Presentation, Videos, Powtoon, Moodboards and more

Student Approach: Consider a 'flipped classroom' approach. This is a form of blended learning where students are introduced to content at home and practice working through this content at school. This is the reverse of the more common practice of introducing new content at school, then assigning homework and projects to be completed by the students independently at home.



For a full copy of **'My Design Guide'**, click or scan the QR code below. This may provide additional prompts for student thinking.

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Click or scan the QR codes

❸ Assessment and Feedback

Assessment and feedback expectations, standards and success criteria should be clearly communicated to students. Assessment is on-going and feedback will further engage students throughout their learning experience.

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JuniorCYCLE for teachers

Glossary of Assessment Terms and Acronyms

Could students develop self-assessment techniques to improve understanding and enhance the learner experience?

Student Approach: Consider using Padlet as a means of offering feedback to students on their online Padlet boards. As a teacher you can comment on each student and give feedback. Whenever a student recognises feedback on their Padlet board, they can instantly make those changes to improve.

padlet

Have you heard of Perusall.com? It allows students to offer feedback on a document that a teacher or students upload.

The traffic light system is a visual way of communication for the student to note their level of understanding to the teacher. This approach could be adapted in the Engineering room.

Note to Teachers:
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Click or scan the QR codes

Engineering

Resource 2

Focus: Developing the Key Skills of Managing Myself, Managing Information and Thinking and Staying Well in consideration of the Engineering mindset and blended learning.

Suggested Year Group: Second-year

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Focus: Developing the Key Skills of Managing Myself, Managing Information and Thinking and Staying Well in consideration of the Engineering mindset and blended learning.

Suggested Year Group: Second-year

Note to Teachers:

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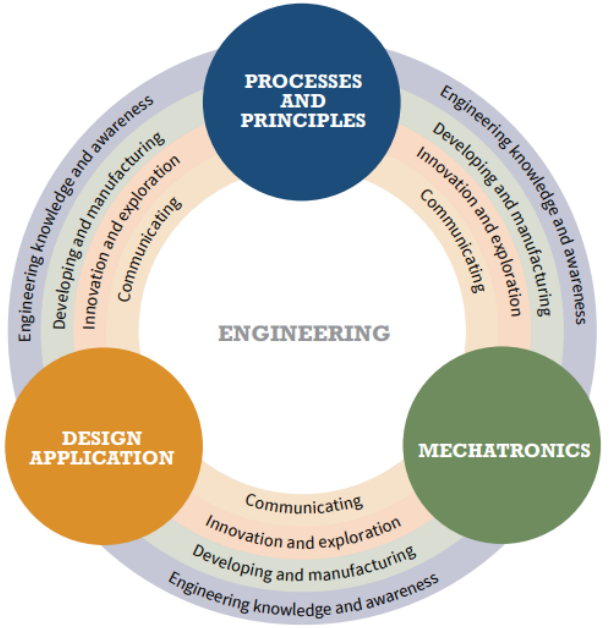
Possible strands and elements which could be explored for the suggested activities in this resource are:

- **Strands:** Processes and Principles, Design Application, Mechatronics
- **Elements**: Communicating, Innovation and exploration, Developing knowledge and awareness, Engineering knowledge and awareness



When deciding on the learning outcomes you can engage in with these activities, you should consider class context, focus of learning and the action verbs you would like to develop with your students. The proposed list is merely a suggestion of the strands and elements which are relevant to the outlined activities that follow.

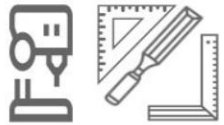
Introduction

As students move from first-year to second-year, the classroom which they may have been familiar with has changed. Students will continue to learn the skills through engagement with the specification but will also need to be familiar with learning using a wider range of approaches to build skills required for engaging with learning from home.

Clean Machines and Tools

For each individual lesson, students should use disinfectant wipes to:

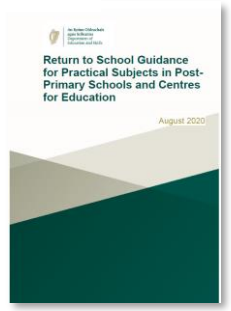
- clean their ***assigned tools*** at the start and at the end of the lesson.
- clean ***shared tools*** between each use.
- clean any ***contact areas*** after each use e.g. handles and on/off switch on a pillar drill.



