An tSraith Shóisearach do Mhúinteoirí

JuniorCYCLE for teachers

Cluster 2019/2020
Workshop

Engineering

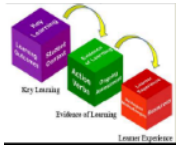
QR Code for specification

An Roinn Oideachais agus Scileanna
Department of Education and Skills

Ionad Oideachais Mhuineacháin

Glossary of Key Terms			
Learning Outcomes **Learning Intentions** (NCCA Glossary of Terms)	Learning Outcomes: Learning outcomes are statements in curriculum specifications to describe the knowledge, understanding, skills and values students should be able to demonstrate after a period of learning. Learning Intention: A learning intention for a lesson or series of lessons is a statement, created by the teacher, which describes clearly what the teacher wants the students to know, understand and be able to do as a result of the learning and teaching activities.	**Subject Learning Assessment Review (SLAR)**	In Subject Learning and Assessment Review meetings, teachers will share and discuss samples of their assessments of student work and build a common understanding about the quality of student learning. Each Subject Learning and Assessment Review meeting will be subject-specific and will focus on the Classroom-Based Assessment undertaken by the particular year group.
Classroom-Based Assessments (CBA) (Framework p. 46)	Classroom-Based Assessments are best described as the occasions when the teacher assesses the students using the specific tasks set out in the subject specification. The tasks are clearly described, as are the criteria for assessment to support teacher judgement. The criteria are found in the Features of Quality linked to each Classroom-Based Assessment. Although the assessment is similar to the formative assessment that occurs every day in class, in the case of classroom-based assessment the teacher's judgement is recorded for Subject Learning and Assessment Review, and is used in the school's reporting to parents and students.	**Formative Assessment** (Framework p. 35-36)	The Junior Cycle will be underpinned by the further integration of formative assessment as a normal part of teaching and learning in classrooms. Formative assessment involves teachers and students reflecting on how learning is progressing and deciding next steps to ensure successful outcomes. A vital part of formative assessment is the feedback that teachers provide to their students. Through a range of assessment activities, the teacher helps the student to identify what has been achieved and where there is room for further learning and development. To facilitate the type of learning envisaged above, the role of the teacher and the dynamics of the teacher-student relationship will evolve. Teachers will place a greater emphasis on integrating assessment into their teaching, so they can better monitor students' progress in learning and identify how they can support students to reflect on and critically analyse their own learning.
Features of Quality (NCCA Glossary of Terms)	Features of quality are the statements in the short course/subject specifications that support teachers in making judgements about the quality of student work for the purpose of awarding achievement grades for certification. As success criteria are closely linked to learning intentions and based on the day-to-day processes in the classroom, student learning will gradually come to reflect the requirements set out in the features of quality which are used for certification purposes.	**Junior Cycle Profile of Achievement** (Framework p. 46)	The JCPA will reward achievement across all areas of learning as applicable: Subjects, Short Courses, Wellbeing, Priority Learning Units, Other areas of learning. The JCPA will draw upon and report on achievement across all elements of assessment including ongoing, formative assessment; Classroom-Based Assessments; and SEC grades which include results from the state-certified examinations and the Assessment Tasks.
Summative Assessment (NCCA Glossary of Terms)	Assessment is summative when it is used to evaluate student learning at the end of the instructional process or of a period of learning. The purpose is to summarise the students' achievements and to determine whether and to what degree the students have demonstrated understanding of that learning by comparing it against agreed success criteria or features of quality.	**Success Criteria** (NCCA Glossary of Terms)	Success criteria are linked to learning intentions. They are developed by the teacher and/or the student and describe what success looks like. They help the teacher and student to make judgements about the quality of student learning.

