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: Leaving Certificate Engineering

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.

Data protection and open data section

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Where a respondent selects 'yes' to the question: *Are you consenting for your submission to be published*, respondents are consenting to having their submission published on ncca.ie.

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Respondent's details

What organisation are you submitting on behalf of?

Engineering Technology Teachers Association

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

- Yes

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

Engineering Technology Teachers Association

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

- Yes

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.

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

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.

The ETTA are happy that the rationale and aims capture the overarching purpose and nature of Engineering. We welcome and appreciate the focus on the fundamentals of Engineering.

Rationale:
We would suggest the inclusion of the following in the final paragraph of the Rationale - line 5 - remove all after ...”STEM careers” and insert the following - by connecting the course content to career pathways in industry, apprenticeships, and manufacturing, including modern engineering practices and problem-solving skills, as well as enhancing technological literacy

Aim:
We would suggest inclusion of the following additional aim: recognise the importance of practical skills as the backbone of the subject and emphasise the development and examination of these skills to prepare students for careers in industry, apprenticeships, and manufacturing.

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)

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

The ETTA are happy that this section effectively captures the development of student key competencies in Leaving Certificate Engineering

Strands of study and learning outcomes [ADD PAGE NUMBERS]

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.

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.

The proposed specification is ambitious and well-structured; however, the allocation of just 180 hours is a major concern. There is a strong sense that this time frame is simply not enough to deliver the broad and demanding content effectively. The learning outcomes are too numerous and the language too vague, making it difficult to plan and teach within such tight time constraints.

There's also concern that the strands lean too heavily on design, with not enough emphasis on practical skills and the hands-on making process. The removal of a practical day exam adds to this concern, raising doubts about how these essential skills will be assessed in a meaningful way. Clearer guidance and teaching resources will be essential, especially for new elements like "Design Capability," which represent a significant shift.

Some strands, such as principles and energy, are viewed as pitched too high for the intended level, while cross-cutting themes like ethics and sustainability seem added on. Additionally, unequal access to ICT equipment across schools could further complicate the delivery of key parts of the specification, especially given the limited hours available.

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.

Clarity for Planning for Teaching and Learning

The breadth of content covered in Strand 1 is considerable. While the specification aspires to provide a comprehensive and integrated understanding of engineering processes, we recommend a review of the learning outcomes to ensure they are realistically achievable within the proposed 180-hour timeframe. Without such revision, there is a risk that the depth of understanding and the quality of teaching and learning may be compromised. Focusing the outcomes would better support teachers in planning effective and manageable instructional sequences.

Alignment with the Rationale and Aims

The following learning outcomes (LOs) in Strand 1 would benefit from rewording to better reflect the rationale and aims of the specification, particularly the focus on sustainability, practical capability, and ethical responsibility in engineering:

- **LO 1.1**: *Evaluate and discuss the evolution of engineering practice considering the evolution of tools, materials, ethics, sustainability and impact on our world.*
- **LO 1.3**: *Describe the contributions of key figures in engineering and technology. List of key figures to be updated on an annual basis, in September of 5th year.*
- **LO 1.8**: *Describe and use a range of additive and subtractive manufacturing techniques adhering to ISO standards of accuracy and precision.*
- **LO 1.9**: *Describe and apply the fundamental principles and theories relating to manufacturing processes, assembly techniques, and their applications in a range of contexts. Include theories and principles in this outcome.*
- **LO 1.17**: *Explain the effects of heat treatments/thermal manufacturing methods on materials, their properties, and their applications.*
- **LO 1.27**: *Describe key concepts involved in quality management, statistical process control and sampling. Include list of key concepts in this LO.*

Suggested Removals:

- **LO 1.2**: *Appreciate the impact that engineering developments have had on our world.*
- **LO 1.26**: *Outline the features and the operations of an automated manufacturing facility.*

Opportunities for the Development of Key Competencies

To further support the integration of key senior cycle competencies, it is recommended that the following learning outcome be added:

- **Proposed LO**: *1.xx Demonstrate an ability to transfer measurements accurately from a working drawing to a working material.*

Access and Challenge for All Students

In its current form, Strand 1 includes an extensive range of learning outcomes covering historical perspectives, ethical considerations, manual and digital manufacturing techniques, health and safety, material science, and quality control. While comprehensive, the volume and complexity presents significant challenges in ensuring equitable access and meaningful engagement for all students.