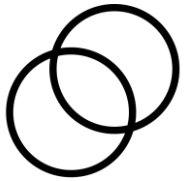
TINKERCAD

Nature of Tasks

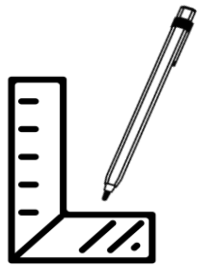
Students manufacture a project from a working drawing using bench tools. The project could require a mechatronic system. The students may analyse the materials and processes they could use to manufacture the project and design the mechatronic system. Alternative material choices for the project may be investigated. The students learn how to create drawings and plan for the skills required for possible future use of the surface gauge.



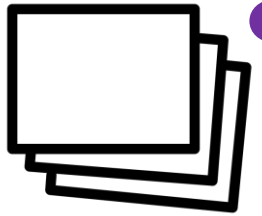
Possible student activities



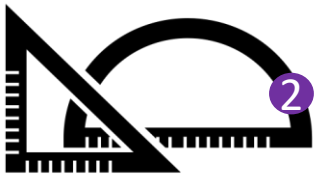
Health and Safety
Compare and contrast the pre- and post- COVID workshop scenarios.



Marking Out
Analyse a working drawing and plan the sequence of steps required to mark out a project. Accurately mark out a project on sheet metal from a working drawing using bench tools.



1 Manufacturing with Plastics
Consider the design and manufacturing implications for making the project from sheet acrylic.



2 Interpreting Drawings
Evaluate an orthographic drawing of a project. Students could create a dimensioned development and/or pictorial view of the individual part(s) of the project using web-based drawing software. Dimension the parts in preparation for marking out with a surface gauge.

3 Mechatronics
Design, test and present a mechatronic system using web-based technology.

Manufacturing with Metals
Explain the advantages of manufacturing a project from sheet metal.

What Learning Outcomes can/did you identify that will support the Key Skills which are focused on in this resource? Which activities will support those Learning Outcomes?

1 Students could consider and reflect on the design of a project they may be currently manufacturing. The students re-consider the implications of choosing an alternative material in order to learn more about the material's properties and associated processes.

Research Questions could be developed on:

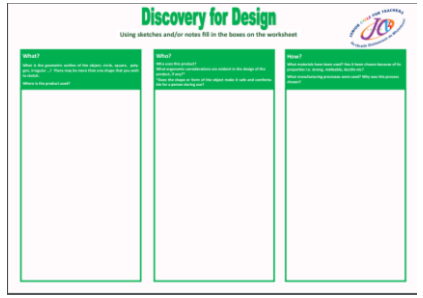
- Material properties
- Alternative processes
- Planning of a manufacturing sequence
- Time required to manufacture
- Form and aesthetics

❖ This list is not exhaustive

Possible Strategy:
Collaboratively mindmap the findings from research using Coggle , Padlet or PowerPoint online.

Possible resources for distance learning:

- Videos of senior students using associated equipment or a teacher demonstration
- Interview with a senior student who outlines how and why they modified their material choice
- Access to digital images of classroom related tools and machinery
- Resources for distance learning available at: https://www.pdst.ie/DistanceLearning