Reflection

Dotmocracy – Reflection on my planning since PLE 1 Use a coloured dot to communicate your progression in relation to each of the following statements. ● I would like to make more progress. ● I have made a lot of progress		
I have started to identify key learning in the 36 learning outcomes.	I have collaborated to further my understanding of learning outcomes.	I have selected key learning from all three strands where possible when planning my units of learning.
I have used the Action verbs to inform ongoing assessment. Example of a learning outcome and its action verb underlined below. 3.7 **Design** a Mechatronic System either individually or collaboratively.	I have considered using a planning tool to design units of learning. 	I have considered active methodologies in my planning.
At your table share where you have made the most progress in relation to planning		

Rationale

Each subject of the technology suite offers the student different experiences which contribute towards their education in technology education. As a result, preparing students for learning in the technology subjects is not just about teaching towards the technology but towards the skills that are fundamental to the technology subjects and are transferable into other areas of their learning: skills that encourage the student to problem-solve through creativity, innovation, communication, collaboration and exploration, all of which are developed in an active learning environment where students can advance their ideas from conception to realisation.

Engineering addresses the process of cyclical design to produce products and systems that adhere to defined conventions and standards. The focus of junior cycle Engineering is goal-oriented problem solving for the manufacture of products, with emphasis on efficiency, accuracy, precision and a high- quality finish. This project-based approach to junior cycle Engineering requires students to develop a knowledge of materials and processes, and to demonstrate a capacity to select appropriate materials and processes for given applications.

Engineering offers students a lens through which to view the role and impact of engineering within their classroom, community and the world. Through the study of engineering, students will have the opportunity to behave as engineers, and develop an engineering mindset. The engineering process is both reflective and systematic. It is reflective in that students continually test their design and modify it based on what they have learned. It is systematic in that students undertake several characteristic steps in reaching a solution. Students identify problems, integrate ideas for how to solve identified problems, and try to improve the design or devise a better one.

Aim

The study of junior cycle Engineering aims to:

- enable students to develop the disciplinary skills and knowledge to engineer an end product.
- enable students to engage in goal-oriented problem solving, creating an awareness of engineering processes.
- develop the necessary skills and apply engineering processes to manipulate material to manufacture a product with efficiency, accuracy, precision and a high-quality finish.
- develop an engineering mindset through the exploration of contemporary engineering developments.

Which aspect of the rationale and aim is most visible in your planning?

Overview of Classroom-Based Assessments

Assessment Overview

CBA 1: Engineering in action		Completed within a three-week period in term two of second year
CBA 2: Research and Investigation		Completed within a three-week period during term one of third year
Project	70%	Set by the SEC and completed after CBA2 in third year
Written Exam	30%	A 90 minute exam common level exam set by the SEC taken at the end of third year

Classroom-Based Assessment 1: Engineering in Action

Engineering in action provides opportunities for students to engage in practical, authentic learning experiences that gives them the experience of exploring the applications of engineering in the world around them. The Classroom-Based Assessment will ask students to research, analyse and draw conclusions on the concepts and applications from their chosen engineering discipline.

Students will capture the various stages of the Classroom-Based Assessment through a learning log that will be presented as part of their final submission. The learning log can be produced in a suitable format, to be decided upon in agreement with the teacher, that captures the students work throughout the Classroom-Based Assessment. Students may present models, artefacts and any other form of evidence to accompany the learning log to further communicate their findings if they deem it necessary. The learning outcomes assessed will, to an extent, depend on the topic chosen and the media in which the work is presented.

Classroom-Based Assessment 2: Research and development

Research and development provides opportunities for students to investigate and develop their understanding of a theme related to their upcoming project, which will be issued by the State Examinations Commission. The theme will change each year and will be derived from the project the students will undertake in that same academic year. The theme for this Classroom-Based Assessment will be developed by the State Examinations Commission and issued by the NCCA online through www.curriculumonline.ie.

The student can communicate the Classroom-Based Assessment through any appropriate media that captures their response. The learning outcomes assessed will, to an extent, depend on the topic chosen and the media in which the work is presented.