- *Recommendation*: Review and refine the scope of learning outcomes to ensure they are appropriately scaffolded for both Ordinary and Higher level students.

These adjustments would uphold the principles of inclusive education and flexibility outlined in the Senior Cycle Framework and better reflect the ethos of Leaving Certificate Engineering as an accessible, forward-thinking, and practically oriented subject.

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.

Clarity for Planning for Teaching and Learning

The breadth of content in Strand 2 is very broad. We recommend a review of these learning outcomes to ensure they are realistically achievable within the reduced 180-hour timeframe, especially in conjunction with the demands of the other three strands. Without refinement, the breadth of this strand may hinder effective delivery of the learning outcomes.

Alignment with the Rationale and Aims

The rationale and aims of the specification emphasise ethical practice, problem-solving, and technological literacy. While the current Strand 2 learning outcomes are technically rich, some may benefit from re-alignment or refinement to more effectively support the development of student competencies and real-world engineering mindsets.

Suggested Rewording:

- **LO 2.2**: *Model system inputs, processes, and outputs, and the relationships between them.*
- **Clarify descriptor (Students learn about)**: *Hardware and software inputs, processes and outputs required for control and monitoring of hydraulic, pneumatic, electronic, electrical and computer-based systems.*

Suggested Removals:

- **LO 2.6**: *Describe the design of a control system using an appropriate technical format..*
- **Descriptor on HMI (Students learn about)**: *Approaches to designing Human Machine Interfaces (HMI) to provide a system with local control and monitoring capabilities.*
- **LO 2.10**: *Appreciate control and monitoring design practice, in terms of the user experience, safety and inclusion.*
- **LO 2.11**: *Implement hardware, software, local control and monitoring interfaces using system analysis specifications.*

Opportunities for the Development of Key Competencies

Strand 2 offers significant potential for the development of key senior cycle competencies, particularly in Thinking and Solving Problems, Managing Learning and Self, and Working with Others. The emphasis on system design, automation, and control provides real-world scenarios for applying theoretical knowledge.

However, by removing more abstract learning outcomes related to HMI, the specification can maintain a focus on practical application over less tangible learning areas, better supporting competency development within available class time.

Access and Challenge for All Students

Strand 2 presents an extensive coverage of topics ranging from basic system components to autonomous technologies. While this reflects the modern landscape of engineering, the current structure of some of the learning outcomes may disadvantage students with less prior exposure to programming, digital systems, or abstract modelling.

- *Recommendations:*
    - Review the scope of the strand to ensure foundational concepts (such as basic automation and control logic) are prioritised over advanced applications (such as HMI integration or autonomous systems with AI).

- Removing or simplifying abstract outcomes like LO 2.6 and 2.10 makes the strand more accessible and reduces barriers for students with varying skill levels.
- Streamlining learning outcomes will also create room for scaffolded learning and differentiated instruction, which aligns with the senior cycle's commitment to inclusion and diversity.

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.

Clarity for Planning for Teaching and Learning

The breadth of content in Strand 3 is considerable. We make the following recommendations to ensure delivery of learning outcomes, and to enhance the experience of our students.

Suggested rewording:

- **3.3**: *Communicate engineering concepts and designs using appropriate media incorporating ISO technical symbols and norms.*
- **3.5**: *Create engineering working drawings through CAD and/or traditional drafting methods that adhere to established ISO drafting standards.*
- **3.6**: *Describe and apply the steps involved in the engineering design and manufacturing process.*
- **3.7**: *Create a design folio to document and evaluate the design and manufacture process.*
- **3.10***: Apply principles of product functionality during the design process. Key principles to be included in the specification.*
- **3.11**: *Apply principles of universal design. Key principles to be included in the specification.*
- **3.12**: *use engineering judgement to specify mechanical components*.
- **3.13:** *select the correct electrical components for engineering applications using recognised ISO symbology*.
- **3.14**: *Calculate the specifications and dimensions required for the design of machine components and powered systems. (formulae to be provided in the specification)*

Alignment with the Rationale and Aims

Strand 3 directly supports the aims of fostering an engineering mindset, enhancing design thinking, and encouraging creativity and ethical responsibility. The proposed refinements further strengthen this alignment by:

- Reinforcing technical precision and communication through references to ISO standards (3.3, 3.5),
- Supporting ethical and inclusive practice through the explicit teaching of universal design (3.11),
- Enhancing students' capacity to articulate and implement the design-to-manufacture process (3.6, 3.7),
- Embedding a more structured understanding of functional and sustainable design (3.10).