Click or scan the QR codes

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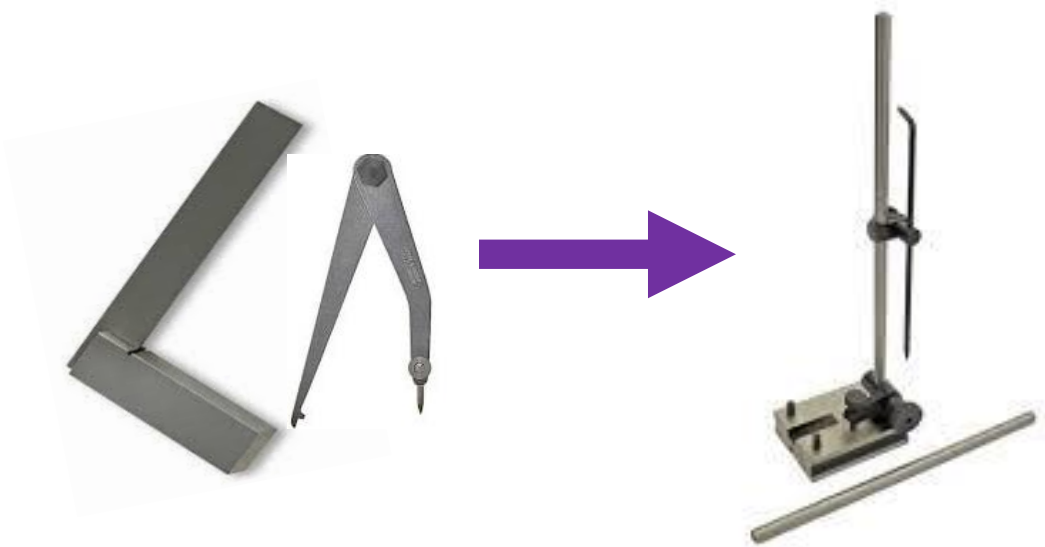
2 Students often learn how to read working drawings by engaging in a marking out and manufacturing activity. Free web-based drawing packages may be used to develop the student's ability to reflect on dimensioned drawings and further their knowledge, understanding, skills and values in terms of their ability to collaborate and communicate digitally in Engineering.

Integration of graphical skills in Engineering



Using web-based tools either in class, or when engaging with learning from home, allows for live teacher student interaction and student collaboration.

Students would have opportunities to develop their ability to interpret drawings and marking out skills by:

- Creating a pictorial drawing and/or a development from an orthographic representation of the part(s)
- Consider dimensioning the parts using absolute dimensioning as required when using a surface gauge
- Communicating the drawings through the use of digital technologies such as PowerPoint Online or Tinkercad
- Peer assessing their work using digital collaborative spaces

Click or scan the QR codes

Access Junior Cycle Graphics Webinar – Digital Learning Activities

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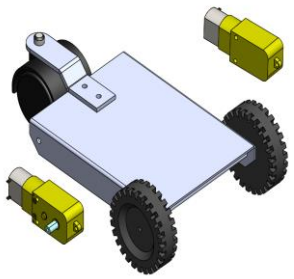
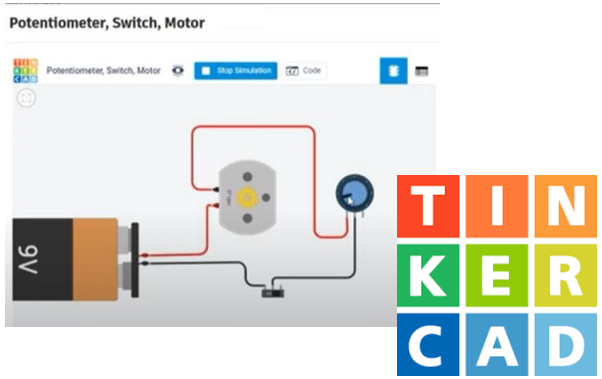
3 Mechatronics is a full strand in Junior Cycle Engineering and is taught using an integrated approach with Processes and Principles and Design Application. There are strategies and resources available to develop knowledge, understanding, skills and values in Mechatronics.



- Students could explore and design possible Mechatronic solutions for their projects.
- This may be done in the Engineering classroom or engaging with learning from home
- As well as being a web-based drawing package, Tinkercad can be used to design, build and test electronic circuits
- The micro:bit Makecode Editor has a simulator to test some code designs before downloading
- Students can take screenshots of their solutions if engaging with learning from home and may compare and peer assess their solutions through online digital platforms



Click or scan the QR codes

QR code: Junior Cycle Graphics Webinar – Digital Learning Activities

QR code: Junior Cycle Mechatronics Elective – Introduction to Control Software for Mechatronics

QR code: Junior Cycle Control Software Elective – Problem Solving through Coding, Applied Control and Mechatronics

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Engineering

Resource 3

Focus: Linking previous learning from outside the classroom to the conventions and practices of an Engineering room while developing the Key Skills of Managing Myself, Managing Information and Thinking and Staying Well.