The Lens for the Classroom-Based Assessment

CBA 1: Engineering in Action

Regardless of the application of engineering the students opt to research, their response should be conducted through the lens of:

- research and analysis
- engineering concepts
- evaluation of the task
- communicating their Classroom-Based Assessment

Assessment Guidelines p.9

CBA 2: Research and Development

To help structure their approach to the Classroom-Based Assessment, the students should focus their work through the lens of:

- research and analysis
- comparing concepts
- communicating their Classroom-Based Assessment

Assessment Guidelines p.19

Features of Quality

Classroom-Based Assessment 1: Engineering in action

Exceptional A piece of work that reflects these Features to a very high standard. While not necessarily perfect, the strengths of the work far outstrip its flaws, which are minor. Suggestions for improvement are easily addressable by the student.	• The research method(s) chosen demonstrated a comparison of a range of sources which led to the production of a comprehensive and detailed analysis of the data/findings. • The response demonstrates a comprehensive awareness of relevant engineering concepts for their chosen area of learning. • Critical evaluation of the response was evident throughout the task that lead to refinements at various stages resulting in meaningful, accurate conclusions and examples of real-life applications. • The presentation of the response is of an excellent standard, using highly effective media which allowed for a critical consideration of what information accurately communicates the task.
Above expectations A piece of work that reflects these Features very well. The student shows a clear understanding of how to complete each area of the task. Feedback might point to the necessity to address some aspect of the work in need of further attention or polishing, but on the whole the work is of a high standard.	• The research method(s) chosen was effective for their area of learning and generated an in-depth level of analysis. • The response demonstrates very good awareness of relevant engineering concepts for their chosen area of learning. • The evaluation of the response is at a high level, with relevant and accurate conclusions that indicates an understanding of real-life applications. • The response is presented to a very high standard, using effective media, with careful consideration of what information bests communicates the task.
In line with expectations A piece of work that reflects most of these Features well. It shows a good understanding of the task in hand and is free from significant error. Feedback might point to areas needing further attention or correction, but the work is generally competent and accurate.	• The research method(s) chosen was appropriate for their area of learning and generated a suitable analysis. • The response demonstrated some awareness of relevant engineering concepts for their chosen area of learning. • The evaluation was appropriate; conclusions are brief and include some suggestions on real life applications. • The response is well presented, using appropriate media, with careful consideration of what information to communicate to best showcase the task.
Yet to meet expectations A piece of work that falls someway short of the demands of the Classroom-Based Assessment and its associated Features. Perhaps the student has made a good attempt, but the task has not been grasped clearly or is marred by significant lapses. Feedback will draw attention to fundamental errors that need to be addressed.	• The research method(s) chosen for their area of learning was ineffective and the analysis lacks depth. • The response demonstrated little or no awareness of relevant engineering concepts for their chosen area of learning. • The evaluation of the response offers little or no conclusions and makes no suggestions on real life applications. • The response is presented in an unsuitable format resulting in an ineffective communication of the Classroom-Based Assessment.

NCCA Assessment Guidelines page 15-16

Before the SLAR Meeting
Teachers will
• Assess student work based on the Features of Quality • Review relevant NCCA annotated examples as necessary (www.curriculumonline.ie) Record the descriptor and any other relevant points that may be useful to refer to during the SLAR meeting • Identify one example, where possible, for each descriptor, to be used in the SLAR meeting • Submit details of samples of work for discussion to the facilitator before the SLAR meeting
Facilitators will
• Collect & copy samples of work submitted by teachers • Develop a running order for the SLAR meeting
During the SLAR Meeting
Teachers will
• Introduce one sample at "Yet to Meet Expectations" level Collaboratively review the piece of work • Make note of the implications of decisions made during the meeting for the rest of the student work that they have assessed • Focus on a 'best fit' approach which allows teachers to agree the descriptors that on-balance is most appropriate for the work being discussed • Repeat the process, in turn, for a sample at each of the descriptors
Facilitators will
• Open the meeting with a focus on consistency of judgement and a common understanding about the quality of student learning • Highlight the value of the meeting in providing feedback to students • Lead the general discussion of samples of work and Descriptors and note any decisions made • Look to establish consensus but focus on the development of professional knowledge and skills
After the SLAR Meeting
Teachers will
• Consider the assessment of their students' work based on the SLAR meeting Report their final descriptors for each student
Facilitators will
• Complete and submit the Facilitator's Report to the Principal • Reflect on what worked well or what could be improved upon in the next SLAR meeting • The Facilitator may also ask teachers, should they wish, to contribute some of their samples of student work to a bank of examples: To support the induction of new teachers • To support future SLAR meetings • To use with students and parents in demonstrating the standard of work achieved

