Written submission: Consultation on the draft Leaving Certificate Engineering specification

NCCA is redeveloping Leaving Certificate Engineering. The aim of this consultation is to obtain the open and honest views of all stakeholders: students, teachers, parents, and other interested parties. The feedback gained from the consultation will inform the work of the development group in preparing the final specification.

NCCA would greatly appreciate your feedback on the draft specification which can be found here: draft-lc-engineering-specification-for-consultation.pdf

When providing feedback, observations or comments, please reference the specific section and / or relevant learning outcomes. **The closing date for this consultation is 2nd May 2025 at 5pm.**

Respondent's details

What organisation are you submitting on behalf of?

WorldWise Global Schools

Are you consenting to be listed as a respondent to this consultation?

- Yes
- No

If yes, please enter the name you wish to have published in the final report.

WorldWise Global Schools

Are you consenting to have the submission published on ncca.ie?

- Yes
- No

Rationale, Aim, and Key Competencies [Pages 2,3 and 5]

Rationale: The rationale (P.2) outlines the nature of Engineering and the role and importance of Engineering in realising the purpose and vision of senior cycle.

Engineering is a dynamic field focused on designing, realising, manufacturing, and testing solutions to practical problems. It plays a pivotal role in addressing contemporary challenges,

fostering innovation, and promoting sustainable living within a circular economy. Engineering requires a blend of theoretical knowledge, practical skills, and a creative mindset. It promotes active learning and effective problem-solving techniques by applying scientific principles to real-world scenarios.

As part of the technology education suite of subjects, Leaving Certificate Engineering enables interdisciplinary learning, enriching students' overall experience. Engineering equips students with practical and technical skills for today's dynamic world, fostering teamwork, communication, and innovation. It helps them understand and address local, national, and global challenges, driving societal and economic progress.

Leaving Certificate Engineering emphasises the importance of ethical responsibility and the value of repair over replacement, which are essential values, helping students to understand the social and environmental consequences of business practices, cultivating a positive attitude toward enterprise and innovation. Leaving Certificate Engineering reflects the importance of engineering in society, inspiring STEM careers and enhancing technological literacy.

Aim: The Aim (P.3) outlines the overarching purpose of the subject and the relevance and expected impact of the subject on student learning.

Leaving Certificate Engineering aims to develop a deep appreciation and understanding of the importance of sustainable and ethical engineering solutions for society. More specifically, Leaving Certificate Engineering aims to:

• foster an awareness of the environmental, social, and economic impacts of engineering decisions and promote sustainable practices and ethical responsibility.

• enable students to learn about the core concepts, processes and principles of engineering.

• develop the students' capability, accuracy and precision using resources and equipment available in the Engineering classroom in a safe and appropriate manner.

• foster an engineering mindset, by enhancing creativity, problem-solving skills and design thinking through practical applications to engineering problems.

• develop students' capacity to effectively articulate ideas, designs, and solutions through various media, enhancing collaboration and engagement.

• encourage the application of theoretical knowledge in a systematic way.

• provide a broad educational experience that prepares students for future studies and the workforce as well as developing awareness of future careers and opportunities.

In your opinion, do the rationale and aim capture the overarching purpose and nature of Engineering; the importance of the subject in realising the vision of senior cycle and the relevance and expected impact of this subject on student learning. Please provide specific feedback / observations / comments.

It is encouraging to see the rationale incorporates the role of engineering in "*promoting sustainable living within a circular economy"* and in addressing "*local,*

national, and global challenges". In addition, we feel there is an opportunity to integrate themes such as global responsibility, interconnectedness, social justice and sustainability here. It could also link to progress towards the Sustainable Development Goals and how engineering can contribute to all 17 of them.

