National Engineering Policy Centre

Institution of MECHANICAL ENGINEERS

Royal Academy of Engineering

Joint response to the Department for Education Curriculum and Assessment review Call for Evidence (November 2024)

The Institution of Mechanical Engineers (IMechE) represents more than 115,000 engineering professionals and students in the UK and worldwide. The Institution plays a significant role in promoting education and skills in mechanical engineering, thus inspiring pupils and young people into engineering careers.

Within the Institution, the Engineering Policy Unit informs and responds to UK policy developments by drawing on the expertise of our members and partners, and the Education and Skills Strategy Board works to influence government and other stakeholders across the field to recognise the contributions and potential of engineering to society.

As part of a joint effort by several Professional Engineering Institutions, led by the NEPC, the IMechE contributed its vision, expertise, and policy capacity to the call for evidence. Through a series of meetings and roundtables, this document captures the overall vision for the Curriculum and Assessment review, reflecting the collective insights and recommendations of the engineering community.

Section 2: General views on curriculum, assessment, and qualifications pathways

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes the education system needs to balance meeting the needs of the individual, setting young people up for life and work, alongside meeting the workforce needs of the UK. Those workforce needs have been recognised by the government as particularly significant in engineering and technology.

For instance, the UK's ambitions around decarbonisation, and missions for sustained growth and clean energy, will fail without the associated workforce. We need a broad and balanced curriculum that addresses diversity issues in STEM teaching and learning, equips a generation of digitally literate young people and increases the visibility of engineering across the curriculum.

In light of this, the National Engineering Policy Centre believes that we need a curriculum that:

- imparts the knowledge and insight to comprehend the science, engineering and technology behind global challenges, such as climate change, biodiversity loss and sustainable energy supply, to enable young people to constructively engage with these issues.
- provides mathematical and data education that better prepares young people for the rapidly changing demands of an increasingly data-rich world.
- provides digital education that ensures that all future citizens can keep up with the pace of technological change so they can be effective, well-informed and safe.
- is inclusive and addresses gender imbalances in progression in subjects such as mathematics, computing and physics
- equips young people with the understanding of the jobs available and the skills required to access those.

To achieve this the curriculum and assessment review should consider:

- the impact of the EBacc system, academization and the nature of the English assessment system at Key Stage 4 and 5 on the breadth of subjects available to young people.

- the importance of context and representation in addressing the diversity challenges particularly in STEM subjects such as physics, computer sciences and Design & Technology.
- the impact of content overload in STEM subjects on the opportunity for more practical hands-on learning.
- the importance of real-world application approaches in teaching and learning, enabling young people to find out more about how physics, maths, computer sciences and Design & Technology link into the world of engineering.
- how to enable more young people to showcase their knowledge and skills through a reformed assessment system.
- a greater focus in the curriculum on equipping young people with digital skills.
- integrating the causes, impact and – crucially – the solutions to environmental problems, particularly climate change, throughout the curriculum, clearly linking it to careers available in this field.
- how to best embed careers education across the STEM curriculum.

10. What aspects of the current a) curriculum, b) assessment system and c) qualification pathways are *working well* to support and recognise educational progress for children and young people?

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK welcomes that the national curriculum categorises English, mathematics and science as core subjects. We express concern that science has been neglected in the narrative around core subjects in this curriculum and assessment review with a focus primarily on 'reading, writing and maths' https://www.gov.uk/government/news/government-launches-curriculum-and-assessment-review. We would encourage the expert group to clearly re-state that science as a core foundational subject in the review.

GCSE and A level qualifications are well understood by society, further and higher education institutions and employers and are largely respected. Other qualifications such as the International Baccalaureate are also respected and offer a broader and more balanced set of subjects to 18. In Post-16 education, qualifications such as BTECs are also well understood by employers. We welcome the general overall direction of reducing the number qualifications on offer in 16-19 education, particularly those that have little labour market value. In this regard we welcomed the introduction of T levels, as a mechanism of simplifying the Post-16 qualifications landscape and linking learning outcomes to employer-defined apprenticeship standards, which will, by definition have currency with employers. However, we have concerns regarding the structure and content of T levels presented below.

We welcome the opportunity for young people to follow technical/vocational pathways at age 16 and we would like to see more young people enabled to access and progress through these routes, particularly as the UK's ambitions around decarbonisation will depend on a significantly increased technician workforce at levels 2 – 5.

11. What aspects of the current a) curriculum, b) assessment system and c) qualification pathways should be *targeted for improvements* to better support and recognise educational progress for children and young people?

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes that overall, there is too much content in the national curriculum https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/the-science-teaching-survey/2022/too-much-content-not-enough-time/

We hear this anecdotally from teachers across all STEM subjects and across the broader curriculum and there are surveys of teachers highlighting the issue.

This prevents deeper exploration of subjects including the application of ideas to real-life scenarios and opportunities to discuss careers and progression pathways related to the subject matter and fundamentally, enjoyment of subjects.

We recommend the expert group review the current method of assessment of English and mathematics in primary schools. The current KS2 SATs in particular result in a highly imbalanced curriculum in year 6, often at the significant expense of practical and creative subjects such as design and technology and computing, and even at the expense of science, despite it being a core subject.

We have concern regarding the linear, terminal assessment nature of GCSEs and A levels. These assessment methods rely too much on knowledge retention and recall, and do not enable the development of a broad range of skills that will be beneficial for engineering (and more general) employment. Moreover, tests that rely on significant memorisation are unfair for particular groups of students such as those with Special Educational Needs and Disabilities (SEND) https://www.ascl.org.uk/ASCL/media/ASCL/News/Press%20releases/The-future-of-GCSEs-survey-responses-March-2020.pdf.

We also have concern that both the overfull curriculum and the terminal assessment nature as well as size of GCSEs has led to a significant reduction in practical work, laboratory exercises and problem-based and project-based learning approaches in subjects such as design and technology, computing and the sciences. The Science Education Tracker survey of schools 2023 https://www.engineeringuk.com/research-policy/attitudes-knowledge/the-science-education-tracker-2023/ undertaken by the Royal Society and EngineeringUK, highlights a significant (18%) decrease in the number of GCSE students undertaking practical work in science on a fortnightly basis since 2019, while simultaneously seeing an increase in the number of videos of practical used as a replacement.

We are concerned that the dual-track approach to science GCSEs (double science vs triple science) is unfair. We recommend that there should only be a single approach to science at GCSE for all schools. The nature of that approach (size, content etc.) should be developed in consultation with the science and engineering community.

There is a strong correlation between the introduction of the English Baccalaureate performance measure on schools and the decline in Design and Technology as a subject at GCSE https://issuu.com/designcouncil/docs/a_blueprint_for_renewal_design_and_technology_educ. We also note the Design and Technology Association, the subject body for D&T teachers also reports a decline in D&T provision at KS3, correlating with the increasing academisation of secondary schools in England which are exempt from following the national curriculum.

Yet design (and the corresponding technologies) is fundamental to the UK and any economy in the 21st century. Design can be defined as the transformation of an existing state to a preferred state. It is important to every person and everything in modern society. All the information systems we use are designed. Medical services are designed. The introduction of Design and Technology as a new subject in 1989, evolving from craft subjects of woodwork, metalwork and needlework etc was hailed as an education policy innovation. https://www.thersa.org/reports/whats-wrong-with-dt We believe that Design and Technology should be seen as a vital part of the curriculum and given due prominence. We also recommend that all state-funded schools be required to follow the national curriculum.

