An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

QR Code for specification

Cluster Delivery 2018/19

Engineering

Ionad Oideachais Mhuineacháin

AN ROINN OIDEACHAIS AGUS SCILEANNA | DEPARTMENT OF EDUCATION AND SKILLS

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.

Statements of Learning

Engineering supports a broad range of learning objectives at junior cycle. Tables 1 and 2 on the following pages show how junior cycle Engineering is linked to central features of learning and teaching in junior cycle.

The statement	Examples of relevant learning
SOL 15: recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning.	Students will be able to apply numerical reasoning through marking out exercises from given dimensions.
SOL 19: values the role and contribution of science and technology to society, and their personal, social and global importance.	Students will evaluate the impact of technologies on their lives, society and the environment.
SOL 20: uses appropriate technologies in meeting a design challenge.	Students will determine the most suitable technologies available to them and apply them to fulfil the criteria of a given challenge.
SOL 21: applies practical skills as she/he develop models and products using a variety of materials and technologies.	Students model and engineer products. This process encourages the development of their practical skills while working with a range of materials and technologies.
SOL 23: brings an idea from conception to realisation.	Students will develop a product to its finished stage from a working drawing, either their own or that of others.
SOL 24: uses technology and digital media tools to learn, communicate, work and think collaboratively and creatively in a responsible and ethical manner.	Students will use digital media tools to research, create and present engineering solutions that can impact positively on the environment and sustainability and contribute to a better future.

Table 1: Statements of Learning

Engineering and Key Skills

In addition to their specific content and knowledge, Engineering provides students with opportunities to develop a range of key skills. There are opportunities to support all key skills in this course, but some are particularly significant. The examples below identify some of the elements that are related to learning activities in Engineering.

Key skill	Key skill element	Examples of students learning activities	How might you foster these elements of the Key Skills in your classroom?
Being creative	Exploring options and alternatives	Students will research alternative technologies to perform operations.	
Being literate	Expressing ideas clearly and accurately	Students will select the most appropriate media to communicate their ideas/solutions.	
Being numerate	Expressing ideas mathematically	Students will use correct mathematical notation when communicating dimensions.	
Communicating	Using language	Students will demonstrate correct technical language when explaining a process and presenting ideas.	
Managing information and thinking	Thinking creatively and critically	Students will engage in innovative thinking in designing solutions and critique their solution based on the needs related to the problem.	
Managing myself	Setting and achieving personal goals	Students will establish a plan of work and apply it to the creation of a project.	
Staying well	Being positive about learning	Students will be encouraged to develop a curiosity about the multi-disciplines of engineering and a positive outlook on the subject.	
Working with others	Co-operating	Students will collaborate to design and build engineering solutions.	

Table 2: Key Skills

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.

Aims

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.

Assessment	Assessment Methods	
CBA 1: Engineering in action	The teacher's judgement is recorded for the purpose of subject learning and assessment review, and for the school's reporting to parents and students. The CBA will be completed within a three-week period during term two of second year	
CBA 2: Research and Development	The teacher's judgement is recorded for the purpose of subject learning and assessment review, and for the school's reporting to parents and students. This CBA will inform the student's work under the project assessment The CBA will be completed within a three-week period during term one of third year.	
	Weighting	
Project	70%	Will be specified and marked by the State Examinations Commission annually.
Written examination	30%	Set at common level with a duration of 90 minutes Will be specified and marked by the State Examinations Commission annually.

Classroom-Based Assessment 1: Engineering in Action

Engineering in action provides students with the opportunity to actively engage in a practical and authentic learning experience that allows them to, individually or collaboratively, explore the applications of engineering in the world around them. Students will investigate real-life applications of the processes and principles of engineering. Students can focus their investigation through the lens of a specific strand, a combination of two strands or can adopt an integrated approach across all three strands. The students will communicate their findings through any appropriate media.
Further information will be set out in the Assessment Guidelines for Engineering.

Classroom-Based Assessment 2: Research and development

This Classroom-Based Assessment will encourage students to carry out research based on a theme which will be reflective of an aspect of the final project. The purpose of this CBA is to research, explore and present their findings through any appropriate media. Classroom-Based Assessment 2 will inform the project assessment.
Further information will be set out in the Assessment Guidelines for Engineering.