We highly value the inclusion of "*ethical responsibility and the value of repair over replacement".*

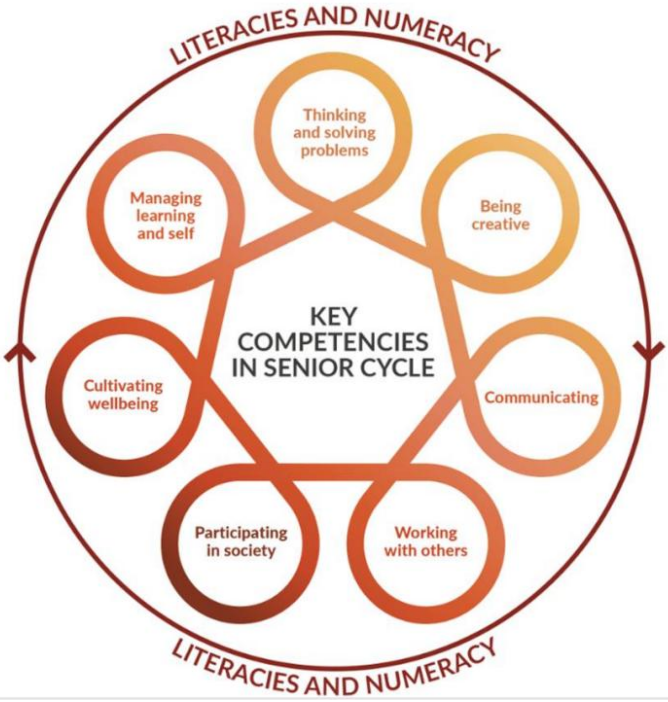
"Social and environmental consequences" could be expanded to refer specifically to the climate emergency, issues with plastic pollution, biodiversity loss and economic inequality and the role of engineering as both a cause and a potential solution.

We suggest that "*Leaving Certificate Engineering reflects the importance of engineering in society*" is expanded to refer to the potential of engineering to solve many of the world's issues.

In the aim, it is good to see the inclusion of "*foster an awareness of the environmental, social, and economic impacts of engineering decisions and promote sustainable practices and ethical responsibility*". We feel teachers may need some guidance on exactly what these impacts are as there will be varying levels of knowledge on sustainable practices and ethics.

We welcome a focus on "*enhancing creativity, problem-solving skills and design thinking through practical applications to engineering problems*" which emphasises the needs for skills and critical thinking in the curriculum. This could link again to engineering's potential to address many of the world's biggest challenges.

Key Competencies: Key competencies is an umbrella term which refers to the knowledge, skills, values and dispositions students develop in an integrated way during senior cycle. These competencies are linked and can be combined; can improve students' overall learning; can help students and teachers to make meaningful connections between and across different areas of learning; and are important across the curriculum. The draft specification sets out examples of how key competencies can be developed in Leaving Certificate Engineering (P.5 – 8)



The key competencies can be developed in Leaving Certificate Engineering 7 through a variety of hands-on, real-world experiences.

Thinking and Solving Problems *- By recognising and investigating how real-world constraints affect possible solutions and actions, students are encouraged to engage in innovative thinking and practical problem solving. Students develop critical thinking and technical problem-solving skills as they design, prototype, and refine engineering projects. Through the study of materials, processes, and technologies, students are encouraged to think creatively about how to apply engineering principles to real-world challenges.*

Being Creative - *Creativity is promoted as students explore innovative design solutions, experiment with materials, and develop prototypes. They are encouraged to take informed risks, test their ideas, and learn from setbacks, all of which are key aspects of the engineering mindset. The strong emphasis on design encourages students to be curious, open-minded, adventurous, and imaginative.*

Communicating - *Students learn to communicate their ideas clearly through effective means and appropriate media, whether through technical drawings, project documentation, prototypes, or presentations of their final designs. By engaging in discussions and collaborative projects, they learn to articulate their design decisions, listen to feedback, and consider different perspectives. This process enhances their ability to collaborate with others, work in teams, and navigate differing viewpoints, which are essential skills in both the engineering field and the broader world of work.*