While we welcome the introduction of T levels as an approach to simplifying the 16-19 qualification offer for learners, we have concern that there is too much specialisation in the qualifications, for example 25 different specialism pathways in the engineering and manufacturing T level, 26 specialism pathways in Construction and the Built Environment T level and 9 pathways in the digital T level. T levels are not competency-based qualifications like apprenticeships. Learners should be able to build a broad base of technical knowledge across a range of subject areas, not a deep narrow specialism in a specific area. Moreover, the large number of specialism pathways make it very difficult for FE colleges to deliver the provision. We are also concerned that the specialised nature of T Levels contributes to the gender divide in who takes these courses.

We have concerns that many learners are unable to fulfil the 45-day industry placement in T levels due to lack of placement opportunities https://www.engineeringuk.com/media/318632/unlocking-talent-ensuring-t-level-deliver-the-workforce-of-the-future-final.pdf. This can result in them completing two years of study but not achieve the qualification. This needs to be addressed.

The current curriculum does not provide young people with the digital literacy that they will require in a world of fast-paced technological change and believe that the education system should equip young people to be prepared for that. In light of this, we would welcome the introduction of computing education (with a broader focus on digital skills as opposed to computer science) as a new core subject for the national curriculum given its increasing importance to all people in society, and for those working in engineering and technology specifically.

To ensure the UK maintains its competitive edge in STEM education, it is crucial to benchmark our curriculum against high-performing countries in international assessments. The OECD's Programme for International Student Assessment (PISA) provides valuable insights into how different countries perform in science and mathematics. We recommend a comprehensive review of curricula from countries that consistently perform well in PISA, focusing on their approach to practical work, problem-solving, and the integration of technology in STEM subjects, such as Singapore https://www.oecd-ilibrary.org/docserver/9149c2f5-en.pdf?expires=1732271338&id=id&accname=guest&checksum=7881A4BC97759ED6612171F6A2392C51#:~:text=Singapore%20scored%20significantly%20higher%20than,and%20science%20(561%20points)

Climate change and sustainability are of much greater concern than at the time of the last curriculum review. 51% of secondary teachers say that climate change, the ecological crisis and the challenges posed by these issues are not embedded in their school's curriculum, in their subject, in a meaningful and relevant way. The causes, impact and – crucially – the solutions to environmental problems, particularly climate change, need to be integrated throughout the curriculum and linked to careers. Young people – particularly girls https://www.engineeringuk.com/media/r2upp5ct/science-education-tracker-2023-engineeringuk-apr-24.pdf – are engaged in environmental issues but are not being shown how a STEM career would support this interest.

Section 3: Social justice and inclusion

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes that for the government to achieve the ambitions as set out in its missions - economic growth, making Britain a 'clean energy superpower' and improving opportunities for all citizens - the country needs an education system that enables more young people from more diverse backgrounds to work in engineering and technology – including women who currently make up only 15.7% of this workforce.

This requires an education and skills system that encourages, among others, more young women to seek opportunities in this sector by equipping them with the knowledge, skills and interest in the subject areas relevant to careers in engineering and technology. As it stands the engineering and technology workforce, as well as the education and training routes into those roles, continue to be dominated by men.

Without more young people from a range of backgrounds as well as more young women entering these sectors the UK will struggle to have the workforce it needs, and the diversity of thought required to develop equitable solutions to today's challenges. Given that engineering and technology roles are more highly paid than average, it is important to ensure that these roles are equally accessible to men and women, and it is especially important that women from poorer socioeconomic backgrounds have this route to improve their social mobility (People working in engineering and technology occupations earned more on average than all other occupations at £39,163.74 gross pay.) https://www.engineeringuk.com/media/eqnhrz1l/the-engineering-and-technology-workforce-update-engineeringuk-october-2024.pdf.

12. In the current curriculum, assessment system and qualification pathways, are there any barriers to improving attainment, progress, access or participation (class ceilings) for learners experiencing socioeconomic disadvantage?

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK highlights research by Archer et al https://www.tandfonline.com/doi/full/10.1080/02671522.2016.1219382 that shows there are clear issues highlighted with the participation of particular groups of learners in triple science compared with double science.

The study reports that differential participation is caused by a range of factors including teacher conceptions of ability of certain groups leading to streaming into higher and lower sets, the (lack of) cultural and science capital amongst learners - often impacting students from lower socio-economic groups, and the school provision of triple science (in some cases the researchers found that triple science was being offered as an extra-curricular option), with students most affected by this differential provision located in schools serving less affluent communities.

The filtering of students from lower socio-economic and from certain minority ethnic groups leads to a closing down of options to study sciences in post-16 education. A study of over 6,000 learners by Francis et al https://www.tandfonline.com/doi/full/10.1080/02671522.2023.2283417#abstract found that those following a triple science route were significantly more likely to progress to further study of science subjects in post-16 education.

Analysis by the Institute of Physics also highlights that schools in areas of high socio-economic deprivation are less likely to have specialist physics teachers and are more likely to use non-specialist teachers (and in many cases not even science teachers) to teach physics https://www.iop.org/about/news/iop-responds-bleak-news-teacher-recruitment-numbers. This pattern is likely to be mirrored for computing, where salaries in the private sector will be a significant draw away from teaching.

The lack of specialist teachers is likely to also result in those schools not offering triple science at GCSE. Institute of Physics analysis suggests almost 40% of the schools that had no students taking triple science, were in areas of high socio-economic deprivation. Many school 6th forms and 6th form colleges will only accept learners on to individual science A levels if they have undertaken triple science GCSE. With fewer specialist teachers in areas of high deprivation, this is acting as a significant barrier.

As a consequence of these various factors, just 5% of the cohort sitting A levels in maths, physics and design and technology at A level in 2023 were eligible for free school meals, while 7% of the computer science cohort were eligible for FSM (against ~ 24% in the student population). Separately, and more generally, we have concern that learners from lower socioeconomic groups and low-income families may struggle to access the virtual learning environments and online learning tools increasingly used by schools.

The Covid-19 pandemic highlighted the barrier to access for online learning for these groups because of access and costs associated with technology (devices, broadband, mobile connectivity), levels of digital literacy in the home (including parents), and the level of school digital infrastructure https://www.cambridgeassessment.org.uk/Images/628843-digital-divide-in-uk-education-during-covid-19-pandemic-literature-review.pdf.

We also have concerns about the ongoing patchy connectivity to fibre broadband and/or high-bandwidth mobile telecoms (4G/5G) across England, which can particularly disadvantage families in rural areas. While we acknowledge recent government commitments to address the issue by the end of the decade https://www.gov.uk/government/news/312000-rural-homes-and-businesses-to-get-access-to-faster-broadband-in-overhaul-of-old-infrastructure the curriculum review should take into account any deleterious impact of the use of the use of technology in delivering the curriculum and assessments to learners who might be unfairly disadvantaged in the interim period.

13. In the current curriculum, assessment system and qualification pathways are there any barriers to improving attainment, progress, access or participation which may disproportionately impact pupils based on other characteristics (e.g. disability, sexual orientation, gender, race, religion or belief etc.)
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK highlights the following barriers:

Girls
We have seen a decreasing participation rate for girls taking Design and Technology GCSE dropping from 40% of the cohort in 2014 to 30% in 2023 https://www.jcq.org.uk/gcse-level-1-and-level-2-results-summer-2024/?a.