Ongoing Assessment

The junior cycle places a strong emphasis on assessment as part of the learning process. This requires a more varied approach to assessment, ensuring that the assessment method or methods chosen are fit for purpose, timely and relevant to the students. Assessment in Engineering at junior cycle will optimise the opportunity for students to become reflective and active participants in their learning and for teachers to support this. This can be achieved through the provision of opportunities for students to negotiate success criteria against which the quality of their work can be judged by peer, self, and teacher assessment; and through the quality of the focused feedback they get in support of their learning.

Providing focused feedback to students on their learning is a critical component of high-quality assessment and a key factor in building students' capacity to manage their own learning and their motivation to stick with a complex task or problem. Assessment is most effective when it moves beyond marks and grades, and reporting focuses not just on how the student has done in the past but on the next steps for further learning. This approach will ensure that assessment takes place as close as possible to the point of learning. Final assessment still has an important role to play but is only one element of a broader approach to assessment.

Assessment Considerations

KEY INFORMATION	HOW WILL THIS IMPACT ON PLANNING TEACHING AND LEARNING?
Classroom-Based Assessment 1: Engineering in Action	
Classroom-Based Assessment 2: Research and Development	
Ongoing Assessment	

Strands

Strand 1: Processes and principles

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.

Strand 2: Design application

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.

Strand 3: Mechatronics

In this strand, students will use a combination of mechanical, manufacturing, electronic and software engineering to explore the relationship between simple inputs, processes and outputs1. 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.

Elements

Each strand includes the same four elements. 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.

Element 1: 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.

Element 2: 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.