Working with Others - *Collaboration is central to the engineering process, and students have many opportunities to work cooperatively with their peers and teacher. Working with others helps students develop their ability to share responsibility and manage different roles within a team. Through this process, they also develop an understanding of group dynamics, learning to give and take and navigate differences of opinion and approach.*

Participating in Society - *Engineering education also emphasises the importance of working ethically and sustainably. Students explore the environmental impact of materials and processes, fostering an understanding of responsible engineering practices. As they become more aware of the societal implications of engineering innovations, they are empowered to make informed decisions that consider both technical and ethical factors.*

Cultivating Wellbeing *- Engineering education supports student wellbeing by encouraging resilience and selfconfidence. As students take on increasingly complex tasks, they learn to cope with setbacks, overcome challenges, and develop perseverance. The emphasis on problem-solving and skills development fosters a sense of agency and achievement, contributing to their overall sense of purpose and belonging.*

Managing Learning and Self - *The development of project plans, with clearly defined goals, timelines, and resource management, is integral to the study of Engineering. This fosters self-management and selfregulation skills, as students monitor their progress and make adjustments when necessary to achieve successful outcomes. Through self-directed projects, students also develop personal responsibility and the ability to manage their learning, preparing them for lifelong learning and adapting to new challenges.*

In your opinion, does this section effectively capture the development of student key competencies in Leaving Certificate Engineering? Please provide specific feedback / observations / comments.

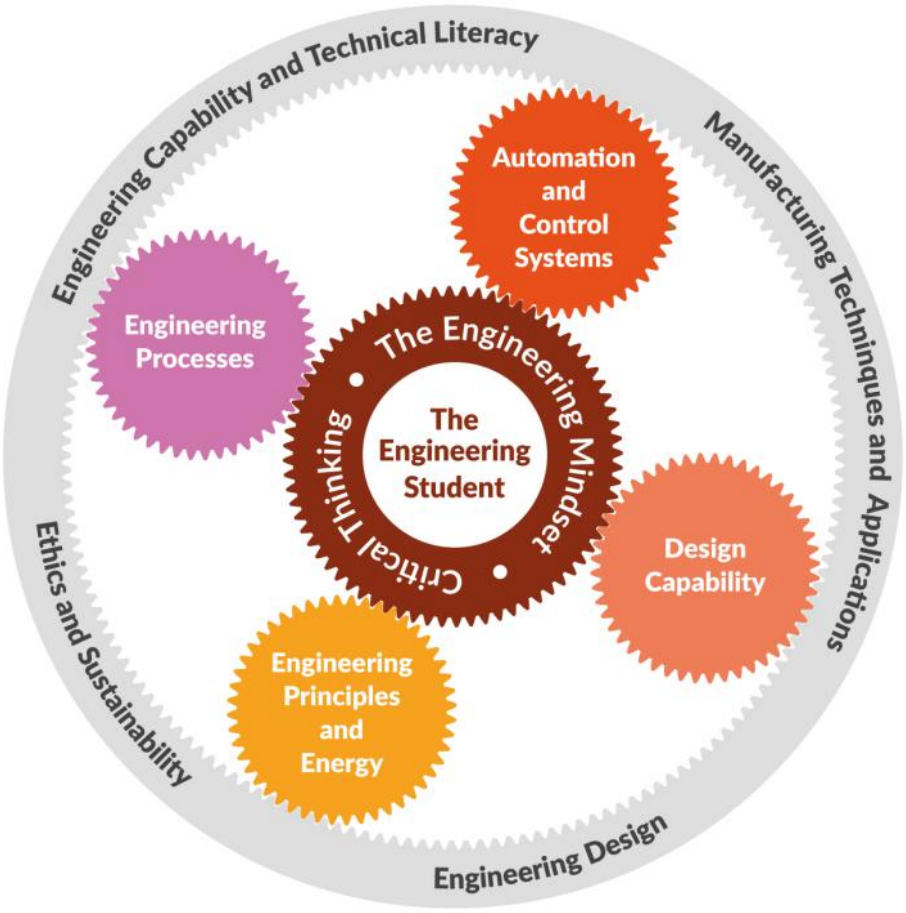
We value the emphasis on "*critical thinking*" and applying "*engineering principles to real-world challenges*" but think this could be enhanced with references to challenges such as adapting to the effects of climate change, reducing plastic waste and enabling universal access to facilities such as schools and hospitals, for example. This would enhance the 'knowledge' strand and provide more structure for teachers delivering this course.