Girls currently make up half of those taking GCSE maths and physics, and 21% of those studying GCSE computer science. However, participation drops sharply at A level with only 37% maths A Levels being taken by girls and 23% and 17% by girls in physics and computer science respectively https://www.kcl.ac.uk/ecs/assets/kcl-scari-computing.pdf. Girls only make up 32% of the Design & Technology A level cohort, but while this seems encouraging compared with physics and computing, it should be noted that this reflects an absolute number of just 2,800 girls out of a total cohort of just under 9,000 learners https://www.jcq.org.uk/examination-results/2024-a-level-results/. Recent research by EngineeringUK highlighted that we would need at least 115,000 more girls to study maths or physics A levels to bridge the gender gap in engineering and technology higher education courses https://www.engineeringuk.com/media/318816/a-levels-to-engineering_report_engineeringuk_feb23fv.pdf.

More generally, we see strong gendering of subjects both towards male-dominated subjects such as computing and Design and Technology at GCSE and physics at A level and female-dominated subjects such as Art and Design and Drama at GCSE.

Interest in school science has declined since 2019 and a gender gap has opened up. Interest among years 7 to 9 overall has declined from 76% to 71%. For girls, the decline is more pronounced, having declined from 75% to 65% over the same period of time www.engineeringuk.com/set. 36% of girls also say that science is not for them.

In addition, 74% of girls reported that not enjoying computing was the reason why they did not choose it at GCSE level, contrasting with 53% of boys. Moreover, 56% of these same girls felt that GCSE Computer Science did not align with their career plans, in contrast to 39% of boys https://www.kcl.ac.uk/ecs/assets/kcl-scari-computing.pdf.

This gendering becomes much more significant in technical education, with women representing just 9% of the cohort in engineering and manufacturing T levels and falling to as low as 2.8% for building services engineering. Apprenticeships are also strongly gendered and only 16% of the engineering and technology apprenticeships cohort are women https://www.engineeringuk.com/media/0cubrq30/t-level-results-2024-engineeringuk-aug-2024.pdf.

As we show below, the way girls experience the curriculum plays an important role in whether or not girls enjoy the STEM subjects that are relevant to engineering and technology and feel that they are good at them. This is relevant in terms of their decision to study these subjects at A or T Level standard or go into an engineering and technology apprenticeship. The reasons for this are manifold, but for the purposes of this consultation, we focus on the following.

National curriculum content and accountability measures

Teachers at Key Stage 4 in state schools in England, Wales and Northern Ireland report that the science curriculum has too much content (73%) https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/the-science-teaching-survey/2022/too-much-content-not-enough-time/ and that there is too little time available to teach it. This coincides with young people reporting that they have less access to practical hands-on learning, impacting particularly on less engaged students. Only 26% of GCSE students report doing hands-on practical work at least every fortnight, down from 44% in 2016 https://www.engineeringuk.com/media/r2upp5ct/science-education-tracker-2023-engineeringuk-apr-24.pdf, this is set against seven in ten students in years 7–11 wanting to do more practical work.

The Science Education Tracker found that female students are more likely to be motivated by practical aspects of science learning including having a good teacher (40% vs 33% of males) and they are also slightly more motivated by doing practical work (54% vs 50% of males). This raises questions as to whether the lack of opportunity for practical hands-on science learning impacts on young women's enjoyment as well as choice of science subjects, and the need for more teaching time to support this type of learning.

The scheduling of the curriculum at Key Stage 4 is shaped by the EBacc in a way which can impact uptake of Computer Science and Design & Technology. Computer Science can replace one of the three sciences in EBacc, but the highly similar level of entries in biology, physics and chemistry at GCSE suggests that few schools take this option. Computer Science is therefore typically taken as additional qualification and may be crowded out by arts subjects that typically highly appeal to girls. Similarly, schools typically group non-EBacc subjects like Design and Technology with arts subjects forcing students to choose between them (Evidence for preferences from Science Education Trackers, attainment from GCSE results). A related concern exists at A Levels, where timetabling may reinforce historic trends of uptake of different subjects by different groups. For instance, schools may recognise that historically few students take art and physics, forcing students who might be interested in this combination to choose between them.

The contexts in which the curriculum is taught and how it is influenced by assessment

The contexts in which the curriculum is taught, including the presentation of historical and contemporary figures, bring it alive, but may resonate differently for different groups of students and contribute to gender differences. In primary schools, non-statutory guidance suggests teaching contexts and examples to help teachers cover the national curriculum. At secondary schools, much of the pedagogical approach is driven by examination specifications drawn up by awarding organisations, covering relevant national curriculum content, and approved by Ofqual. Awarding organisations provide textbooks and teaching materials for their examinations, as well as at Key Stage 3, that give detailed contexts. Thus, assessments heavily influence students' experiences and enjoyment of a subject.

Representation matters. There is some evidence that role models, or an absence of them, influences young people's interest in subjects and careers and that increasing the presence of relatable role models for different demographic students is often a part of educational and career interventions (EngineeringUK's rapid review (2023). A survey https://www.britishscienceassociation.org/edi-strategies-in-the-stem-sector by Stemettes and BSA, however, found that nearly half of the girls and non-binary respondents disagreed or strongly disagreed that they felt represented within the classroom. The same research found that at A-Level and GCSE, in the Science curriculum there are 23 named male role models and only 4 named female role models. There are no named female role models in the Maths or Computer Science curriculum for GCSE and A-Level. Also important is the relevance of the role model to the young person, with peer-to-peer role models having proven to be an effective way to encourage more young women into STEM.

Furthermore, it is important to consider the topics used to teach scientific concepts, and the impact these have how girls experience science teaching versus boys. A survey https://www.uv.uio.no/ils/english/research/projects/rose/publications/rose-report-eng.pdf of 1,200 English 15-16 year olds explored their science education found that: '*When asked what they wished to learn about, there are marked differences in the responses of boys and girls. For girls, the priorities lie with topics related to the self and, more particularly, to health, mind and well-being. The responses of the boys reflect strong interests in destructive technologies and events.*' This difference is starkly characterised by a table of the top ten topics identified by boys and girls which has no overlapping topics.

This leads us to consider whether the way scientific concepts are being contextualised uses topics that appeal more to girls than boys and what happens if we change this. A study How can we enhance girls' interest in scientific topics? S. Kerger, R. Martin and M. Brunner, British Journal of Educational Psychology (2011) asked 190 Belgian 14-year-old boys and girls about their interest in scientific concepts in biology, physics, IT and statistics with the same concepts being presented in both the standard masculine contextual topics and also in feminine contextual topics. Boys and girls were similarly interested in biology topics with little impact from context. However, girls' interest in physics, IT and statistics topics significantly increased when they were presented in the feminine rather than standard contexts, indeed, girls were significantly more interested in physics and statistics concepts than boys were when they were presented in feminine contexts.

We recommend that:

1. The STEM curriculum and assessment redevelopment should pay as much attention to inclusivity across gender within each subject area, and with other demographic groups, as is given in the consultation document to socioeconomic inequality.
2. The curriculum (and assessments) should be written and designed in ways that do not perpetuate gender differences in subject uptake.

3. The content of qualifications (that drives much of the topics and context of teaching), should be tested for appeal across demographic groups; awarding organisations should be challenged to demonstrate that they have assessed the inclusivity of their content and include a better representation of positive role models from different demographic groups https://lopapatel.com/wp-content/uploads/2024/03/ONLINE-Final-Equitable-Curriculum-Reform-More-and-Diverse-Women-and-Non-Binary-Representation-in-The-UK-GCSE-and-A-Level-Science-Technology.pdf in the STEM curriculum, with teaching materials challenging the gender stereotypes around STEM careers.