Design Brief

Design a toy suitable for a child aged between 8 and 12 years. The toy should be safe for use and visually appealing to children of that age group. The longest dimension should not exceed 200mm.

The design should be sketched on an A3 page. Use notes as appropriate to help communicate your ideas.

In the spaces below, identify the elements of good design evident in the examples of students' work.

Ball:

Fish:

Make-up case:

Submarine:

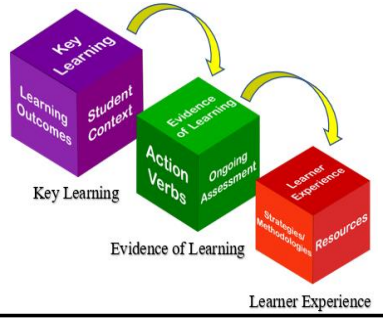
ENGINEERING PLANNING AID

	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	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.	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.
	1. PROCESSES AND PRINCIPLES	**2. DESIGN APPLICATION**	**3. MECHATRONICS**
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 engineered materials	2.1 **understand** the key stages of the engineering design process 2.2 **evaluate** the factors that influence design 2.3 **choose** a suitable material to **engineer** a product	3.1 **explain** the operation of basic mechatronic systems 3.2 **investigate** relationships between inputs, processes and outputs for basic control systems 3.3 **appreciate** the application of mechanisms in a controlled system
INNOVATION AND EXPLORATION	1.5 **research** applications of existing and emerging technological developments 1.6 **engage** with the various engineering disciplines by relating them to everyday application	2.4 **explore** how design impacts on the function and quality of a product including ergonomic considerations 2.5 **apply** appropriate engineering concepts and approaches in the execution of their design solutions 2.6 **use** relevant information to enhance design and function	3.4 **explore** the application of systems in an engineering setting such as the classroom, home and industry 3.5 **investigate** the impact of mechatronics on the environment and society 3.6 **configure and program** basic mechatronic systems using appropriate software 3.7 **design** a basic mechatronic system either individually or collaboratively
DEVELOPING AND MANUFACTURING	1.7 **develop** engineered solutions to various challenges 1.8 **identify** appropriate tools and equipment specific to a task 1.9 **apply** suitable manufacturing processes to **engineer** a product 1.10 **demonstrate** high-quality work, to include accuracy and surface finish	2.7 **apply** their knowledge of the properties associated with a range of engineering materials 2.8 **manufacture** a product from a working drawing 2.9 **modify** an existing product/design 2.10 **incorporate** basic project management techniques	3.8 **build and test** a basic mechatronic system with specific inputs or outputs 3.9 **incorporate** basic mechatronics into their engineered products
COMMUNICATING	1.11 **create** sketches, models and working drawings 1.12 **interpret** working drawings 1.13 **use** appropriate technical language and notations	2.11 **present** ideas through modelling and prototyping, using appropriate media 2.12 **communicate** their design decisions using suitable media	3.10 **represent** key information using appropriate media 3.11 **justify** their choice of the most appropriate system or systems for a specified purpose