It is welcome to see a push to "*consider different perspectives",* the "*importance of working ethically and sustainably"* and *"the environmental impact of materials and processes".*

The section that mentions *"informed decisions that consider both technical and ethical factors"* could be expanded to include social and environmental factors which would link well to the rationale. This would contribute to the key competencies of: Thinking and Solving Problems and Participating in Society.

Course overview: The course overview sets out the knowledge, skills, values and dispositions for students in four strands. The specification emphasises a non-linear, integrated approach to learning across the strands. The details of the strands are described on pages 8 - 22 of the specification.

The details of the cross-cutting themes are described on pages 8 – 9 of the specification.



<u>*Themes:*</u>

1. *Engineering Capability and Technical Literacy*

Engineering capability and technical literacy equips students with the ability to understand, evaluate, and use modern technologies. It emphasises the critical assessment of technological advancements, and adaptability to a rapidly evolving technological landscape.

2. Ethics and Sustainability

Engineering ethics promotes sustainability and encourages students to reflect on the short and long term environmental, social, and economic impacts of engineering decisions. This theme promotes sustainable practices and ethical responsibility, fostering an awareness of the challenges and opportunities in creating a more equitable and sustainable future.

3. Engineering Design

This theme supports students in identifying challenges, exploring innovative solutions, and systematically applying engineering techniques to address real-world problems. Students enhance their ability to collaborate, present, and critically engage with others through verbal, written, graphical, engineering drafting standards, practical, digital or other suitable media.

4. Manufacturing Techniques and Applications

Students learn to integrate creativity and technical precision, develop an awareness and proficiency in a range of manufacturing processes and techniques in the engineering classroom. Students develop knowledge, skills and an appreciation of manufacturing techniques and applications all while fostering a deep understanding of how engineering shapes everyday life, industry, and society.

In your opinion, does the structure illustrate the connected nature of the strands and the development of student knowledge, skills, values and dispositions in an appropriate way? Please provide specific feedback / observations / comments.

We agree that the structure illustrates the connected nature of the strands and we value the inclusion of the theme "Ethics and Sustainability". We suggest that more direction could be given on what this should look like, or particular topics that should be covered, or this may too heavily rely on teacher experience and expertise.

The "*the critical assessment of technological advancements"* links well to the themes of ethical and environmental responsibility in the rationale and the skill of critical thinking. The "*Ethics and Sustainability"* section also supports the rationale. It links knowledge, skills and values well.

Strand 1: Engineering Processes (P.12 – 14)

Please provide your views on the learning set out in this strand with reference to

- clarity for planning for teaching and learning
- alignment with the rationale and aims
- opportunities for the development of key competencies and
- access and challenge for all students.

Please provide specific feedback / observations / comments.

We value the inclusion of "*1.6 evaluate the environmental considerations, economic, and societal impacts of engineering decisions in historical and modern times*", however, in order for there to be 'clarity for planning for teaching and learning' we suggest there is more direction on what this should look like. Some more specific examples include: raw material extraction, workers' rights, use of non-renewable resources, greenhouse gas emissions etc.

"*Ethical issues involved in engineering"* could again include some more concrete examples and direction for teachers e.g. human rights, supply chains, workers' rights, in order to provide clarity for planning for teaching and learning. We would

value the inclusion of the concept of ‘greenwashing’ or masking environmental impact for profit.