14. In the current curriculum, assessment system and qualification pathways, are there any barriers in continuing to improve attainment, progress, access or participation for learners with SEND?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK has concern regarding the linear, terminal assessment nature of GCSEs and A levels. These assessment methods rely too much on knowledge retention and recall, and do not enable the development of a broad range of skills that will be beneficial for engineering (and more general) employment. Moreover, tests that rely on significant memorisation are unfair for particular groups of students such as those with Special Educational Needs and Disabilities (SEND) https://www.ascl.org.uk/ASCL/media/ASCL/News/Press%20releases/The-future-of-GCSEs-survey-responses-March-2020.pdf.

15. In the current curriculum, assessment system and qualification pathways, are there any enablers that support attainment, progress, access or participation for the groups listed above?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK refers the review panel's attention to the Institute of Physics report Opening Doors https://www.iop.org/sites/default/files/2019-02/opening-doors-countering-stereotyping.pdf which highlights the need for a whole school approach to gender stereotyping and not focused interventions around specific subjects.

Section 4: Ensuring an excellent foundation in maths and English

16. To what extent does the content of the national curriculum at *primary* level (key stages 1 and 2) enable pupils to gain an excellent foundation in a) English and b) maths? Are there ways in which the content could change to better support this aim? *Please note, we invite views specifically on transitions between key stages in section 9.*
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK supports the Royal Society report 'A new approach to mathematical and data education' https://royalsociety.org/-/media/policy/projects/maths-futures/new-approach-to-mathematics-and-data-education.pdf which makes the strong case for a greater focus on data education and the use of calculators and computational tools at the appropriate stages in primary education to support children's exploration of number and to enhance problem-solving and investigating. We also welcome the report's recommendation around the need for more spatial reasoning, which plays a key role in the development of number, measurement, data and geometry skills, all important for engineering.

It is disappointing that none of the questions in this section refer to the third core subject of science.

17. To what extent do the English and maths *primary* assessments support pupils to gain an excellent foundation in these key subjects? Are there any changes you would suggest that would support this aim?
No answer

18. To what extent does the content of the a) English and b) maths national curriculum at *secondary* level (key stages 3 and 4) equip pupils with the knowledge and skills they need for life and further study? Are there ways in which the content could change to better support this aim?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK again highlights the Royal Society mathematics report, which calls for a curriculum that integrates appropriate data, statistics and computational tools coherently with mathematics. In addition, we would welcome the use of data literacy and data education across all subjects, not just confined to mathematics.

19. To what extent do the current maths and English *qualifications* at a) pre-16 and b) 16-19 support pupils and learners to gain, and adequately demonstrate that they have achieved, the skills and knowledge they need? Are there any changes you would suggest that would support these outcomes?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK highlights its deep concern that, given the critical importance of mathematics skills for all young people in life and work regardless of future career pathways, there is a continuing high failure rate among learners (28% at age 16), and even higher among those taking resits (87% at 17-19).

We again refer to the Royal Society mathematics report which highlights the need for greater data education and the use of computational tools for mathematics. GCSE mathematics qualifications should be updated to reflect this new emerging need.

There is concern among the engineering higher education community that T levels in engineering and manufacturing do not adequately provide the necessary maths content for progression to undergraduate engineering degrees. While this is partly to do with a lack of knowledge of the content, there are gaps in the maths subject areas covered in T levels (Unpublished Engineering Professors Council analysis of 16-19 engineering qualifications maths content). Historically, universities have required post-16 students taking technical/vocational qualifications such as BTECs to fill these knowledge gaps with the study of mathematics at A level as an additional qualification. However, the size of T levels in engineering, Construction and Digital (band 7 (1530GLH) or band 8 (1680GLH)) https://www.gov.uk/government/publications/t-level-funding/t-levels-funding-guide-for-2023-to-2024#t-level-funding and the associated funding for delivery, do not allow for any additional qualifications to be undertaken. As such, progression from T levels to undergraduate degrees is not universal across HE institutions.

For those students in post-16 education not taking mathematically based qualifications (either academic or technical), there should be some form of compulsory mathematics education to 18 (as proposed in the Advanced British Standard). While we recognise Core Maths as a qualification for those learners who have achieved Level 4 at GCSE and who are not taking A level mathematics, participation rates are very small, at ~ 12,000 entries in 2022 https://amsp.org.uk/leadership/core-maths/what-is-core-maths/.

20. How can we better support learners who do not achieve level 2 in English and maths by 16 to learn what they need to thrive as citizens in work and life? In particular, do we have the right qualifications at level 2 for these 16-19 learners (including the maths and English study requirement)?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK highlights that there is a significant proportion of the cohort that do not achieve Grade 4 at GCSE for mathematics at age 16. In 2023, 605,000 students aged 16 were entered for GCSE mathematics. Of those, approximately 28% (170,000) did not meet grade 4, identified as the threshold of passing the GCSE.

Government policy now requires those students to continually re-sit mathematics GCSE until they achieve grade 4. In 2023, 134,000 entries to mathematics GCSE were from students 17 and over https://www.jcq.org.uk/examination-results-archive/?post-year=2023&post-location=, this would predominantly be resits, but there may have been some learners being entered for the first time. Of this older cohort, 87% did not achieve grade 4 https://www.jcq.org.uk/wp-content/uploads/2023/08/GCSE-Full-Course-English-and-Maths-Results-England-Post-16.pdf.

The policy of requiring re-sits for GCSE maths clearly is not resulting in any improvement in the attainment of those students who did not achieve grade 4 at the first attempt. This appears to be a fundamental failure of education, using up teaching time and resources, and demoralising young people who are being failed by the system.

Moreover, the engineering sector, and many others, are in significant need of people at all skill levels and we are losing potential talent because of the mathematics GCSE. We therefore recommend an urgent review of this policy and the exploration of a different qualification with different content that meets the needs of learners in their future life and work. A new form of assessment for Level 2 mathematics without grading should be explored for all 16-year-olds, such that all learners receive a pass or fail, and those that fail can continually re-attempt the examination (such as with functional skills qualifications) until they pass. A separate GCSE exam could continue for those who require grading to progress with subjects which require demonstration of higher levels of mathematics ability.

21. Are there any particular challenges with regard to the English and maths a) curricula and b) assessment for learners in need of additional support (e.g. learners with SEND, socioeconomic disadvantage, English as an additional language (EAL))? Are there any changes you would suggest to overcome these challenges?
No answer

Section 5: Curriculum and qualification content

22. Are there particular curriculum or qualifications subjects where: a. there is too much content; not enough content, or content is missing; b. the content is out-of-date; c. the content is unhelpfully sequenced (for example to support good curriculum design or pedagogy); d. there is a need for greater flexibility (for example to provide the space for teachers to develop and adapt content)? *Please provide detail on specific key stages where appropriate.*
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK highlights substantial evidence to show that there is too much content in the science curriculum. Ofsted's 2023 report on science teaching in schools highlighted that 'pupils did not have sufficient opportunities to practise and consolidate what they learned before moving on to new content'. The report went on to say 'In some schools, there was an over-reliance on pupils catching up when the content was repeated later in the curriculum, rather than ensuring it was learned first time. Often this happened when teachers were expected to teach too much content in a short time. This was more common in secondary schools.'