QR CODE FOR SPECIFICATION

An tSraith Shóisearach do Mhúinteoirí
Junior CYCLE for teachers

Action Verb	Description
Apply	select and use information and/or knowledge and understanding to explain a given situation or real circumstances
Appreciate	Appreciate recognise the meaning of, have a practical understanding of
Build	construct by putting parts or material together
Choose	pick out as being the best or most appropriate of two or more alternatives
Configure	arrange or put together in a particular form or configuration
Communicate	use visual, gestural, verbal or other signs to share meaning or exchange information; interaction between sender and recipient; both work together to understand
Create	process and give form to the topic that is to be created using selected methods and material and/or to give the material used a new form
Demonstrate	prove or make clear by reasoning or evidence, illustrating with examples or practical application
Design	planning the features of a solution that solves a perceived user problem
Develop	advance a piece of work or an idea from an initial state to a more advanced state
Engage	enter into or become occupied by an activity or interest; to attract or hold interest and attention
Engineer	develop/build an item for a specific purpose that includes critical-to function components
Evaluate	collect and examine evidence to make judgements and appraisals; describe how evidence supports or does not support a judgement; identify the limitations of evidence in conclusions; make judgements about the ideas, solutions or methods
Explain	give a detailed account including reasons or causes
Explore	to think or talk about something in order to find out more about it
Identify	recognise patterns, facts, or details; provide an answer from a number of possibilities; recognise and state briefly a distinguishing fact or feature
Incorporate	take in or contain something as part of a whole
Interpret	use knowledge and understanding to recognise trends and draw conclusions from given information
Investigate	observe, study, or make a detailed and systematic examination, to establish facts and reach new conclusions
Justify	give valid reasons or evidence to support an answer or conclusion
Manufacture	something made from raw materials by hand or by machinery
Modify	to alter one or more particulars of an object/product
Present	make objects perceivable for others
Program	to instruct a device or system to operate in a particular way or at a particular time
Recognise	identify facts, characteristics or concepts that are critical (relevant/ appropriate) to the understanding of a situation, event, process or phenomenon
Represent	bringing clearly and distinctly to mind by use of description or imagination
Research	the study of materials and sources in order to establish facts and reach new conclusions; revision of accepted theories or laws in the light of new facts
Test	establish the quality, performance, or reliability of something
Understand	have and apply a well-organised body of knowledge
Use	apply knowledge or rules to put theory into practice; employ something in a targeted way



PLANNING APPROACH

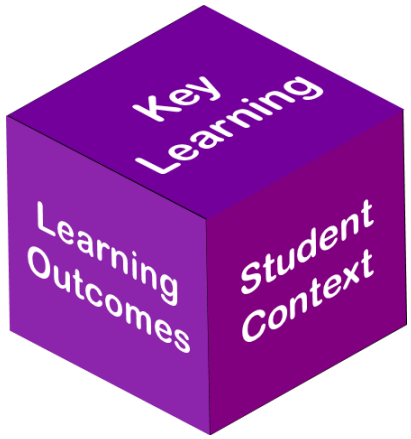
Identifying student context and selecting appropriate learning outcomes will outline KEY LEARNING.

Outline action verbs to help to plan for ongoing assessment. This outlines EVIDENCE OF LEARNING.

Having outlined what key learning and evidence of learning are present in the unit. Strategies/methodologies and resources need to be considered. This outlines LEARNER EXPERIENCE.

Planning for Learning - Prompt Questions

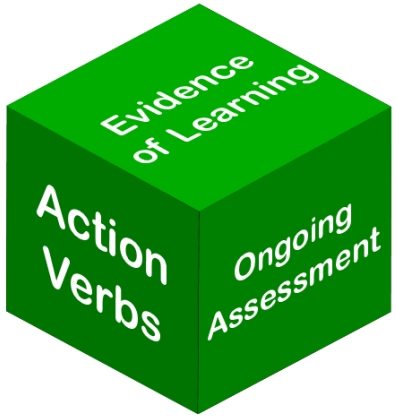
Key Learning



Have we considered:

- Which Learning Outcomes would work well together?
- What do I want my students to learn? Is there a particular area of learning I wish to explore with my students?
- What prior learning do my students have or would they need?
- The age and stage of my students. Are these learning outcomes suitable for first year students?
- Selecting Learning Outcomes from across the strands/ elements
- Are the Action Verbs reflected in the Key Learning?