“*1.6 evaluate the environmental considerations, economic, and societal impacts of engineering decisions in historical and modern times.”* - different times, different countries or communities could also be considered. E.g. how did an engineering project impact the local community vs. the company who created it? How are people impacted differently in low and high income countries? *Unsustainable* engineering could be explored as well as good practice.

We value the inclusion of “*Rethink, reduce, reuse, recycle, and the right to repair*” but we also emphasise a need for pressure to be shifted from an individual level, towards the systems level: there is a need for systemic change to solve the world’s biggest problems, it cannot rely on individual actors.

Strand 2: Automation and Control Systems (P.15-16)

Please provide your views on the learning set out in this strand with reference to

- clarity for planning for teaching and learning
- alignment with the rationale and aims
- opportunities for the development of key competencies and
- access and challenge for all students.

Please provide specific feedback / observations / comments.

We feel that commenting on this section is beyond the scope of our expertise, but would value the inclusion of case studies and examples from a range of countries and contexts.

Strand 3: Design Capability (P.17 – 19)

Please provide your views on the learning set out in this strand with reference to

- clarity for planning for teaching and learning
- alignment with the rationale and aims
- opportunities for the development of key competencies and
- access and challenge for all students.

Please provide specific feedback / observations / comments.

We would value the inclusion of case studies and examples from a range of countries and contexts, particularly when asking students to “develop solutions to real-world problems”. Embedding approaches such as *Design Thinking*;

specifically the Stanford Model, which is included in the WorldWise Global School Wood Technology for Junior Cycle Guide and also used by Munin Catalyst, would enhance this focus. This model is very useful and aligns well with a Global Citizenship Education (GCE) lens, *The Circular Economy*, and a sustainability-focused approach to designing. It encourages students to consider user needs, systems thinking, iterative problem-solving, and how materials and products can be kept in use for as long as possible.

We are pleased to see this section included: "Students learn to incorporate environmental considerations and ethical decision-making into their designs. By exploring concepts such as product life cycles and the sustainable use of materials, they develop an understanding of how their choices in materials and processes can impact both the product and society over time." However, we note that "product life cycles" are only mentioned here and could easily be overlooked. The concept of a *life cycle assessment* could be introduced as a core idea and used to link many of the themes and ideas in this specification (currently, students are only asked to 3.9 describe the main stages and characteristics of the product lifecycle, rather than assess). This would support the focus on environmental impact mentioned throughout—it is a simple concept for students to understand and helps them think beyond the use/disposal of an item. It would also complement the principles of *The Circular Economy*, helping students frame their thinking around design for longevity, reuse, and minimal waste.

Strand 4: Engineering Principles and Energy (P.19 – 22)

Please provide your views on the learning set out in this strand with reference to

- clarity for planning for teaching and learning
- alignment with the rationale and aims
- opportunities for the development of key competencies
- access and challenge for all students.

Please provide specific feedback / observations / comments.

We are pleased to see the inclusion of "*evaluate the energy requirements for various control systems, considering efficiency and the use of renewable energy sources*" and "*an analytical approach in solving real-world engineering problems*" but again feel there could be more direction for teachers to support "clarity for planning for teaching and learning". Could direction on real-world examples be provided?

Section "*4.3 explain the impact of production and disposal of materials on the environment*" is another area that would benefit from the inclusion of life cycle assessment - this brings the focus to the entire life of a product and could include the specific example of plastic, to highlight its overuse and non-renewable nature.

In the section "*4.4 identify approaches used to conserve natural resources"* we would like to see renewable/non-renewable options mentioned, perhaps with a specific example on why wood/paper is a better option than e.g. plastic (despite them both being derived from natural resources). A lack of examples or direction could lead to great variation in what students learn about depending on teacher interest and expertise.