In addition, the Royal Society of Chemistry, in its 2022 survey of KS4 teachers across England, Wales and Northern Ireland, found that 73% of teachers said that the science curriculum had too much content, while 68% felt the content was too demanding for the students to access.

There is also an argument to suggest that the amount of content, lack of practical activity and focus on memorisation of facts at the expense of deeper exploration of topics and consideration of careers opportunities related to subject content is leading to a reduction of interest in science, as indicated in the Royal Society and EngineeringUK Science Engagement Tracker:

The percentage who rated each subject as very or fairly interesting decreased over this time period: among year 7–9s, from 76% to 71% for science and from 60% to 56% for computing; and among year 10–13s, from 74% to 71% for biology, from 59% to 55% for chemistry. https://royalsociety.org/-/media/policy/projects/science-education-tracker/science-education-tracker-2023.pdf

There is a need to address the low numbers of young people pursuing computing education at key stage 4. This may require a re-think about the curriculum at key stage 3, with a greater emphasis on digital literacy, use of computers in society, and application of computing in areas such as digital media and animation etc.

While the changes to Design and Technology in the last national curriculum review were intended to deliver a more design-centred approach to student learning, the lack of professional development support for teachers inevitably led to the status quo of a focus on the fabrication or manufacture of the end product (pencil case, clock, box etc.) rather than on learning through the design process https://issuu.com/designcouncil/docs/a_blueprint_for_renewal_design_and_technology_educ.

Nevertheless, there is an opportunity to update the curriculum for Design and Technology with more explicit emphasis on sustainability as a key context for design and considerations of inclusion and ethics in design.

While there has been much narrative around STEM education in schools, there is no engineering explicit in any learning outcomes of the national curriculum. While it is implicit in subjects such as D&T, computing, science and mathematics, there is a real need for young people to understand what the subject of engineering is, if they are to make informed decisions at age 16 on career pathways. As such we would recommend engineering be much more explicitly referred to in the key subject outlined above.

At the same time as there is too much content in some areas, other aspects are missing, in particular dedicated space to bring the curriculum to life and to link it to the real world. All secondary schools in England are required to deliver careers insights and education to their students. However, access to STEM focused careers provision in schools and colleges across England is still patchy. https://www.engineeringuk.com/media/aslbpni4/advancing-stem-careers-provision-in-england-engineeringuk-september-2024.pdf. To ensure that all young people get access to enrichment activities that enable them to find out more about the many careers available in the STEM sector, we would recommend embedding careers into the subject content of the STEM curriculum and ensures that it highlights the diverse range of roles and people working in science, technology and engineering. Specifically, we recommend embedding STEM careers within the curriculum from Year 7 (Key Stage 3), with a focus on diverse role models and real-world applications, in alignment with the Career Development Institute (CDI) framework. This should provide teachers with more time to link curriculum learning with careers as stipulated by Gatsby Benchmark 4 and ensure that all young people are offered opportunities to be inspired.

51% of secondary teachers say climate change, the ecological crisis and the challenges posed by these issues are not embedded in their school's curriculum, in their subject, in a meaningful and relevant way https://www.sos-uk.org/research/climate-education-and-the-secondary-curriculum. Where the current curriculum covers climate change (typically in geography and science https://discovery.ucl.ac.uk/id/eprint/10195286/1/UCL%20Student%20Survey%20Report.pdf), its focus is on the causes and impacts of climate change, rather than on the solutions to it. Students are therefore not being made aware of careers links to the many and varied solutions to climate change, and their levels of eco-anxiety will be exacerbated. At a personal level, students might miss a rewarding career tackling environmental problems, while at a national level the UK's carbon targets will be at risk through a shortage of engineers required to decarbonise the economy. “Between 135,000 and 725,000 net new jobs could be created by 2030 in low-carbon sectors, such as buildings retrofit, renewable energy generation and the manufacture of electric vehicles” https://www.theccc.org.uk/publication/a-net-zero-workforce/; it is important to note that engineering and technology roles dominate these examples, and are fundamental to the achievement of Net Zero.

In addition, there should be greater energy literacy in the curriculum, so that young people can better understand the broader need for energy in society and how different energy vectors and systems need to work together to decarbonise. As we transition to a low-carbon energy system, understanding the range of energy technologies and innovations will become increasingly crucial not just for the net zero workforce (capable of creating solutions from a whole-systems, integrated perspective), but indeed for all citizens to have an informed debate on energy security, resilience and its impact on the climate.

As highlighted above, whatever curriculum development is undertaken, this must be met with appropriate subject-specific professional development of teachers. CPD is crucial to ensure the effective delivery of the new curriculum. Failure to provide this CPD will potentially result in a decline in the educational outcomes for learners, disillusionment in the teaching workforce and, as has been seen in D&T since the last curriculum review, a maintaining of old teaching practices and disregard for the new curriculum.

23. Are there particular changes that could be made to ensure the curriculum (including qualification content) is more diverse and representative of society?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes that generally, there could be more opportunities to enrich the curriculum with examples of how mathematical and scientific discoveries have been developed, particularly where contributions have been made outside of well-known European / Western historical perspectives. For example, many young people will be taught Pythagoras theorem and understand Pythagoras to have developed the relationship between the sides of the right-angled triangle, but historians now know much older societies in Egypt, India and Babylon were using this relationship up to a thousand years earlier https://link.springer.com/article/10.1057/jt.2009.16.

All STEM subjects could explore (failures of) inclusion and bias in, for example, experimental medical research, population data, product design, computer programming and algorithms, that have led to poor outcomes for particular groups in society.

As outlined in the section on inclusion and diversity, representation matters and there is some evidence that role models, or an absence of them, influences young people’s interest in subjects and careers[1] and that increasing the presence of relatable role models for different demographic students is often a part of educational and career interventions https://www.engineeringuk.com/research-policy/provision-outreach/rapid-evidence-reviews/

24. To what extent does the current curriculum (including qualification content) support students to positively engage with, be knowledgeable about and respect others? Are there elements that could be improved?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes there could be an opportunity to have a greater focus on the teaching of ethical behaviours in work and in society. This could include, for example in STEM subjects, the issues which led to the

[1] Only Ada - Author version 30.10.2024

Grenfell Tower fire, the Post office Horizon IT system, infected blood scandal etc. as well as future-facing areas for ethical development, such as in AI.

25. In which ways does the current *primary* curriculum support pupils to have the skills and knowledge they need for life and further study and what could we change to better support this?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK sees a significant need to address gender disparities that already become developed in primary school as highlighted by the Wellcome Trust in its 2019 report on science in primary schools https://wellcome.org/sites/default/files/what-pupils-think-of-science-in-primary-schools.pdf.

26. In which ways do the current *secondary* curriculum and qualification pathways support pupils to have the skills and knowledge they need for future study, life and work and what could we change to better support this?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK notes that engineering employers highlight a lack of broad employability skills among applicants and recruits https://www.theiet.org/media/9234/2021-skills-survey.pdf. This includes skills such as creative problem solving, critical thinking, teamworking and systems thinking.

The assessment of GCSEs at KS4, principally based on linear, terminal examinations that focus on the memorisation and recall of information under high-pressure examination situations. Even in inherently practical subjects such as Science, Design and Technology and Computing https://www.gov.uk/government/news/gcse-computer-science-assessment-arrangements the assessment model has driven an inevitably narrow model of teaching focused on maximising the retention and regurgitation of facts.

