

# Engineering Kids' Futures

A series of recommendations to the UK Government to raise the profile of engagement in engineering and technology within schools.



theiet.org/engineeringkidsfutures

#### Engineering Kids' Futures is published by the Institution of Engineering and Technology.

Please note that the views expressed in this publication are those of the IET, the key stakeholders involved in the roundtables, and those who have co-signed this report.

The IET Education department would welcome any comments you may have on the contents of this report and your ideas for future publications. Please get in touch by emailing **ieteducation@theiet.org**.



The Institution of Engineering and Technology (IET) is working to engineer a better world. We inspire, inform and influence the global engineering community, supporting technology innovation to meet the needs of society. The Institution of Engineering and Technology is registered as a Charity in England and Wales (no. 211014) and Scotland (no. SC038698).

© The Institution of Engineering and Technology 2022.

## **Contents**

1.	Opening	Remarks	4
2.	Executiv	ve Overview	5
3.	Recomm	endations	6
4.	Introduc	tion	7
5.	Backgro	und: Why we need 'Engineering Kids' Futures'	8
	5.1	The skills gap	8
	5.2	Current awareness of engineering amongst young people	9
	5.3	Primary education	9
	5.4	Secondary education	9
	5.5	Curriculum enhancement and enrichment	9
6.	Roundtables		10
	6.1	Common themes (from all roundtables):	11
	6.2	Devolved region-specific emerging themes	12
7.	Enginee	ring Community Responsibility	14
8.	Conclusi	ions	15
9.	The IET's Position		16
10.	References		17
11.	Annex A: Roundtable Participant's Organisations 1		
12.	Open Letter Co-Signatories 2		

# 1. Opening Remarks



## **Danielle George**, Former President and Fellow of the IET

In 2021 I was proud to launch *Strategy 2030* which outlines the strategic direction of the IET. Since then, we have used this as the basis of our organisational annual planning process, and to help us work more collaboratively together to deliver activities linked to the societal challenges and strategic themes, described within the strategy.

Working to engineer a better world remains core to Strategy 2030. It's why we exist and why, for the past 150 years, we've been using our influence, knowledge and expertise to champion the role of engineering and technology in the future of our society and our planet. A key aspect of this is influencing Government to build engineering excellence into their education programmes. I was pleased to see Education included as one of the five pillars of Strategy 2030, as I had recognised for many years that we were letting our children down by not exposing them to high quality engineering education from an early age, and thereby limiting their choices later in life. I therefore wrote to the then Prime Minister and Secretary of State for Education, asking for their support to explore how we might do this, in an already full curriculum. By early 2022 we had set up a series of roundtables with experts from industry, academia, education, Government, and STEM providers, from across the UK, to do exactly this. These were fascinating sessions, raising both familiar and innovative themes of discussion, in an open, friendly, and collaborative environment; with all participants obviously very supportive of the basic premise - we need our kids to experience engineering at the earliest possible opportunity.

The outputs from these roundtables are distilled in this report. It is intended to stimulate debate and action within Government. But more than that, it represents the start of a plan that will significantly add to our economic growth and future prosperity for the nation. The engineering community has its part to play, and we are ready and willing to lead this, but we need Government endorsement, encouragement, engagement, and support to make it happen. We refuse to stand by and watch our home-grown talent pool be denied the opportunities that engineering presents. This is the start of the UK actively **Engineering Kids' Futures**.

#### **David Lakin**, IET Head of Education, Safeguarding & Education Policy

**Engineering Kids' Futures** offers a real opportunity for the IET to demonstrate its commitment to be a champion for engineering and technology education in the UK. We already have a strong portfolio of offers to support the education sector, as do many of our partners and colleagues from across engineering. However, our overarching aim to significantly increase the number of quality engineers and technicians entering the workforce can only be achieved by letting young people see the opportunities that a career in the engineering sector presents.

Children eagerly learn about science and maths, but the connection to engineering - the link between these subjects, their purpose and application to the world in which we live - is not currently being made. We need to ensure there are clearer learning outcomes for these subjects. Put simply, we need to embed engineering into the mainstream curriculum. There are many options about how to do this, and the engineering community is ready to help develop and implement these. Our **Engineering Kids' Futures** roundtable events have highlighted some of the major challenges, and we now need Government to demonstrate its commitment to work with us and make it happen.

## 2. Executive Overview

There is currently a shortfall of over 173,000 workers in the Science, Technology, Engineering and Maths (STEM) sectors: an average of 10 unfilled roles per business in the UK. Our latest skills survey identifies that half (49%) of engineering and technology businesses are experiencing difficulties in the skills available to them when trying to recruit. This has a serious negative impact on our economy, which is estimated to suffer a loss of £1.5bn per year due to these engineering and technology skills shortages. This is a challenge that we have tracked for the last 15 years – longer than the time it takes for a primary aged-child to complete their education.