These refinements also contribute to preparing students for both future studies as well as for entering the world of work.

Opportunities for the Development of Key Competencies

Strand 3 provides rich and diverse opportunities to develop key senior cycle competencies:

- **Thinking and Solving Problems**: through iterative design, prototyping, and problem analysis.
- **Being Creative**: by encouraging students to ideate, sketch, and refine original solutions.
- **Communicating**: via the creation of engineering drawings and the design folio.
- **Working with Others**: through collaborative design activities and peer evaluation.
- **Managing Learning and Self**: in planning and documenting the design and manufacturing journey.

The suggested clarifications, especially the inclusion of key principles and formulae, support meaningful engagement and allow students to develop these competencies through structured, purposeful activity.

Access and Challenge for All Students

The volume and complexity of Strand 3 may pose challenges for students with diverse learning profiles. To address this while ensuring that all abilities of student are challenged:

- Explicitly listing key principles (3.10, 3.11) supports clear and equitable access to complex abstract concepts like functionality and inclusivity in design.

- Providing formulae in the specification (3.14) helps scaffold learning for all students, especially those who may struggle with applied mathematics in engineering contexts.

These refinements promote inclusive education by enabling differentiated instruction while ensuring opportunities for advanced learning and challenge.

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.

Clarity for Planning for Teaching and Learning

The breadth of LOs in Strand 4, while important to Engineering, may affect the ability of teachers to deliver all outcomes in meaningful depth. We would welcome the inclusion of formulae within the specification, as this would be a significant support for clarity and ensure consistency across schools.

Recommendations:

- **Rewording and Clarification of Learning Outcomes:**
  - **LO 4.2**: *Describe the production of common engineering materials.*
  - **LO 4.11, LO 4.14, LO 4.17, LO 4.21, LO 4.22**: *Add*: *Formulae to be provided in the specification* to all these outcomes
  - **LO 4.20**: *Identify and describe friction forces for drive and braking applications.*
  - **LO 4.24**: *Identify and describe sensor and drive systems in DC circuits.*
  - **LO 4.27**: *Interpret and apply pneumatic and/or hydraulic circuit diagrams involving valves, cylinders and energy supplies.*

Alignment with the Rationale and Aims

The recommended rewordings enhance alignment by ensuring learning remains focused on applicable, relevant content that supports practical application and real-world engineering contexts.

The inclusion of formulae is strongly aligned with the aim to "enable students to apply theoretical knowledge in a systematic way," and supports precision, safety, and informed decision-making.

Suggested Removals:

- **LO 4.7:** *describe the relationship between microstructure and material properties.*
- **LO 4.8:** *use phase diagrams to explain the effects of heat treatment processes for altering the properties of metals.*
- **LO 4.9:** *identify the effects of mechanical working on material properties.*
- **LO 4.13**: *analyse closed systems or steady flow systems using a simplified energy balance.*
- **LO 4.26**: *Calculate the forces acting on master and slave cylinders involving static fluid pressure using Pascal's Law.*

These removals allow space to strengthen key Engineering competencies and support depth over breadth in the teaching and learning associated with this strand

Opportunities for the Development of Key Competencies

Strand 4 presents significant opportunities to develop competencies in:

- **Thinking and Solving Problems**: through analytical and applied calculations in energy, forces, and mechanics.
- **Managing Learning and Self**: as students engage with engineering calculations, system diagrams, and design justifications.
- **Communicating**: through interpretation and application of technical data.

The proposed inclusion of formulae enhances student engagement and allows more time to engage with the why behind the calculations, rather than solely the how.

By simplifying or removing overly complex outcomes and rewording others for accessibility, students will be better positioned to engage meaningfully and apply their learning across integrated projects.

Access and Challenge for All Students

The technical density of Strand 4 presents challenges for meaningful student access across the full range of ability, particularly when highly abstract concepts or advanced calculations are included. The proposed adjustments help balance the theoretical knowledge with inclusivity by:

- Replacing high-level material science content (4.7–4.9) with more accessible and relevant content.