Evidence of Learning



Have we considered:

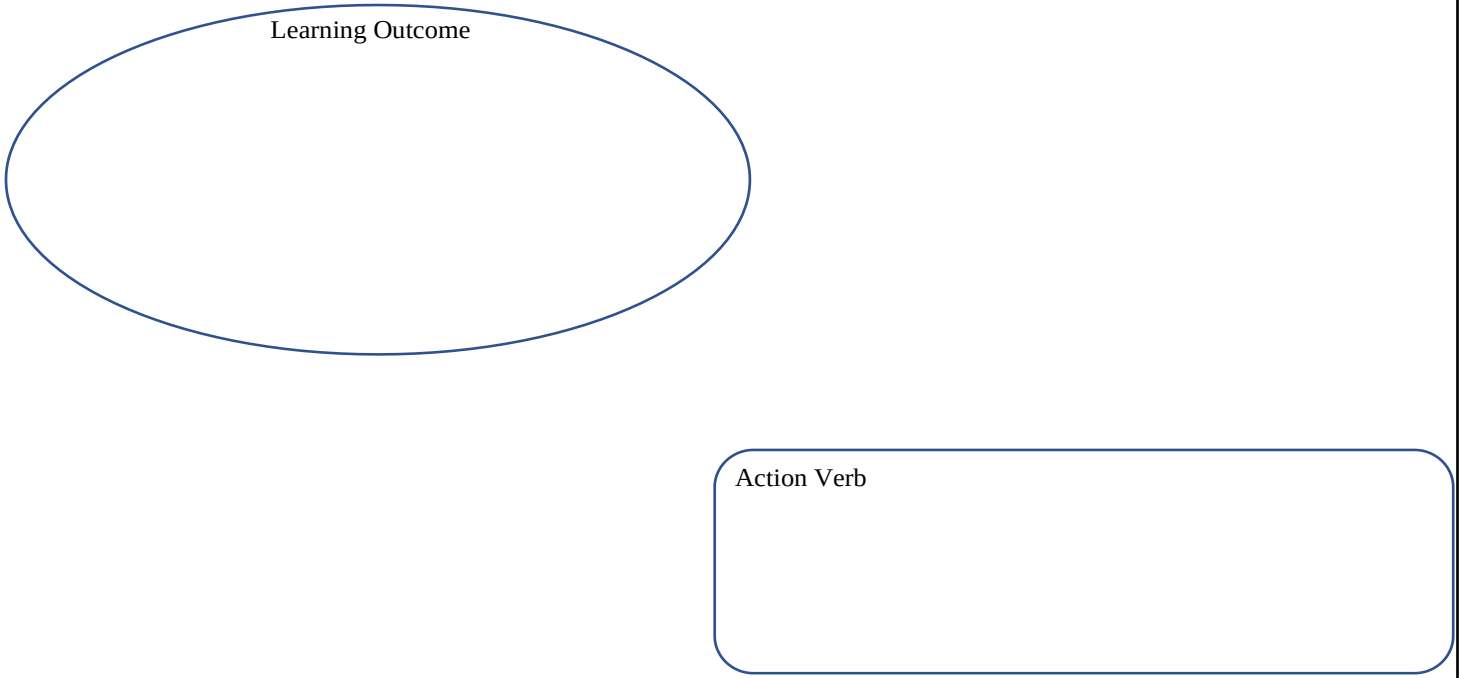
- How I will check in on student learning and plan for ongoing assessment?
- The inclusion of both summative and formative assessment approaches
- The action verb and what it asks of students engaging with the Learning Outcomes?