International studies confirm that young people in the UK are not performing as well as their peers internationally. A key approach employed by many of these countries is embedding clarity in their technical education systems – for students, providers and employers – all clearly communicated, with lines of sight to employment and progression opportunities available throughout. This strong understanding of the expectations of and opportunities for all parties has helped to build the reputations of these systems as leaders in technical education.<sup>1,2</sup>

We believe the solution to the skills gap lies in education. By adding more focus on misunderstood disciplines like engineering where we know there is a perception problem, it will help young people from all backgrounds better understand how STEM can be applied, close the education gap, increase their career aspirations, and develop other skills such as creativity and problem-solving. Future skills need addressing now.



## 3. Key Recommendations

To raise engineering's profile, engagement, and uptake amongst young people in our schools; and realise the subsequent economic and social benefits of doing so, the following recommendations are presented to the UK Government. We believe the implementation of these will have the most strategic impact on the teaching and learning of engineering within schools in England, and significantly increase the number of quality engineers and technicians entering the workforce:

#### The National Curriculum

Without receiving any formal teaching in engineering, young people cannot make informed choices regarding future study or career options in engineering and technology. It is recommended that the English schools National Curriculum be reviewed to embed the teaching of engineering, at both primary and secondary levels of education.

#### The Design & Technology Curriculum

The Design & Technology (D&T) subject area (the closest aligned subject to engineering) is suffering from poor pupil uptake, falling numbers of subject specialist teachers, and concern regarding its future as a taught subject. It is recommended that the current D&T curriculum at secondary level be reviewed, to refocus it as an 'engineering and design' subject, with a possible rebranding of the subject accordingly.

#### 3 The English Baccalaureate (EBacc)

A significant factor affecting the profile and uptake of D&T (and by proxy engineering) is its perceived low value in secondary school accountability measures. It is recommended that school accountability measures (Progress 7 and Attainment 8) be reviewed to move D&T into the EBacc suite of subjects, 'Bucket 2'.

#### <sup>4</sup> Engineering training for teachers

To increase their confidence in the subject, all primary and specialist secondary teachers should have some exposure to and experience of engineering as part of their Initial Teacher Training (ITT). It is recommended that UK Government endorse, actively promote, signpost and support an engineering package of training aligned with the ITT Core Content Framework.

#### <sup>5</sup> Bursaries and scholarships

A key factor in attracting potential teachers into the profession is the availability of funding support whilst on ITT. This is particularly relevant for engineering professionals considering a change of career as salary differentials between engineering roles and teaching are particularly acute. It is recommended that Government funded ITT bursaries and scholarships in engineering be reviewed to increase their value and availability.



## **4**. Introduction

In November 2021 Professor Danielle George MBE, Past President of the Institution of Engineering & Technology (IET) wrote an open letter to the then Prime Minister Boris Johnson MP, and the then Secretary of State for Education Nadhim Zahawi MP. The letter outlined a proposal to bring together stakeholders across Government, education, the professional institutions, and industry, to explore how engineering can be better embedded into the school curriculum, without additional pressure being placed on teaching staff.<sup>3</sup>

In December 2021, the Minister of State for School Standards responded, indicating the Department's support for a range of STEM initiatives, and expressing interest in the proposal.<sup>4</sup>

Following this exchange, the IET initiated and facilitated a series of roundtables across the UK between March and September 2022. The roundtables brought together over 100 representatives from a wide range of stakeholder groups (including industry, academia, education, STEM providers and the civil service). The roundtables gathered expert opinion, advice, and evidence regarding potential options for the development of engineering teaching and learning within UK schools. The outputs from the roundtables have formed recommendations for this report.

## 🚍 5. Background: Why we need this 'Engineering Kids' Futures' campaign

As has been repeatedly acknowledged by all recent Governments, the STEM subjects are of vital importance to the UK. They are key in delivering on the Government's ambitions, for a high-skill, high-wage economy, levelling-up, facilitating a green industrial revolution, and reinforcing the UK's position as a science and technology superpower.



#### 5.1 The skills gap

Latest studies indicate that the UK economy suffers a loss of £1.5bn per year due to STEM skills shortages<sup>5</sup>, largely driven by a shortage of skilled engineers. To meet this gap the UK needs to generate an estimated 59,000 engineers annually, at level three and above<sup>6</sup>, just to keep up with current demands.

Engineering continues to have a vital role in driving economic growth and productivity, generating 21.4% (£1.2 trillion) of the UK's £5.7 trillion turnover in 2018<sup>6</sup>. This lack of engineering talent represents a significant market failure in terms of the UK's prosperity, and of young people's and adults' ability to work in more skilled employment, and potentially pioneer new technologies. There are several options open to the UK to fill this skills gap:

- Outsourcing our industry's STEM requirements to overseas partners is a well-trodden approach but is an expensive option. It also comes with many drawbacks including the loss of capability, capacity, and financial reward to competing nations.