Suggested Year Group: Second-year

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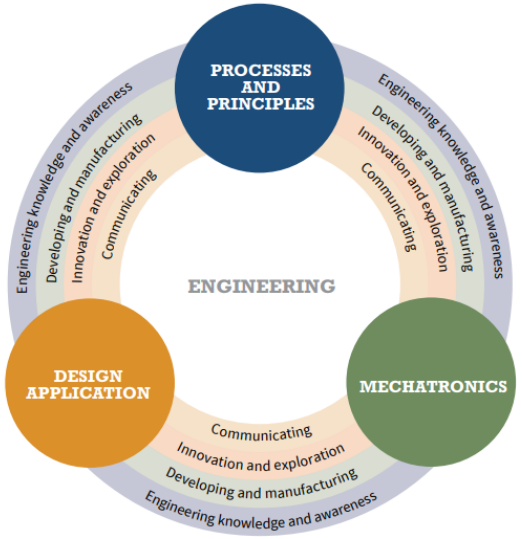
Note to Teachers:

The following resource is designed to align with the Engineering strands, elements and learning outcomes. Contained within this resource are suggestions for a range of possible learning experiences, developed across the three strands. The suggested activities can be used in isolation following a period of instruction or as a combination of activities. The depth and time allocated is dependant on a teacher's plan for learning and their students' prior knowledge and understanding.

Possible strands and elements which could be explored for the suggested activities in this resource are:

- **Strands:** Processes and Principles, Design Application
- **Elements**: Communicating, Engineering Knowledge and Awareness, Innovation and Exploration



When deciding on the learning outcomes you can engage in with these activities, you should consider class context, focus of learning and the action verbs you would like to develop with your students. The proposed list is merely a suggestion of the strands and elements which are relevant to the outlined activities that follow.

Introduction

In recent months, DIY and hobby stores have recorded huge sales in home improvement equipment and models. You, your family or your neighbours may have made something or fixed something around your home.

Nature of Tasks

Students are tasked with carrying out primary and secondary research into different areas such as material properties, material origins, material selection etc. Using this information you will have to apply it through sketching and/or creating a project.

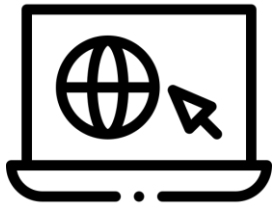
Click for Design Guide

Possible student activities

1

An interview with your neighbour/ family member about the project undertaken: processes/ materials used etc.

Collect photographic evidence of your project's progression at every stage. Research, design etc.

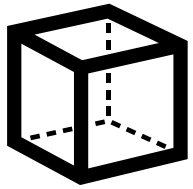


Internet research about the materials used and where they came from or how they were made

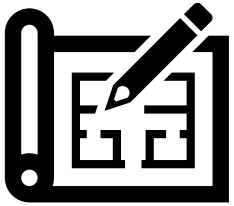
Take the design of the project and alter it so it may work better if it was to be made again

2

Create a presentation about the skills you learned making this project, or from talking with a neighbour or family member and how that will help you in the engineering classroom



Create a 3D representation (using any medium) of your project, suggesting some improvements that could be made



Make detailed sketches of the project and how it is put together and what you have learned from this process

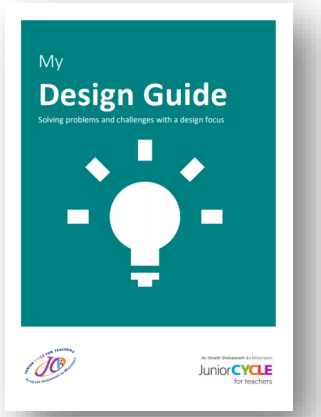
3

Using the new skills you have learned, create a plan to manufacture the improved solution using materials and processes you have identified

What Learning Outcomes can/did you identify that will support the Key Skills which are focused on in this resource? Which activities will support those Learning Outcomes?