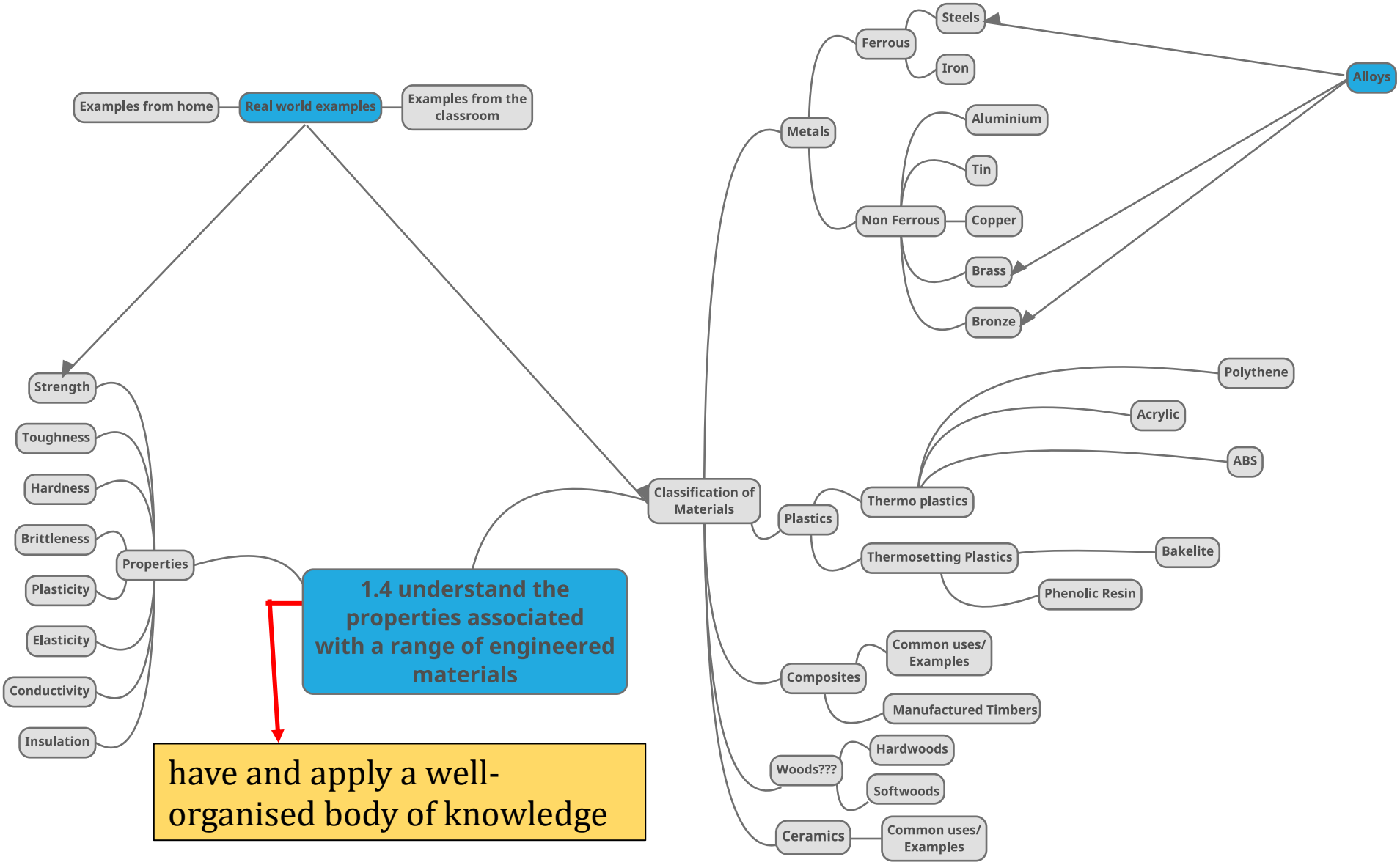
Element 3: Developing and manufacturing

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.

Element 4: 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.

A Sample Consideration of Learning Outcome 1.4



	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

DESIGN BRIEF:

Brief
Develop an effective prototype incorporating a mechanism to demonstrate the transformation of motion.

Presentation
Present you prototype focusing on the inputs, process and outputs.
Your presentation should also refer to the steps taken to develop the design solution and to the problems you encountered and your solutions to these problems.

Research/Design Sketching

PROBLEMS ENCOUNTERED	SOLUTIONS IDENTIFIED

Personal Reflection:

Prototype Materials

All contents of the Mechanism Kit are contained in the plastic container distributed by the facilitator.

Prototype Materials

The Assembly components listed below are also contained in the distributed plastic container. The shared equipment is available from the facilitator when required.

An tSraith Shóisearach do Mhúinteoirí
JuniorCYCLE for teachers

Marking, Manufacture & Assembly

Hole Punch – 33mm Edge Reach

Shared Equipment
- Hole Punch
- Stapler
- Compass
- Pencil Sharpener

Team Packs
- A4 Mountboard
- Steel Rule
- Scissors
- Tape
- Pencils

Assembly
- M4 * 70mm Studding
- M4*50 Pan Head Screws
- M4*20 Pan Head Screws
- M4*12 Pan Head Screws
- M4 Hex Nuts
- M4 Cap Nuts
- Straw (Spacers)
- Rubber Band (Drive Belt)
- Hexagon / Allen Key

Tips
- Tape all bend lines to prevent cracking.
- Approach as a Sheet Metal Exercise.

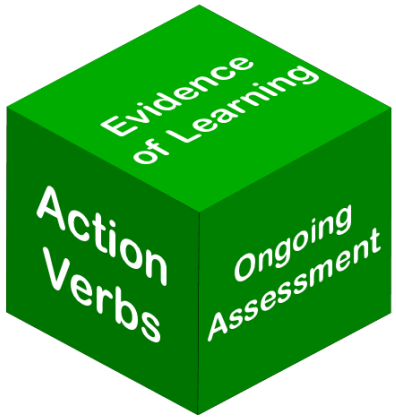
Planning Prompt Questions

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?
- Selecting Learning Outcomes from across the strands/ elements
- That Action Verbs help to inform the Key Learning

Evidence of Learning



Have we considered:

- How will I 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?

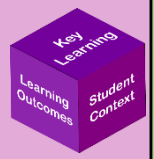
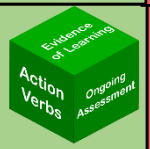
Learner Experience