 A second option is to retrain and reskill our existing workforce to build our own STEM capacity. Several programmes and initiatives have been successful in achieving this in specific STEM sectors, but this does not deliver on the scale required to address the skills shortfall overall.

 The third option is the long-term, strategic approach to 'grow-your-own' workforce, with the STEM skills required now and in the future. This is the focus of Engineering Kids' Futures, with an emphasis on the development of engineering and engineering skills starting at primary school level, feeding through into secondary education and beyond.

### 5.2 Current awareness of engineering amongst young people

Engineering UK's 2021 Engineering Brand Monitor highlighted that only 55% of young people said they know what engineers do<sup>7</sup>, which although shocking is not surprising as in England, Wales, and Northern Ireland engineering is not taught as a core curriculum subject. It is therefore understandable that young people cannot make a properly informed decision about potential career routes into engineering if they have not been exposed to, or experienced any form of, engineering prior to making those choices.

#### 5.3 Primary education

Only five percent of primary school teachers have a STEM background, and therefore have little confidence in delivering any engineering content as part of their school syllabus.

At primary level, the National Curriculum does not include any engineering content. Therefore, it is not surprising that relatively little engineering teaching and learning occurs at this stage of education.

#### 5.4 Secondary education

Engineering is not delivered as part of the National Curriculum in England. Secondary schools have the option to deliver GCSE Engineering, but uptake of this is poor nationally. In 2022 only 2,483 entries were recorded for GCSE Engineering of the 630,000 UK candidates aged 16 taking GCSEs, representing less than 0.4% of the cohort.<sup>8</sup>

Vocational & Technical Qualifications (VTQ) in engineering related subjects are also available at secondary level, however in practice these are primarily delivered in Further Education colleges as post-16 options. Very few secondary schools offer engineering VTQs. The profile of engineering as a distinct subject is therefore very low within secondary schools. The closest aligned subject to engineering in secondary schools is Design & Technology (D&T). D&T is in decline and the number of entries for D&T GCSE qualifications has reduced rapidly in recent years (280,670 entries in 2009 compared to 53,094 entries in 2022).<sup>8</sup> There has also been a decline in D&T specialist teachers, which now accounts for only 3% of all teachers nationally. This is exacerbated by the falling numbers of D&T teachers entering Initial Teacher Training (ITT). Recruitment into D&T ITT was just 23% of the target in 2021/22.<sup>9</sup>

Significant policy changes, including the introduction of the English Baccalaureate (EBacc) which has a significant influence on school performance tables has also affected uptake of D&T. D&T is not included in the EBacc suite of subjects, and therefore may not be viewed by school leaders as a priority subject. The profile of D&T (and by proxy, engineering) is also low in secondary schools.

## 5.5 Curriculum enhancement and enrichment

In the UK we are fortunate to have a range of highquality curriculum enrichment and enhancement opportunities in engineering for schools to take advantage of. These activities are often designed and delivered by the professional engineering institutions, offering real and valued insight into engineering and engineering careers. However, participation in these interventions is not equitable across the UK. They are optional, can be regional, some are costly, many are only suitable for particular year groups, they can consume valuable curriculum time, or require pupils to participate out of school time (with all the associated barriers that this may impose). Introducing engineering to all young people via these programmes is not a feasible or a sustainable option.



## 📒 6. Roundtables



During the period between March and September 2022, the IET convened a series of roundtables across the UK, in Manchester, Birmingham, London, Bristol, Glasgow, Northern Ireland (virtual) and Wales (virtual).

The roundtables brought together over 120 representatives from a wide range of stakeholder groups (including industry, academia, education, STEM providers and the civil service). At each event participants considered the following issues from an education perspective:

- Why do we have a shortfall in engineering talent within the UK?
- Could Government intervention help, and if so, what options are open to Government?
- What can be realistically delivered?
- What action is recommended to Government?

Several common themes emerged repeatedly at these events, but each event also generated several unique perspectives and proposals for consideration. From these discussions and presentations, a number of outputs have been distilled and are presented in the shortlist of recommendations at the beginning of this report. A range of other outputs were generated but many of these require further investigation or are focused on the wider engineering community. These recommendations have therefore not been included in this report and will be reviewed separately.

Participants recognised that the education systems across the UK are a complex system, and any proposed changes at any phase of education (e.g. primary) could have implications and consequences for other areas of the system. It was also apparent that the engineering community has a role to play in developing the engineering competence of our young people and their teachers. The IET remains committed to the continuing support of engineering education across the UK through our work to:

- Influence, where we can, to ensure Engineering and Technology elements of STEM become a core part of the UK curriculum
- Increase our STEM education provision
- Become the "go to" place for engineering education expertise and thought leadership
- Be an exemplar of STEM education delivery strategy and teacher training/Continuing Professional Development (CPD)
- Provide support and guidance for all routes into an engineering career.