- Clarifying the scope of expected calculations and ensuring formulae are embedded in the specification.
- Providing more descriptive, identification-based alternatives to advanced analytical outcomes (e.g., 4.20, 4.24).

These recommendations enable better differentiation and allow teachers to build conceptual understanding before introducing more technical complexity, while ensuring that every Engineering student can access and understand the content.

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.

Additional Assessment Component:
The draft specification allocates 45 hours for the design project, which now accounts for 50% of the overall assessment. This represents a significant increase in weighting compared to the current system, without a corresponding increase in dedicated time. There are already concerns around the time allocated to the current project with this new specification allocating less time for a higher weighting.

Proposed Second Additional Assessment Component:

The ETTA has serious concerns regarding the omission of a second Additional Assessment Component (AAC). Many of the learning outcomes — particularly those focused on practical competencies — cannot be meaningfully assessed through a written examination or the current proposed project model alone.

Given increasing challenges related to academic integrity in the age of AI, the traditional Day Practical Examination has proven itself a robust and authentic assessment method, effectively capturing practical and problem-solving skills in real time.
ETTA proposes the inclusion of a **second additional assessment component: Machining & Bench Skills Assessment**, in line with current practice in *Leaving Certificate Construction Technology*. This proposal is grounded in the aims, learning outcomes, and key competencies articulated in the draft specification and seeks to enhance the validity, inclusivity, and equity of assessment in Engineering at senior cycle.

Rationale for the Machine & Bench Skills Assessment in Engineering

1. Alignment with Learning Outcomes and Specification Intent

The draft specification highlights the importance of developing technical proficiency, accuracy, and manual craft skills as integral to the discipline of engineering. Strand 1: *Engineering Processes* and Strand 3*: Design Capability* includes specific learning outcomes that directly relate to the development and demonstration of these skills (e.g., outcomes 1.7, 1.11, 1.12, 1.19, 1.20, 3.15). A Machine & Bench Skills Assessment would provide a direct and focused means to assess these competencies in a valid and authentic context.

2. Reinforcement of Key Senior Cycle Competencies

The proposed Machine & Bench Skills Assessment would provide meaningful opportunities for students to demonstrate a wide range of senior cycle key competencies, including:

- **Numerical Reasoning** – through precision measurement and technical interpretation of drawings.
- **Critical Thinking and Problem-Solving** – through the real-time execution of manufacturing sequences.
- **Self-Management** – through the structured and time-restricted nature of the task.
- **Preparation and Planning** – the processes involved in acquiring and preparing the workpieces to the specifications outlined (accuracy, precision, material selection), along with organising the equipment needed to complete the assessment on the day.
- **Effective Communication** – through the practical application of interpretation of engineering drawings and specifications.

These competencies are embedded throughout the Engineering specification and are well-aligned with the learning outcomes of a focused practical assessment.

3. Complementarity with the Existing Design and Manufacture Project

The existing Design and Manufacture Project assesses students' capacity to creatively design, plan, implement and document a project over an extended period. While it addresses a broad range of learning outcomes, it allows for significant variation in design complexity, allowing each student a unique opportunity to showcase their talents and skills, and levels of teacher support. In contrast, a Machine & Bench Skills Assessment would focus on the standardised execution of practical skills, providing a controlled, consistent, and equitable measure of students' craft competence and skills. Together, these components would offer a more comprehensive and balanced profile of student achievement.

4. Motivation and Integration with Teaching and Learning

The inclusion of a Machine & Bench Skills Assessment would reinforce the subject's practical identity, serving as a motivating target for students and a clear instructional focus for teachers. Its integration into regular classroom practice would promote engaged, active learning and support students in making explicit connections between theoretical knowledge and practical application.

5. Equity and Consistency Across the Technology Subjects

Currently, the draft Construction Technology Subject Specification includes a Craft Skills Assessment as a second additional assessment component, while Engineering does not. This creates a disparity in how practical competencies are assessed across both subjects. The inclusion of a second additional assessment component in Engineering would address this inconsistency, ensuring equity of assessment opportunity for students of Engineering and recognising the full spectrum of skills, knowledge and abilities the subject seeks to develop.