Generally, the engineering community would like to see a curriculum that encouraged a wider range of pedagogies leading to the development of skills alongside the accumulation of knowledge.

More specifically, we agree with the Gatsby Good Practical Science report https://www.gatsby.org.uk/uploads/education/reports/pdf/good-practical-science-report.pdf that hands-on, practical work is an essential part of learning science and that it develops valuable skills and attitudes towards science and is one of the gateways to employment in science-based subjects. We agree with the report's recommendation that all students should experience a practical activity in at least half of their lessons. We would extend this principle to design and technology and computing as well.

27. In which ways do the current qualification pathways and content at *16-19* support pupils to have the skills and knowledge they need for future study, life and work and what could we change to better support this?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK welcomes T levels as a new suite of qualifications to Post-16 technical education and we agree with their purpose and intention to simplify an overly complex and confusing landscape of qualifications. Further decluttering of the qualifications landscape is welcome.

We also broadly welcome the alignment of learning outcomes from T levels to apprenticeship standards, which gives them currency with employers and ensures that students are developing knowledge and skills for the workplace. While we welcome the introduction of work placements in T levels, there is clearly an issue with the 45 day length of placements resulting in limited placement opportunities being offered by employers https://feweek.co.uk/red-tape-and-cost-pressures-leave-firms-struggling-to-offer-t-level-work-placements/. It is particularly challenging for employers working in hazardous environments or where health and safety concerns can arise, leading to increased costs for employers for insurance etc.

The current qualification pathways should place greater emphasis on developing lifelong learning skills. In an era of rapid technological change and evolving job markets, it is crucial that students are equipped with the ability to continuously adapt and learn https://www.unesco.org/en/articles/fostering-culture-lifelong-learning-digital-era. We recommend incorporating specific modules or learning outcomes that focus on metacognitive strategies, self-directed learning techniques, and digital literacy skills https://educationendowmentfoundation.org.uk/education-evidence/guidance-reports/metacognition.

These competencies will enable students to navigate future career transitions and engage in ongoing professional development along with reflective behaviours for learning, both in the educational environment and in the workplace.

The effectiveness of any curriculum reform hinges on the quality of teacher training and development. Evidence suggests that sustained professional development programmes lasting at least two terms are more effective than one-off workshops https://tdtrust.org/leading-cpd/focus/sustained-focussed-and-iterative-cpd/#:~:text=Settings,-QualityAuto&text=Research%20shows%20that%20for%20effective,programme%20of%20support%20and%20engagement.

We advocate for a robust programme that offers ongoing professional development, particularly in STEM subjects where content and pedagogical approaches are rapidly evolving. This should include regular training opportunities, mentoring programmes, and collaboration with industry experts to upskill teachers in areas such as computational thinking and emerging technologies.

Section 6: A broad and balanced curriculum

28. To what extent does the current *primary* curriculum support pupils to study a broad and balanced curriculum? Should anything change to better support this?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK recognises that the intended current primary national curriculum is broad and balanced, however we have concern that statutory tests for the core subjects of English and maths have resulted in these dominating teaching time https://www.tes.com/magazine/teaching-learning/primary/why-do-we-teach-english-and-maths-morning and all non-core subjects tend to be squeezed into afternoon teaching periods. While science is also a core subject, it no longer has statutory testing at key stage 2, and we are concerned that this has resulted in a decline in the teaching of the subject.

The 2023 Ofsted thematic review into science https://www.gov.uk/government/publications/subject-report-series-science/finding-the-optimum-the-science-subject-report--2#primary highlighted that science should be taught at least once a week. It found that in most schools this is the case, but in some schools, pupils had less than one science lesson per week and in extreme cases pupils went for entire half-terms without any science lessons. The curriculum review should set out clear expectations to primary schools of their statutory responsibilities to deliver science as a core subject at least once per week.

We also hear anecdotal evidence through our networks of schools engaging in STEM activities that some schools are dropping Design and Technology from the curriculum. This is enabled particularly by the removal of the statutory duty of academies to deliver the national curriculum and their ability to demonstrate the provision of their broad curriculum through the teaching of art and design as an alternative.

29. To what extent do the current *secondary* curriculum and qualifications pathways support pupils to study a broad and balanced curriculum? Should anything change to better support this?

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK has concern that both the overfull curriculum and the terminal assessment nature as well as size of GCSEs has led to a significant reduction in practical work, laboratory exercises and problem-based and project-based learning approaches in subjects such as design and technology, computing and the sciences.

There is a strong correlation between the introduction of the English Baccalaureate performance measure on schools and the decline in Design and Technology as a subject at GCSE https://issuu.com/designcouncil/docs/a_blueprint_for_renewal_design_and_technology_educ. We also note the Design and Technology Association, the subject body for D&T teachers also reports a decline in D&T provision at KS3, correlating with the increasing academisation of secondary schools in England which are exempt from following the national curriculum. We recommend that all state-funded schools be required to follow the national curriculum which includes Design and Technology.

Design and Technology is one of the few opportunities for learners to explore practical, hands-on making activities in the classroom. Given the critical importance and pervasiveness of practical, technical roles to the UK's economy (from construction trade skills to life sciences to theatre set design and many other examples), and to the UK's long-term ambitions to meet climate change targets (solar, wind, electrification of the vehicle fleet etc.), the removal of opportunities for learners to experience hands-on, making activities in schools and explore this as a potential future career option is a major concern.

30. To what extent do the current qualifications pathways at *16-19* support learners to study a broad curriculum which gives them the right knowledge and skills to progress? Should anything change to better support this?

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes that the qualifications pathways at 16-19 do not support a broad curriculum. As highlighted in the British Academy report https://www.thebritishacademy.ac.uk/documents/5468/British-Academy-report-Subject-choice-trends-post-16-education-England.pdf, the previous government's policy of decoupling AS levels from A level has resulted in an overall reduction in AS / A levels. Further, students are narrowing their subject choices to those within a particular subject group (e.g. STEM, arts and humanities, social sciences).

As stated in 11 above, there is too much specialisation in T level qualifications, for example 25 different specialism pathways in the engineering and manufacturing T level, 26 specialism pathways in Construction and the Built Environment T level and 9 pathways in the digital T level.

We believe that all young people would benefit from a broader education, with a mix of STEM and Non-STEM subjects to the age of 18.

31. To what extent do the current curriculum (at primary *and* secondary) and qualifications pathways (at secondary *and* 16-19) ensure that pupils and learners are able to develop creative skills and have access to creative subjects?

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes that the premise of this question needs to be challenged. There is a false dichotomy in the education system between creative and non-creative subjects. There should be opportunity for creative skills to be developed in every subject, including mathematics, science, computer science, design and technology etc. It is unhelpful to draw any kind of distinction as creative skills are required in all disciplines, in all jobs and sectors and all aspects of society.

However, it should also be stated that while the curriculum and qualifications pathways allow for access to creative subjects, the EBACC accountability measure puts pressure on schools and learners to narrow subject choices at GCSE to those that count towards the measure. This also has a negative impact on gender diversity in STEM subjects in line with the evidence presented in response to question 13 above. The Royal Academy of Engineering has undertaken research with Professor Bill Lucas, Dr Ellen Spencer and colleagues at the Centre for Real World Learning at the University of Winchester, to explore how creativity can be delivered across various subjects in the current national curriculum. The study (as yet not published) is available on request.