## 6.1 Common themes (from all roundtables):

#### 6.1.1 The curriculum

All participants recognised that the most obvious way to ensure all young people were aware of, and had experience of engineering, was to teach it as part of the curriculum. Participants were keen to see engineering embedded into the curriculum at both primary and secondary level; either as a discrete subject, taught within D&T, or delivered across the curriculum within subjects including Maths, English, Science, and the Humanities.

The National Curriculum in England sets out the programmes of study and attainment targets for all subjects at all four key stages, and all local-authoritymaintained schools in England must teach these programmes of study. Most of the current National Curriculum was introduced in September 2014, with English and Maths coming into force for all year groups from September 2016.

Participants appreciated that the National Curriculum already presents a full and demanding range of material to be delivered in schools, and it may not be practical to simply expand the curriculum further with the addition of engineering content. It was also clear that 'shoehorning' engineering into the current curriculum was not a realistic option. A more comprehensive review of technical education at primary and secondary phases would be required to effectively embed engineering into the curriculum.

Participants recognised that the current Government has not publicly stated any plans to review the current curriculum. They appreciated that this would be a significant and potentially expensive piece of work. Participants looked at other potential options, that although may be sub-optimal, could offer considerable improvements in the curriculum's technical education offer.

These options would still align with the underlying concept of a knowledge-rich curriculum, enabling a robust understanding of (engineering) principles, that can be subsequently applied by young people. The curriculum review was agreed by all participants to be the highest priority recommendation.

#### 6.1.2 Design and Technology

The status of D&T within secondary schools was also a recurring topic of discussion. Participants were well aware of the declining numbers of young people studying the subject, fewer specialist teachers in schools and under ITT, and an EBacc structure that did not recognise the importance of D&T qualifications.<sup>9</sup>

It was recognised that D&T as a subject had been through several iterations in recent years, but there was still apparent confusion regarding the value of D&T, the content of D&T programmes, and how it aligned with engineering.

Participants agreed that there was potential for a review of D&T with an aim to increase its alignment, content, and context towards engineering design, and engineering more generally. Although not as comprehensive as a full curriculum review, this approach was viewed as a more measured approach by participants, and the IET were seen as taking a significant role in this exercise, working alongside other key partners including the Royal Academy of Engineering, the Institution of Mechanical Engineers, and the Design and Technology Association.

A strongly supported suggestion amongst participants was that as part of this review, D&T should be rebranded as '*Engineering*, *Design & Technology*'. This would better reflect a revised subject syllabus and clearly identify the subject for employers who were not familiar with the details of the curriculum.

Participants were concerned regarding the status of D&T and wanted to ensure that any D&T curriculum review would also include a review of D&T's significance within the wider school curriculum. Currently, school accountability measures are based on Progress 8, Attainment 8 and English Baccalaureate (EBacc) performance. D&T as a subject sits in 'Bucket 3' – the open group of subjects, which have less weighting towards school performance than Bucket 1 or 2 (see diagram below).

All roundtables agreed that a revised D&T (*Engineering*, *Design & Technology*) should be moved to Bucket 2, and therefore become an EBacc qualification. This would then better reflect its importance to society, the economy, employers, and would also encourage school leadership teams to recognise its importance within the wider curriculum. The review of the D&T curriculum, and its position within school attainment measures was viewed by participants as the second highest priority recommendation.



#### 6.1.3 Initial Teacher Training (ITT)

Participants were strongly in favour of supporting all schoolteachers, particularly during the ITT phase to increase their confidence and ability to teach engineering related materials. ITT delivers a core set of learning as detailed in the ITT Core Content Framework<sup>10</sup>, which is presented as eight 'Standards'. Standard 3 is based around Subject and Curriculum (Teachers must 'Demonstrate good subject and curriculum knowledge'). However, the ITT Core Content Framework is designed to cover the content required by trainee teachers irrespective of subject or phase. Therefore, the document does not provide a breakdown of the content to be covered across the various subject training routes for ITT. Throughout the framework there is regular reference to ensuring pupil literacy and numeracy skills are developed and reinforced, but other subject area skills are to be developed or are left to the discretion of the ITT provider. A review of ITT provision indicates that generally little time is allocated for the development of STEM subject knowledge or teaching skills.

At primary level, only five percent of primary school teachers have a STEM background<sup>11</sup>, so it is not surprising that a high proportion of primary school teachers do not have 'good subject knowledge' of engineering, and therefore may be under-confident in the delivery of engineering related activities within their classrooms (for which there is no specific requirement to deliver anyway).

Participants agreed that a package of training could be developed which introduces some basic engineering principles to trainees. These principles would be accessible, exciting, inspirational and give them the confidence to deliver elements of these in the classroom; and would also signpost them to the many other resources available, including STEM Ambassadors, age-appropriate careers materials and progression routes, such as T Levels.