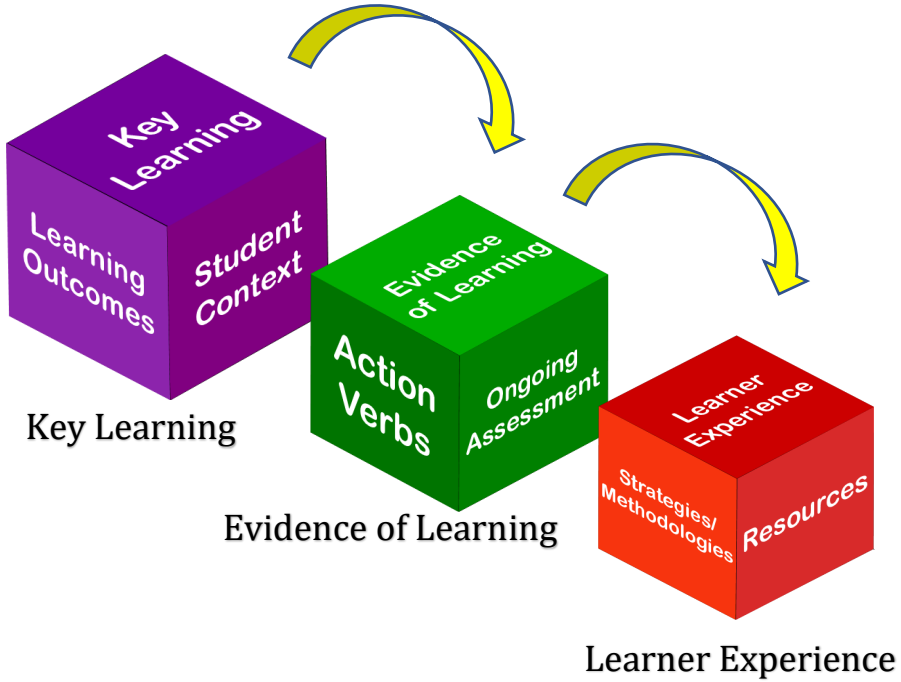
Have we considered:

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

Learning Outcomes:

Reflection/Notes:

KEY LEARNING	EVIDENCE OF LEARNING	LEARNER EXPERIENCE
		Strategies/Methodologies: 
	Action Verbs:	Resources:



Reflection/Notes

1.1 - UNDERSTAND THE CONCEPTS AND APPROACHES THAT ARE REQUIRED WHEN SOLVING AN ENGINEERING PROBLEM

2.1 - UNDERSTAND THE KEY STAGES OF THE ENGINEERING DESIGN PROCESS.

2.11 - PRESENT IDEAS THROUGH MODELLING AND PROTOTYPING, USING APPROPRIATE MEDIA

3.1 - EXPLAIN THE OPERATION OF BASIC MECHATRONIC SYSTEMS.

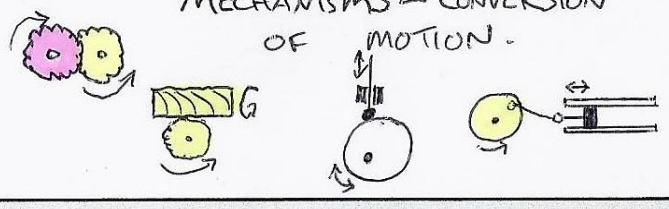
LEARNING OUTCOMES

STUDENT CONTEXT

- FOLLOWING L2LP/LILP PROGRAMME
- AGE + STAGE → 1ST YEAR TERM 3
- PRIOR KNOWLEDGE

MECHANISMS — CONVERSION OF MOTION.

BRING INFORMATION FORWARD? HOW? WHY?

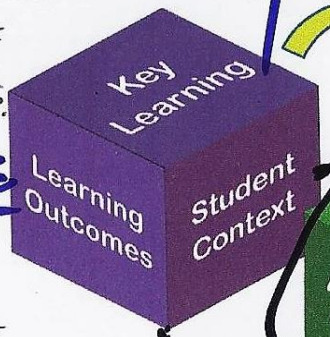


KEY LEARNING.

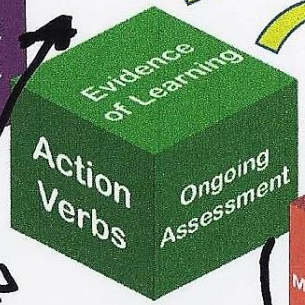
- DEVELOP PROBLEM SOLVING SKILLS THROUGH ENGAGEMENT WITH DESIGN BRIEF
- ENGAGEMENT WITH AN ENGINEERING DESIGN PROCESS
- ENHANCE COMMUNICATION SKILLS INCORPORATING PHYSICAL AIDS
- CREATING A PROTOTYPE
- DEVELOPING AN UNDERSTANDING OF INPUTS AND OUTPUTS IN A MECHANISM.