We also hear anecdotally that there is increasing use of standardised presentations to deliver lessons in many subjects (such as those by the Oak Academy). We are concerned that the rigid application of these presentations closes down opportunity for creative activity in the classroom. School leaders talk of the increasing pressure on schools to standardise curriculum content at the expense of creativity and deeper exploration of subject matter. One senior school leader we heard from likened this approach to using teachers as 'mechanics or technicians' delivering a pre-configured curriculum and not like 'engineers' who bring their professional judgement, deep technical knowledge, creativity and design to their work.

32. Do you have any explanations for the trends outlined in the analysis and/or suggestions to address any that might be of concern?

As noted earlier, the National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK has have particular concern for the decreasing numbers of learners taking GCSE in design and technology over the past two decades. While we recognise that up until 2006 D&T was a compulsory curriculum subject at KS4, and therefore participation rates were artificially inflated, the subsequent decline has been significant, and participation rates are among the lowest of progress 8 subjects.

While we welcome that the trends for computer science have been increased since the introduction of the subject as a new GCSE in 2014, it appears the number of entries is plateauing at around 85-90,000 per year. This suggests that around 85% of the cohort are not taking the GCSE and are therefore having little to no computing education from the age of 14 onwards. This is deeply concerning and needs to be addressed as a matter of priority in the curriculum and assessment review. As stated earlier in the response, we recommend Computing Education be made a core subject and compulsory for all learners up to and including Key Stage 4 but with a focus on broader digital literacy and computing skills, not computer science. We also recommend that all state-funded schools be required to teach all subjects in the national curriculum without any exceptions.

33. To what extent and how do pupils benefit from being able to take vocational or applied qualifications in secondary schools alongside more academically focused GCSEs?

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes that access to vocational or applied qualifications is important for young people as it enables them to relate what they learn to the 'real' world. It also enables young learners who might struggle with the more theoretical aspects of learning to learn in different ways. BTECs, for example, emphasise real-world applications of knowledge, making them a compelling choice for those keen on a hands-on learning experience. BTECs provide a blend of practical hands-on- learning mixed with academic rigour.

Vocational and applied qualifications are considered to be a vital route for many young people into engineering and technology roles and are considered to enable greater social mobility.

However, access to vocational or applied qualifications in secondary schools has decreased dramatically since the Wolf Review of Vocational Education https://www.gov.uk/government/publications/review-of-vocational-education-the-wolf-report and the subsequent government reforms to eligible qualifications in school accountability measures.

The engineering community regularly hears from teachers and senior leaders their frustration that that many learners would benefit from a different type of technical/vocational education at key stage 4, particularly those who become disengaged and disenfranchised because of the linear, terminal assessment model of GCSEs.

34. To what extent does the current pre-16 vocational offer equip pupils with the necessary knowledge and skills and prepare them for further study options, including 16-19 technical pathways and/or A levels? Could the pre-16 vocational offer be improved?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes that the current pre-16 qualifications system does not prepare young people very effectively for 16-19 technical pathways because there are too few qualifications available for the reasons set out in our response to Q33.

We believe it is important for young people to have access to a much broader range of qualifications outside academic GCSEs to be able to properly explore different progression pathways and career options in post-16 education. This would potentially support the perception that technical qualifications are a different pathway to careers and not inferior to academic qualifications, and also give more young people opportunities to test vocational / technical education to enable them to make an informed choice about these taking these qualifications at 16-19.

For this to happen, more technical/vocational qualifications would have to be recognised in accountability measures, otherwise schools will not offer them to learners.

Section 7: Assessment and accountability

35. Is the volume of statutory assessment at key stages 1 and 2 right for the purposes set out above?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK questions the need for Key Stage 2 assessments in English and mathematics in primary schools. These result in a highly imbalanced curriculum in year 6, often at the significant expense of practical and creative subjects such as design and technology and computing, and even at the expense of science, despite it being a core subject.

36. Are there any changes that could be made to improve efficacy without having a negative impact on pupils' learning or the wider education system?
No answer

37. Are there other changes to the statutory assessment system at key stages 1 and 2 that could be made to improve pupils' experience of assessment, without having a negative impact on either pupils' learning or the wider education system?
No answer

38. What can we do to ensure the assessment system at key stages 1 and 2 works well for all learners, including learners in need of additional support in their education (for example SEND, disadvantage, EAL)?
No answer

39. Is the volume of assessment required for GCSEs right for the purposes set out above? Are there any changes that could be made without having a negative impact on either pupils' learning or the wider education system?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK thinks that the volume of assessment at Key Stage 4 appears to be too high. The House of Lords education committee report into 11-16 education noted that "most pupils will undergo more than 30 hours of assessment" for GCSEs https://publications.parliament.uk/pa/ld5804/ldselect/ldedu1116/17/1707.htm#_idTextAnchor075.

The report went on to highlight the negative impact of the intensive period of exams on pupils' wellbeing.

Because GCSE results underpin school accountability measures, teachers also feel under pressure. We hear of many schools truncating time spent on curriculum for exam preparation, with preparation for the final exam and mock exams eating into curriculum teaching time.

40. What more can we do to ensure that: a) the assessment requirements for GCSEs capture and support the development of knowledge and skills of every young person; and b) young people's wellbeing is effectively considered when assessments are developed, giving pupils the best chance to show what they can do to support their progression?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK has concern regarding the linear, terminal assessment nature of GCSEs and A levels. These assessment methods rely too much on knowledge retention and recall, and do not enable the development of a broad range of skills that will be beneficial for engineering (and more general) employment. Moreover, tests that rely on significant memorisation are unfair for particular groups of students such as those with Special Educational Needs and Disabilities (SEND) https://www.ascl.org.uk/ASCL/media/ASCL/News/Press%20releases/The-future-of-GCSEs-survey-responses-March-2020.pdf. We also do not believe that GCSEs can adequately capture the wide range of knowledge and skills that pupils will have developed during their education.

As above in our answer to Q39, it is clear that 30+ hours of exams are not considering the wellbeing of young people.

Nor are GCSEs supporting the wellbeing of teachers because of the dual use of GCSEs as a key school accountability measure. As such there should be a decoupling of GCSE results from school performance measures.

The National Engineering Policy Centre recommends that the volume of GCSE examinations is considered in the context of this review and other assessment measures developed.

41. Are there particular GCSE subjects where changes could be made to the qualification content and/or assessment that would be beneficial for pupils' learning?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK would recommend that the review panel consider making recommendations regarding Computer Science. Currently some GCSEs in computer science involve no use of computers in the assessment but rely solely on written exams.

Reduce the role of examined end-point assessment within KS3 and KS4 Design and Technology. The 50% written examination structure is having negative consequences for teaching and learning quality. We would welcome an increase in project-based applied learning that is coherent with real-world design processes.

42. Are there ways in which we could support improvement in pupil progress and outcomes at key stage 3?
No answer

43. Are there ways in which we could support pupils who do not meet the expected standard at key stage 2?
No answer

Accountability

44. To what extent, and in what ways, does the accountability system influence curriculum and assessment decisions in schools and colleges?
As outlined in our response to question 29 above, The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK highlights that there is a strong correlation between the introduction of the English Baccalaureate performance measure on schools and the decline in Design and Technology as a subject at GCSE https://issuu.com/designcouncil/docs/a_blueprint_for_renewal_design_and_technology_educ. The English Baccalaureate performance measures have driven a focus on a narrow set of academic qualifications. This also has a negative impact on gender diversity in STEM subjects in line with the evidence presented in response to question 13 above.
We also note above the creation of an imbalanced curriculum and the truncation of non-core subjects at the end of key stage 2 as primary schools focus on English and mathematics in preparation for KS2 SATs.