The role of the professional engineering institutions, industry and academia was discussed in the creation of such a training package (being cognisant that the ITT syllabus was already extremely comprehensive). It was proposed that should Government support this initiative, a forum of these bodies would come together in partnership with DfE, to fund development, create resources (and potentially deliver) this training into ITT providers across the country, for both Primary and Secondary. Government endorsement and support would be required to promote this amongst ITT providers, signpost this training package within the ITT Core Content Framework, and recognise those ITT providers who successfully embed this in their provision.

#### 6.1.4 Teaching bursaries and scholarships

Participants recognised that helping individuals with funding during their ITT did have significant effect on uptake of training, and bursary support was recognised as a successful mechanism for this. However, in England there is no additional bursary funding available from the Government for primary teachers who wish to specialise in selected subject areas (including teaching Primary with Maths and Primary with Science). There is currently no ITT provision for teaching Primary with Engineering.

At secondary level there are bursaries and scholarships available to support ITT trainees in selected subjects (including engineering). Participants commented that there is relatively little attraction for engineers who were working in industry and considering a change of career into teaching, predominantly due to the significant drop in salary they would encounter in doing so. The introduction of a bursary or scholarship specifically focused on engineering, and at a more appropriate level, would cushion any salary drop and could be a positive factor in the recruitment of engineers into the teaching profession.

If we are to attract and retain teachers with an interest and ability to teach engineering in schools across the education landscape, much more emphasis needs to be applied to these financial incentives with a focus on engineering. Participants recommended a review of Government funded bursary and scholarship availability for those teachers with an engineering background or wishing to update their skills in the teaching of engineering.



## 6.2 Devolved region-specific emerging themes

#### 6.2.1 Scotland

The Scotland roundtable participants were conscious of a number of ongoing initiatives that were unique to Scotland, and could influence how engineering is delivered in the curriculum:

 An independent review of the wider Scottish education system was recently completed and published in March 2022<sup>12</sup>. The Scottish Government has responded positively and instigated a range of measures to implement the recommendations of the review. These measures will take up until 2024 to be fully embedded, and infrastructure changed accordingly. - The STEM Education and Training Strategy for Scotland<sup>13</sup>, launched in 2017, lists a number of Key Performance Indicators (KPIs) based around the themes of Excellence, Equity, Inspiration and Connection. Although good progress has been made in many areas, the effects of COVID-19 have affected overall performance. Participants were aware of this and were keen to be involved in any future review of the strategy.

- The Scottish Curriculum for Excellence<sup>14</sup> includes a set of experiences and outcomes based around the application of engineering at each stage of a pupils' learning. These are concise statements about children's learning and progression at each stage of their development and appeared to be a reasonable basis for an understanding of engineering. However, unlike the National Curriculum in England, this is not a mandatory curriculum and does not give teachers a prescriptive list of topics to be taught or when they are to be taught.

 Much of the education policy is devolved to local councils, who vary in their approaches. Participants felt that as a result, the teaching and learning of engineering is not well delivered across the country and is in need of a review.

The recurrent themes outlined in the English roundtable events were echoed by the Scotland participants who, in addition, called for involvement in the future of the STEM strategy and recommended much better co-ordination across local authorities in the teaching of engineering, and the access to enrichment and enhancement opportunities.

#### 6.2.2 Northern Ireland

The current Northern Ireland Curriculum is statutory and applies to all 12 years of compulsory education. Engineering is not taught within this, but elements of design and technology are delivered within a broad area of learning called 'The World Around Us' in Key Stage 1 and 2 and within 'Science and Technology' at Key Stage 3. This NI Curriculum was last revised in 2019. Key observations emerging from the roundtable included:

 The overarching Independent Review of Education within Northern Ireland commenced in October 2021.
An interim report is due in October 2022, and the final recommendation by April 2023.<sup>15</sup>

- The Northern Ireland '10X Economy' initiative for economic growth across NI includes a significant skills component. This skills strategy is a key pillar of the economic vision for Northern Ireland. It sets out plans to focus on innovation by increasing further education qualifications in technical and professional skills, and rebalancing higher education towards STEM. This was launched in March 2022. Participants were concerned that the 10X strategy may not be deliverable due to lack of STEM expertise within the education system. It was broadly agreed that the themes outlined at the English roundtable, if adopted by the NI Government, could significantly help to achieve goals of 10X.

#### 6.2.3 Wales

Participants at the Welsh roundtable were aware that the National Curriculum for Wales has only just been formally launched within schools this year, and schools are adapting their curriculum accordingly. This new curriculum is less prescriptive than the English National Curriculum, allowing for much more flexibility and creativity in its delivery within schools. It was agreed that although engineering was only briefly referred to, the open format of the new curriculum represented a real opportunity for engineering to be embedded, should schools wish to do so. The Welsh roundtable suggested the following initiatives for further consideration by the Welsh Government:

 Develop a series of prepared, age-appropriate lesson plans, based around engineering which would be available to all schools. This would enable teachers to easily deliver lessons on engineering and wider STEM topics.