FEED IN

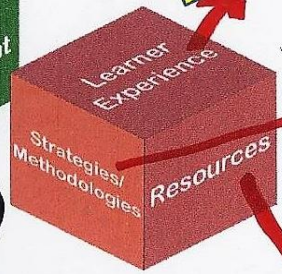
FEED IN



Key Learning



Evidence of Learning



- GROUP WORK
- DISCUSSION
- CREATING A DISPLAY

Learner Experience

ONGOING ASSESSMENT

- CREATING PROTOTYPE
- EVALUATION OF PROTOTYPE
- PRESENTATION
- TEACHER OBSER
- TEACHER FEEDBA
- PERSONAL REFLECTION

- STIMULUS VIDEO
- A1 DESIGN SHEET
- PROTOTYPE PACK.

ACTION VERBS

HOW WILL THEY INFORM ASSESSMENT?

EXPLAIN - GIVE A DETAILED ACCOUNT INCLUDING REASONS OR CAUSES.

PRESENT - MAKE OBJECTS PERCEIVABLE TO OTHERS

UNDERSTAND - HAVE AND APPLY A WELL-ORGANISED BODY OF KNOWLEDGE

Reflection/Notes → LO 1.3 IMPORTANT FOR THIS UNIT IN THE MANUFACTURE

MOVING FORWARD

TAKE DIRECTLY TO A MANUFACTURE

POSSIBLY LO'S		
2	1.10	BASIC
2.1	3.8	

Learning Outcomes:

1.1 UNDERSTAND THE CONCEPTS AND APPROACHES THAT ARE REQUIRED WHEN SOLVING AN ENGINEERING PROBLEM

2.1 UNDERSTAND THE KEY STAGES OF THE ENGINEERING DESIGN PROCESS

2.11 PRESENT IDEAS THROUGH MODELLING AND PROTOTYPING USING APPROPRIATE MEDIA

3.1 EXPLAIN THE OPERATION OF BASIC MECHATRONIC SYSTEMS

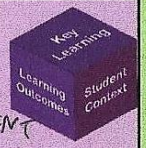
Reflection/Notes: 1.3 UNDERLYING IN THIS UNIT.

MOVING FORWARD

MOVE PROTOTYPE TO MANUFACTURE

LO's 1.2, 1.10, 2.7, 3.8.

KEY LEARNING



- DEVELOP PROBLEM-SOLVING SKILLS THROUGH ENGAGEMENT WITH DESIGN BRIEF
- ENGAGEMENT WITH AN ENGINEERING DESIGN PROCESS
- ENHANCE COMMUNICATION SKILLS INCORPORATING PHYSICAL AIDS
- CREATING A PROTOTYPE
- DEVELOPING AN UNDERSTANDING OF INPUTS AND OUTPUTS IN A MECHANISM.

EVIDENCE OF LEARNING

- CREATING PROTOTYPE
- EVALUATION OF PROTOTYPE
- PRESENTATION
- TEACHER OBSERVATION
- TEACHER FEEDBACK
- PERSONAL REFLECTION

Action Verbs:

[redacted] - GIVE A DETAILED ACCOUNT INCLUDING REASONS AND CAUSES

PRESENT - MAKE OBJECTS PERCEIVABLE TO OTHERS

UNDERSTAND - HAVE AND APPLY A WELL-ORGANISED BODY OF KNOWLEDGE.

LEARNER EXPERIENCE

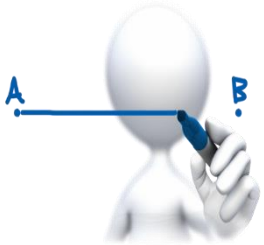
Strategies/Methodologies:

- GROUP WORK
- EFFECTIVE QUESTIONING
- DISCUSSION
- CREATING A DISPLAY
- PROTOTYPING.

Resources:

- STIMULUS VIDEO
- A1 FLIP CHART SHEET WITH DESIGN CYCLE ON IT.
- PROTOTYPE PACK

NEXT STEPS FOR 2019



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

Contact Details

Administrative Office:

Monaghan Ed. Centre,

Armagh Road,

Monaghan.

www.metc.ie

Director's Office:

LMETB,

Chapel Street,

Dundalk

For all queries please contact:

info@jct.ie

Follow us on Twitter:

@JCforTeachers

@JCt4ed

QR code Feedback form

Key websites:

www.jct.ie

www.curriculumonline.ie

www.ncca.ie

JUNIOR CYCLE FOR TEACHERS

JCT4

An tSraith Shóisearach do Mhúinteoirí