1 Interview with Neighbours or Family

Using ‘My Design Guide’ will help you to find the right questions to ask



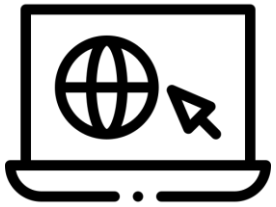
My ‘Design Guide’ will not have all the questions to ask but it might help inspire the creation of your questions.

Each Section has many questions for each stage of the design process. Here are some examples:

- Why is it designed and made in this way?
- What materials and resources were available?
- What skills are needed to create the project?
- Have I chosen the best way to process the materials?

Effective Interview Techniques

- Do your research: know a bit about the project before you start
- Be prepared: have your questions chosen and ready to ask the person
- Listen: don’t jump in too fast with the next question, sometimes we need time to think



How could you do a physically distant interview?

- Over the phone
- Zoom
- Google Classroom
- Teams
- Send the questions and ask them to write the response

Note to Teachers:
The above are suggestions of possible learning experiences to develop students’ understanding of the importance of communication in Engineering. The suggested tasks can be used in isolation following a period of instruction or as a combination of activities. When planning for teaching and learning, teachers should consider the needs and context of their students, when choosing learning outcomes and the learning activities that will best support the learning. In planning teachers should also consider situations where students may need to engage with learning from home. If students are engaging with learning from home, assessment and reporting procedures may need to be reconfigured to reflect this circumstance.

Making Presentations

How can I Make a Presentation?
Presentations can be made in many different formats:

- Blogs/Vlogs
- Posters
- PowerPoint
- Verbal presentation
- Collages

*This list is not exhaustive

Click or scan the QR codes

What does a Presentation have to do?

- Presentations have to clearly give information about your chosen topic
- Should include pictures or sketches to show off your ideas
- Present/display/explain about how you have gotten from one point to the other
- Display how you can now use what you have learned in the future

Find the best approach to make a presentation suit you and your skills

Tips for the presentation:

- Make sure to make what you have learned relevant to an Engineering classroom
- What skills have you learned that you can bring back into your classroom practice: holding of materials, cutting materials, material selection, for example.

What Digital Technology could you use to make the presentation?

- PowerPoint/Google Slides/Keynote
- Coggle
- Collage generated Poster (canva/photocollage)
- Audacity
- Phone recorder and video editor

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Making Products Based on Findings

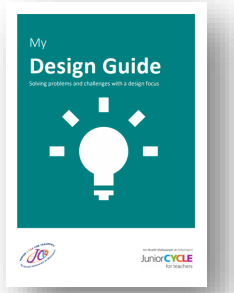
Making Links

- What new **processes** have I learned?
- What new **material** uses have I learned about?
- What new **machines** have I learned to use safely and effectively?

❖ Are these available to use in the Engineering room?
❖ Have I everything required to make these products effectively in the Engineering room?
❖ How can I show the teacher that I am able to use these new skills effectively and safely?

Key Questions to ask myself?

- What do I know now and how can I use it?
- What is the design idea? (sketches/working drawings)
- Have I chosen the right materials?
- Have I chosen the best way to assemble the product?
- Have I the skills required to make the product?
- Have I adequate time to make the product?
- Am I working safely?



Access to My Design Guide

Using relevant knowledge to complement the new skills learned

- When making new products we need to remember the older skills we have too. Using them helps us to get better at them and make the product look better rather than showing off just new skills we haven't mastered yet
- Marking out, filing, cutting and finishing are very important and should always be practiced and improved

Remember some key points

- Make a plan for each stage of the project
- Try and stick as closely as possible to the plan
- Allow some time for things to run over
- How are you going to finish the product?
- Are there materials or finish elements you need to get that are not in the room? How will that happen?

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Junior Cycle **Engineering** Activities

Classroom activities for the physically distanced classroom in the school year 2020/2021

These resources were designed and collated in response to the '*Returning to school* - Guidance on learning and school programmes for post-primary school leaders and teachers' and have a focus on the Junior Cycle Key Skills of Managing Myself, Managing Information and Thinking and Staying Well from the 'The Framework for Junior Cycle 2015'.

These activities only offer, as a suggestion, some possible tasks which could be completed by students to engage these Key Skills in the Engineering classroom.

Teachers' knowledge of their own students' context should inform their decisions around which activities would best engage their students.