 Explore how engineers working within industry could become suitably trained and qualified in teaching, to work part-time (or on secondment) within a school to deliver engineering curriculum content.

 Work with local authorities to establish an expert STEM Advisor role for schools to access and gain assistance and advice regarding engineering curriculum delivery (there was some evidence of this happening in at least one Welsh local authority).



# **7. Engineering Community Responsibility**



It was recognised throughout the discussions held across all the roundtables that the wider engineering community needs to continue working to increase its engagement with schools, teachers and young people, including (but not limited to):

- Develop a package of training which is appropriate for inclusion in teacher ITT.
- Campaign within the engineering sector to:
  - Raise the opportunities for engineers to work with schools, teachers, and young people; and create more of these (including work placements).
  - II. Promote routes into teaching engineering within schools and colleges.
  - III. Promote career opportunities and routes into engineering roles to young people.
- Create more, higher value bursaries, scholarships, and grants for teachers of engineering or those considering training as a teacher of engineering, to supplement Government provision.
- Create more resources based around cutting edge real-world engineering for schoolteachers, careers advisors, and young people to access.
- Consider sponsoring an 'Engineering Quality Mark' for schools where good teaching of engineering is evident.

## 8. Conclusions

We need more engineers and technicians. The growth of the UK's economy is highly dependent on the talent within our engineering sector, but currently we do not have enough skilled engineers to seize the opportunities that are available to our industries. One of the major factors influencing why more of our young people choose not to study engineering or pursue engineering careers is that they have not been exposed to engineering during their primary and secondary education. We need to change this.

Our National Curriculum gives schools and teachers the statutory guidance regarding what is taught in our schools. Engineering is an obvious omission and must be included in any future review of the curriculum.

Design & Technology as a subject has long been in decline in schools. We must reverse this trend by reinvigorating the subject and aligning it much closer to engineering and thus, inspire more young people. Closely coupled with this is the need to review the perceived value of the subject within schools. Moving a revived D&T into the headline school performance measures (i.e. the EBacc) would send a clear signal to all, including the industry sector, that engineering is considered 'important' within our education system.

A key factor in the teaching and learning of any engineering content within schools, is the ability and confidence of school teaching staff to do so. If curriculum reform is to succeed, we need to offer exciting and inspiring examples of engineering content that can be developed and delivered to all teachers during their ITT period. This in turn would give teachers confidence and the necessary tools they may currently lack to deliver engineering at all stages of schooling.

In support of all this we need to maintain our ability to attract and recruit new teachers into the profession. A key element of this is supporting trainee teachers during their ITT period. We need to be better at this, particularly so in the engineering field where pay differentials between professional engineers and teachers can be significant. Raising the value and increasing the availability of bursaries and scholarships for engineering teachers would help considerably.



Our recommendations outlined at the front of this report are the high-level outputs from the roundtables. They need significant decomposition and development before implementation can be taken forward. The IET and the wider engineering community would welcome the opportunity to do this in partnership with the DfE and other relevant Government departments.

#### What can Government do:

- **Review** the National Curriculum
  - **Overhaul** the current D&T curriculum (to include an emphasis on engineering)
- Include a refreshed D&T subject in the EBacc suite of qualifications
- Support inclusion of engineering training in all ITT
- 5 Raise the value and availability of bursaries during ITT for engineering teachers

We would do this by leading a working group to examine each recommendation in detail, identify the key actions required, and the most appropriate stakeholders to engage with. Detailed options, actions, and costed business plans could then be developed and presented. Implementation would also form part of this work, and we would ensure the engineering community maintains an ongoing contribution to ensure the success of this initiative. We are convinced that this is in the best interest of the Government, the engineering sector and the wider success of the UK internationally.

# 9. The IET's Position



The IET is Europe's largest Professional Engineering Institution, representing over 155,000 members. Education is one of the five strategic themes of the Institution. The IET is committed to championing engineering and technology education throughout the UK to increase the number and quality of engineers and technicians entering the workforce, while growing our economy through our engineering capital.

The IET believes the engineering capability of many of our young people could be amazing if nurtured and developed appropriately. Given appropriate opportunities, guidance and advice regarding the engineering sector, young people could make much better-informed choices regarding their future study and careers, which in turn will contribute to the UK retaining its reputation as a global engineering superpower. It is against the background outlined above that the IET launched the *Engineering Kids' Futures* campaign, and now offers Government some key recommendations that will enable the UK to grow our own future workforce of engineers and technicians.