Conclusion

We propose that a **second additional assessment component – the Machine & Bench Skills Assessment – be introduced in Leaving Certificate Engineering**. This component would:

- Strengthen the alignment between assessment and intended learning outcomes.
- Provide a clear and fair measure of technical proficiency and skill acquisition.
- Motivate students during the 2-year course through meaningful practical engagement.
- Ensure consistency with assessment practices in other technology subjects.

Such an inclusion would enhance the validity, equity, and educational relevance of the subject and provide a more accurate reflection of students' abilities in both the theoretical and practical dimensions of engineering.

The proposed Machine & Bench Skills Assessment would serve as a valuable addition to the Leaving Certificate Engineering assessment framework. In line with the key competencies of the Leaving Certificate, this second additional assessment component will cultivate wellbeing by being accessible to all students, regardless of gender, and in line with the reasonable accommodations available from the SEC. It reflects best practice in practical and vocational education, supports the development of essential life and career skills, and contributes to a more inclusive, balanced, and student-centred approach to senior cycle learning.

Considering the points above, ETTA proposes the following assessment structure for consideration:

- **Written Examination:** 50%
- **AAC 1 – Design Project:** 25%
- **AAC 2 – Day Practical Assessment:** 25%

This approach would offer a fairer, more balanced, and more inclusive assessment model that retains academic rigour while acknowledging the diverse pathways students pursue after school.

Supports for Successful Enactment

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

While the course is undoubtedly modern and progressive, it appears to lean towards the needs of students who may pursue university education. However, a significant proportion of students who take Engineering at senior cycle go on to pursue apprenticeships, which is a career route currently facing critical shortages.
We are concerned that these students may feel alienated by the draft specification. International models, such as curriculum for excellence in Scotland, offering multiple Engineering pathways for example, one focusing on Engineering Science and another on Practical Metalwork which focuses on practical machining skills, metal fabrication and thermal joining processes, catering to a broader range of student abilities and aspirations.
ETTA respectfully requests that greater emphasis be placed on hands on practical skills development, which is integral to a deeper understanding of engineering

principles and to ensuring that all students of various abilities and aptitudes, regardless of their intended career path, are appropriately catered for.
The breadth of content covered in the draft specification is considerable, especially when considered against the revised allocation of a minimum 180 hours of class contact time, a reduction on the current time allocation of minimum of 10%. This recommended minimum time will be the allocated class contact time, due to time requirements of other subjects.
We recommend a review of the learning outcomes to ensure that they are realistically achievable within this reduced timeframe, without compromising depth of understanding or the quality of teaching and learning.
ETTA has serious concerns regarding the omission of a second Additional Assessment Component (AAC). Many of the learning outcomes, particularly those focused on practical competencies, cannot be meaningfully assessed through a written examination or the current proposed project model alone.
Given increasing challenges related to academic integrity in the age of AI, the traditional Day Practical Examination has proven itself a robust and authentic assessment method, effectively capturing practical and problem-solving skills in real time.
Learning outcomes that can only be assessed appropriately by the inclusion of a second additional assessment component are 1.7, 1.11, 1.12, 1.19, 1.20, and 3.15. We propose its inclusion as a second AAC.
The draft specification allocates 45 hours for the design project, which now accounts for 50% of the overall assessment. This represents a significant increase in weighting compared to the current system, without a corresponding increase in dedicated time. There are already concerns around the time allocated to the current project with this new specification allocating less time for a higher weighting.
Many schools have equipment in engineering rooms across the country, that are operating machinery that is of a previous generation. The resourcing and associated maintenance of engineering rooms with appropriate tools and equipment such as CNC machining, laser cutters, 3D printers, thermal joining equipment, computers, pneumatics etc is a primary concern of the ETTA (this list is not exhaustive and should cater to the full specification when released). We recommend a standardised equipment and furniture list to be released alongside the final specification, with guaranteed ringfenced funding to allow all schools to provide the same educational experience to all students studying engineering. A review of existing engineering rooms should be carried out that is standardised across all sectors regardless of school patronage.

ETTA remains open to further discussions around the development the new LC Engineering specification.

We thank the Development Group, the NCCA, and the Minister for Education for their time and commitment to this important work, and we hope that these considerations will be taken on board in the next stage of review.