Additional Assessment Component (AAC)

The design and manufacture project provides an opportunity for students to display evidence of their learning across all strands of the specification. The senior cycle key competencies of thinking and solving problems, being creative, communicating, working with others, and managing learning and self, developed through working with learning outcomes across the specification, will be applied through the student's engagement with the project.

A Design and Manufacture Project brief will be issued annually by the SEC. The brief will set out the requirements for the Design and Manufacture Project and will:

· set a context for the project

· provide guidance to students in the development of their project work

· allow students to develop their knowledge and understanding in areas related to the brief

· facilitate teachers and students in their planning.

This experience will allow students to demonstrate their creativity, showcase the breadth and depth of their practical and manufacturing ability, and refine their communication techniques as they develop, implement, and document their progress through the design and manufacturing process.

Please provide specific feedback / observations / comments on the AAC in Leaving Certificate Engineering with reference to how the AAC might motivate students, how it aligns to the learning outcomes in the specification and how it facilitates the development of key competencies.

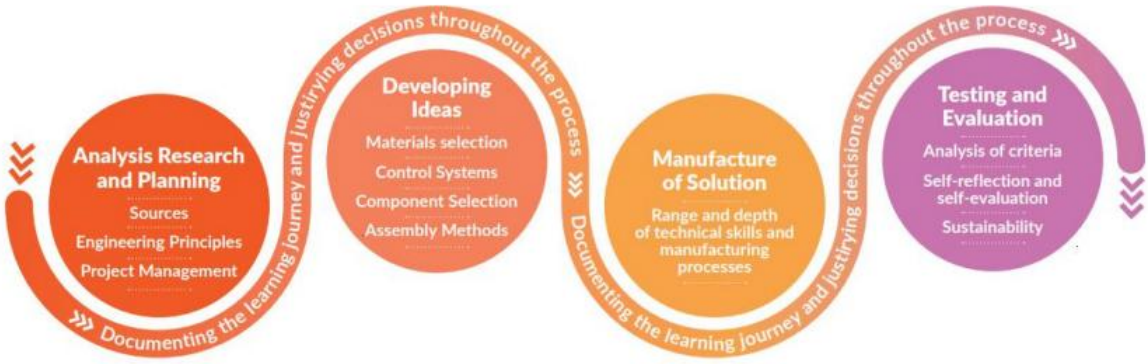


Figure 4 Additional Assessment Component (AAC)

We see the design and manufacture project as a great opportunity for students to display evidence of their learning whilst developing the key competencies. As the SEC will set the context for these projects, we would like to see these set in the context of global issues, such as mitigating for, or adapting to, the impact of climate change, reducing plastic waste or supporting the shift towards renewable energy. This is an excellent opportunity for students to demonstrate their creativity and showcase their practical and manufacturing ability whilst facilitating the development of key competencies. This could also include a 'connecting global to local section' encouraging students to link their engineering project to their lives and their communities, whilst also considering the bigger global picture.

Supports for Successful Enactment

Please provide specific feedback / observations / comments on supports that might be needed for successful enactment of this subject specification.

This specification gives clear guidance on how skills and competencies should be developed throughout this course. It provides a strong foundation for teaching about engineering's role in the world as both a cause of issues and a solution, whilst developing practical skills. We feel that the specification lacks detail at points, and although this provides freedom for teachers, it could lead to great variation in what students are taught depending on teacher interest and expertise. We suggest that some core themes, examples or pointers are given to ensure that important topics are not overlooked. For example, inclusion of the issue of climate change, plastic as a material and the issue of labour exploitation, would provide extra structure for teachers, without prescribing exact content. This would support educational policy goals that encourage the integration of global perspectives and a citizenship focus.

To further support teachers, Appendix 1: Glossary of terms should be extended to provide definitions of terms such as sustainability, ethical, social justice, environmental responsibility etc. to support non-specialists of citizenship or ethics education.