Learner Experience

Have we considered:

- What strategies/ methodologies would be most appropriate for my students
- The resources that are available to me to facilitate these learner experiences

Strand 1: Processes and principles	Strand 2: Design application	Strand 3: Mechatronics
In this strand, students will learn about and employ the fundamental processes and principles of engineering. Students will apply their knowledge of materials and equipment to design and manufacture products. Students will be encouraged to use the engineering principles and processes, together with accuracy and precision, to help develop an engineering 'mindset' which ultimately leads to the production of innovative and efficient solutions of high quality and finish.	In this strand, students will learn about the key stages of the engineering design process. They will understand the importance of design in both the end-user experience and the economic and social impact of the product. They will discover how informed choice of materials and processes combine to produce a solution that is functional and efficient. Students will learn the value of good project management and how to manage themselves and the product development through the journey from the design to the manufacture stage.	In this strand, students will use a combination of mechanical, manufacturing, electronic and software engineering to explore the relationship between simple inputs, processes and outputs. Mechatronics engages students in learning how high-tech manufacturing is performed and why it is becoming one of the fastest-growing career areas. Students will develop an appreciation of how control systems operate on a much larger scale and consider how the design of control systems can impact positively on the environment and sustainability. They will appreciate the role that Engineering can play in employing 'systems thinking' to design products and services that contribute to a better future.



Element 1: Engineering knowledge and awareness	Element 2: Innovation and exploration	Element 3: Developing and manufacturing	Element 4: Communicating
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.	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.	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.	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.

ENGINEERING DIGITAL PLANNING TOOL		
CLASS GROUP:		UNIT:
CLASS TEACHER:		TERM: START DATE: DURATION:

IDENTIFYING KEY LEARNING

(Based on collaborative discussion)

Prompt Questions

Is there a particular area I/we want to explore with students?

How might this unit of learning progress prior learning?

Have I/we considered the age and stage of students?

Have I/we considered using learning outcomes across the strands/elements?

Have I/we considered the action verbs in identifying key learning

Learning Outcomes and Key Learning

The **Engineering specification** specifies **learning over 3 years**. **Key learning** identifies what **learning we hope to achieve** in this unit of learning **with students**.

IDENTIFYING ASSESSMENT METHODS

(Based on collaborative discussion)

Prompt Questions

Having identified key learning we consider how students will be able to demonstrate this learning.

Have I/we considered the use of both formative and summative assessment?

Have I/we considered action verbs in developing assessments to allow students to demonstrate this key learning?

Action Verbs and their definition

Evidence of Learning

REFLECTION / ADDITIONAL NOTES ON PLANNING:

IDENTIFYING LEARNER EXPERIENCE

(Collaborative and/or individual)

Prompt Questions

Have I/we considered what strategies/ methodologies would be most appropriate for my students?

Have I/we considered the resources that are available for these learner experiences?

Have I/we considered learners with particular SEN through the planning process?

Strategies/Methodologies

Resources

Learner Experience

Classroom Approach

Teachers' Collaborative/Individual Planning

A drill is a fundamental piece of equipment our first years use to drill holes.

Draw a Drill.

Reflection on task:

What is a “good” project?

What does the word “project” mean to you and your teaching?

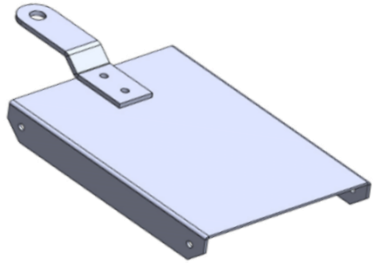
What is the purpose of a project?

What learning should occur in a project?

How do I know what learning has taken place?

How can students further their learning?

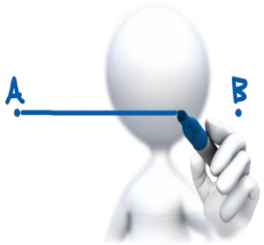
Possible success criteria have been written for the skill and process of marking out the chassis in the table below.



Task – Discuss and write possible success criteria for the remaining skills and processes in the table which could be applied to the chassis.

Success Criteria	
Engineering skills/processes	
Marking out	Developed to the given dimensions e.g. the curve, all bend lines, 8 drill holes and 4 chamfers all located in the correct position with correct lengths
Cutting and Shaping	

NEXT STEPS



What I must do

What I could do

What I would like to do

NOTES/REFLECTIONS

NOTES/REFLECTIONS

An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

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Key websites:

www.jct.ie

www.curriculumonline.ie

www.ncca.ie