45. How well does the current accountability system support and recognise progress for all pupils and learners? What works well and what could be improved?
No Answer

46. Should there be any changes to the current accountability system in order to better support progress and incentivise inclusion for young people with SEND and/or from socioeconomically disadvantaged backgrounds? If so, what should those changes be?
As outlined in our response to question 34 above, the National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK highlights that accountability measures should recognise more technical/vocational qualifications, which support social mobility, so as to incentivise more schools to offer them.

Section 8: Qualification pathways 16-19

47. To what extent does the range of programmes and qualifications on offer at each level meet the needs and aspirations of learners? Level 3, Level 2, Level 1 and entry level
No answer

48. Are there particular changes that could be made to the following programmes and qualifications and/or their assessment that would be beneficial to learners:
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes that for AS/A level qualifications, the coupling of the grading at AS level to A level should be reinstated. This will take some pressure off GCSEs as the only indicator of academic performance of

prospective students and would encourage a broader set of subject to be studied. Further thought should also be given to the continuation of maths and English to 18 as stipulated by the discussion around the Advanced British Standard. As outlined in our response to question 19, for students in post-16 education not taking mathematically based qualifications (either academic or technical), there should be some form of compulsory mathematics education to 18. While we recognise Core Maths as a qualification for those learners who have achieved Level 4 at GCSE and who are not taking A level mathematics, participation rates are very small, at ~ 12,000 entries in 2022 https://amsp.org.uk/leadership/core-maths/what-is-core-maths/.

T Level and T Level Foundation Year programmes: as highlighted above, the intention of T levels to simplify the 16-19 technical qualifications landscape is welcome. However, it appears as though the number of pathways for each of the T level routes has resulted in too much narrowing of content and over-specialisation at too early a stage in their technical education. We believe a broader "T" shaped curriculum which would benefit full time college students more than the over-prescriptive link to apprenticeship standards that is currently in place.

There is significant employer buy-in for qualifications such as BTECs and there is concern among employers and educators that to remove BTECs from public funding would do significant harm to progression routes for young people https://www.fenews.co.uk/skills/education-and-employer-groups-write-to-education-secretary-about-plans-to-scrap-btecs/. That said, we do understand that the number of 16-19 qualifications on offer is too confusing for students and some of these qualifications have little value to employers.

While the previous government focus has been on driving progression to level 3 and above, it is important for the curriculum review group to know that many engineering employers require skills at level 2. The focus on L3 progression has led to a lack of consideration of appropriate qualifications at level 2 that will serve many people at level 2 with high paid and meaningful employment.

49. How can we improve learners' understanding of how the different programmes and qualifications on offer will prepare them for university, employment (including apprenticeships) and/or further technical study?

The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK highlights that the introduction of the Gatsby Benchmarks and the focus on careers provision in schools and colleges has widely been credited with supporting young people to better understand the pathways into further education and employment https://www.careersandenterprise.co.uk/media/14cdft1b/cec-now-next-report.pdf. It is therefore vital that the education system enables young people's access to careers and enrichment activities.

Improving the overall knowledge of engineering, what careers it offers and the pay you can expect, among young people is key to attracting more, and a more diverse group of, young people into engineering careers. Research conducted by EngineeringUK clearly shows that young people who know more about what engineers do are more likely to perceive the profession in a positive way and to consider a career in engineering (Hanson, J. et al. 'An evaluation of the Northeast of England pilot of the Gatsby Benchmarks of good career guidance', International Centre for Guidance Studies, University of Derby, 2021). The research also shows that STEM outreach and education activities are critical in this context.

As outlined in our response to question 22 also, access to STEM focused careers provision in schools and colleges across England is still patchy. To ensure that all young people get access to enrichment activities that enable them to find out more about the many careers available in the STEM sector, we would recommend embedding careers into the subject content of the STEM curriculum and ensures that it highlights the diverse range of roles and people working in science, technology and engineering. Specifically, we recommend embedding STEM careers within the curriculum from Year 7 (Key Stage 3), with a focus on diverse role models and real-world applications, in alignment with the Career Development Institute (CDI) framework. This should provide teachers with more time to link curriculum learning with careers as stipulated by Gatsby Benchmark 4 and ensure that all young people are offered opportunities to be inspired.

50. To what extent is there enough scope and flexibility in the system to support learners who may need to change course?
No answer

51. Are there additional skills, subjects, or experiences that all learners should develop or study during 16-19 education, regardless of their chosen programmes and qualifications, to support them to be prepared for life and work?
No answer

Section 9: Other issues on which we would welcome views

52. How can the curriculum, assessment and wraparound support better enable transitions between key stages to ensure continuous learning and support attainment?
No answer

53. How could technology be used to improve how we deliver the curriculum, assessment and qualifications in England?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes that the use of artificial intelligence tools should be embraced in the national and curriculum assessment review. Rather than seek mechanisms to prevent the use of AI, educators and awarding organisations should be looking at how to effectively use AI in the classroom and for assessment. AI will be a significant part of people's careers in future, and they should be taught how to use it effectively as part of their education. In addition, the expert panel should examine how AI can be used for personalised learning to support all learners in the classroom.

Further Views

54. Do you have any further views on anything else associated with the Curriculum and Assessment Review not covered in the questions throughout the call for evidence?
The National Engineering Policy Centre, representing 40 professional bodies for engineering in the UK believes the education system needs to balance meeting the needs of the individual, setting young people up for life and work, alongside meeting the workforce needs of the UK. Those workforce needs have been recognised by the government as particularly significant in engineering and technology. For instance, the UK's ambitions around decarbonisation, and missions for sustained growth and clean energy, will fail without the associated workforce. We need a broad and balanced curriculum that addresses diversity issues in STEM teaching and learning, equips a generation of digitally literate young people and increases the visibility of engineering across the curriculum.

In light of this, the National Engineering Policy Centre believes that we need a curriculum that:

- imparts the knowledge and insight to comprehend the science, engineering and technology behind global challenges, such as climate change, biodiversity loss and sustainable energy supply, to enable young people to constructively engage with these issues.
- provides mathematical and data education that better prepares young people for the rapidly changing demands of an increasingly data-rich world.

- provides digital education that ensures that all future citizens can keep up with the pace of technological change so they can be effective, well-informed and safe.
- is inclusive and addresses gender imbalances in progression in subjects such as mathematics, computing and physics
- equips young people with the understanding of the jobs available and the skills required to access those.

To achieve this the curriculum and assessment review should consider:

- the impact of the EBacc system, academization and the nature of the English assessment system at Key Stage 4 and 5 on the breadth of subjects available to young people.
- the importance of context and representation in addressing the diversity challenges particularly in STEM subjects such as physics, computer sciences and Design & Technology.
- the impact of content overload in STEM subjects on the opportunity for more practical hands-on learning.
- the importance of real-world application approaches in teaching and learning, enabling young people to find out more about how physics, maths, computer sciences and Design & Technology link into the world of engineering.
- how to enable more young people to showcase their knowledge and skills through a reformed assessment system.
- a greater focus in the curriculum on equipping young people with digital skills.
- integrating the causes, impact and – crucially – the solutions to environmental problems, particularly climate change, throughout the curriculum, clearly linking it to careers available in this field.
- how to best embed careers education across the STEM curriculum.