# **10.** References

1	https://www.oecd.org/pisa/publications/PISA2018_CN_GBR.pdf
2	https://www.gatsby.org.uk/education/latest/reflections-from-gatsby-s-international-study-visits
3	https://www.theiet.org/impact-society/factfles/education-factfles/iet-skills-survey/iet-skills-sur- vey-2019
4	https://www.engineeringuk.com/media/156198/key-facts-figures-2019-final-20190627.pdf
5	https://www.theiet.org/media/8186/addressing-the-stem-skill-s-shortage-challenge-report.pdf
6	https://www.engineeringuk.com/media/156198/key-facts-figures-2019-final-20190627.pdf
7	https://www.engineeringuk.com/media/318108/euk2708-parents-report-fv.pdf
8	https://www.jcq.org.uk/examination-results/?post-year=2022&post-location=
9	https://epi.org.uk/wp-content/uploads/2022/03/Spotlight-on-DT-report_EPI-March-2022.pdf
10	https://www.gov.uk/government/publications/initial-teacher-training-itt-core-content-framework
11	https://raeng.org.uk/media/bcbf2kyb/112408-raoe-uk-stem-education-landscape_final_lowres.pdf
12	https://www.gov.scot/publications/putting-learners-centre-towards-future-vision-scottish-education
13	https://www.gov.scot/publications/science-technology-engineering-mathematics-education-train- ing-strategy-scotland
14	https://education.gov.scot/education-scotland/scottish-education-system/policy-for-scottish-educa- tion/policy-drivers/cfe-building-from-the-statement-appendix-incl-btc1-5/experiences-and-outcomes
15	https://www.education-ni.gov.uk/independent-review-education

# 11. Annex A: Roundtable Participants Organisations

1	1851 Trust	
2	Amplify	
3	Association for Science Education	
4	BAE Systems	
5	Boeing	
6	Cummins inc.	
7	Defence Science & Technology Laboratory	
8	Department for Education	
9	Design & Technology Association	
10	Dŵr Cymru Welsh Water	
11	Electrical Contractors Association	
12	Energy Skills Partnership	
13	Engineering Development Trust	
14	Engineering Education Scheme Wales (STEMCymru)	
15	Engineering in Motion	
16	Engineering UK	
17	EON UK	
18	ERA Foundation	

19	Fairfield Control Systems Ltd
20	FSG Tool & Dye Limited
21	Glasgow Science Centre
22	Glasgow University
23	Greenpower Trust
24	HME Logistics LLP
25	HS2 Ltd
26	Hydrock
27	Institute of Materials, Minerals & Mining
28	Institute of Mechanical Engineers
29	Institute of Physics
30	Institution of Engineering & Technology
31	Institute of Explosives Engineers
32	Jaguar Land Rover
33	Limina Immersive
34	Linxon UK Ltd
35	Liverpool John Moore University
36	MAKE UK

37	Mathematics in Education & Industry
38	Microsoft
39	Ministry of Defence
40	National Grid
41	Northern Ireland Department of Economy
42	Northern Ireland Electricity Networks
43	Nottingham Trent University
44	Okdo / RS Components
45	Primary Engineer
46	Renishaw plc
47	Royal Academy of Engineering
48	Royal Air Force
49	Royal Society of Edinburgh
50	Sentinus
51	Star Refrigeration
52	STEM Gogledd
53	STEM Learning
54	Swansea University

55	Teach First
56	Technology Scotland
57	Thales UK Limited
58	The Smallpeice Trust
59	The STEM Workshop
60	Ucan Achieve
61	Ulster University
62	University College London
63	University of Birmingham
64	University of Hull
65	University of Manchester
66	University of the West of England
67	University of the West of Scotland
68	Urenco (UK) Ltd
69	Ursuline Academy
70	VVB Engineering (UK) Ltd
71	Women's Engineering Society
72	Zimmer Biomet

## 12. Open Letter Co-Signatories

To launch the IET's Engineering Kids' Futures campaign, we joined forces with over 150 world-leading engineers, STEM ambassadors, professional institutions, and celebrities to urge the Government to help tackle the UK's engineering skills shortage by embedding engineering into current primary school learning and support.

You can view the full letter on our website: www.theiet.org/media/campaigns/engineering-kids-futures

#### **Co-signatories:**

Adam Horton, Head of Technical, SA Group Adam Taylor MSc BEng (Hons) CEng MIET, Plant Manager, Lhoist Air Vice Marshal John Main CB OBE FRENG Hon FIET FRAeS RAF(Ret'd) Alan Thom, Maintenance Team Manager, Northumbrian Water Alasdair Coates BEng (Hons) MSc CEng FICE MCIHT CMIOSH, Chief Executive Officer, The Engineering Council Alex Gray BEng (Hons) CEng MIET, Head of Operational Technology, Thames Water Alexandra Knight CEng FIMechE FWES, Founder & Director, STEMAZING Ltd Alison Thomas, Director, Coderus Alistair Somerville, President Elect, Institute of Acoustics Amanda Cooper IEng MIET AAPM, UK Head of Strategic Capability Planning, Thales Ammaarah Ravat, Graduate Compliance Engineer, Cummins Inc Andrew Short CEng MIET, Principal Electronics Engineer, Renishaw plc Andrew Smyth MEng MIET ARAeS, Presenter & Aerospace Engineer Andy Hughes BEng (Hons) CEng FIET MIoD, Managing Director, AGH Engineering Ltd Andy Thomis MEng ACGI FIET, Chief Executive, Cohort plc Ann Allen MBE, Chief Executive Officer, Chartered Institution of Civil Engineering Surveyors Ashley Smith BEng, LNG Terminal Electrical Engineer, National Grid Ben Obiri-Bonney CEng MIET, Substations Asset Lifecycle Management Engineer, National Grid Bethany Clarke BSc (Hons) EngTech MIET, Consultant Engineer, Capgemini Engineering UK Bina Taylor BA, HR Advisor, General Dynamics Blane Judd BEng FCGI CEng FIET, Chief Executive, Institution of Railway Signal Engineers Bobby Seagull, Mathematics Teacher, Writer and Presenter Callum Daniel, Founder, iCodeRobots and IET Young STEM Personality of the Year 2021 Captain (Tfc) Chris Brown R Signals CEng MIET BSc (Hons) PG Cert, MOD Captain Roy Organ MSc CEng, Royal Signals Captain Steven Valentine BEng(H) CMgr MCMI MIET MInstRE, Garrison Engineer, MOD Captain Stuart Yates, Technical Officer Telecommunications, MOD Carl Haycock BEng, UK Operations Director, Domino Printing Carol Vorderman MBE MA, IET Honorary Fellow Catherine Allen, Founder, Limina Immersive Chris Morgan CEng MIET, Senior Process Engineer Mortars, BAE Systems Land UK Christopher Clark, Knowledge Management & Future Capability Lead, BMT Global

Colin Cooper BSc (Hons) MIET CEng, Senior Controls System Engineer, Actemium Automation Nottingham Dallas Campbell, television presenter on the factual Channel 5 series, The Gadget Show, and BBC One science series, Bang Goes the Theory Dan Francis MIET, Principal Engineer, CEMA Ltd David Midwinter, Coderus David Moore BA (Hons) PG (Dip) EP MIET, Chief Executive Officer, GES Group David Pearce CEng MIET, Regional Engineering Manager Midlands, Allied Bakeries David Shammas, Protection Services Manager, Dagem Power David Sherburn, Defence Science and Technology, DSTL David Woolhouse, Chief Executive Officer, Intelligent Energy Dawn Bonfield MBE CEng FIMMM FICE HonFIStructE FWES HonDEng, Royal Academy of Engineering Visiting Professor of Inclusive Engineering, Aston University Denize Ivy Pilarta EngTech AMInstNDT, Non-Destructive Examination Engineering Technician at BAE Systems Dr Alice Bunn FIMechE, Chief Executive, The Institution of Mechanical Engineers Dr Carol Marsh OBE, Head of Systems at Celestia and Vice President, The Institution of Engineering and Technology Dr Colin Church CEnv FIMMM, CEO of Institute of Materials, Minerals & Mining Dr Dame Sue Ion FREng FRS, IET Honorary Fellow Dr Dolores Byrne OBE, IET Honorary Fellow Dr Gavin Young CEng FIET, Head of Fixed Access Centre, Vodafone Dr Hermann Hauser FRS FREng KBE, Amadeus Capital Partners, IET Honorary Fellow Dr Iain Baillie, President, British Institute of Non-Destructive Testing (BINDT) Dr James H Sharp, Principal Engineer, Software and Systems Dependability Team, Dstl Dr Lynne Bianchi, Director of Science & Engineering Education Research and Innovation Hub and the Great Science Share for Schools Campaign Director Dr Melanie Jimenez, Royal Academy of Engineering Research Fellow and Chancellor's Fellow Biomedical Engineering, University of Strathclyde Dr Ozak Esu BEng PhD CEng MIET, Technical Project Manager R&D, Hilti Group Dr Paul Gosling FREng DPhil BSc FIET FInsP CEng Cphys, CTO, Thales UK Dr Susan Scurlock, CEO and Founder, Primary Engineer Duncan Abercrombie MSc CEng FIET FRAeS, Senior Principal Engineer, Dstl Ed Almond MSc MBA FCA FIET, Chief Executive and Secretary, The Institution of Engineering and Technology Ella Podmore MEng, Materials Engineer, McLaren Automotive and IET Young Woman Engineer of the Year 2020 Engineering Development Trust (EDT) Engineering in Motion Eur Ing David Tester CEng FIET, Chief Engineer, EnSilica plc Eur Ing Gary Hicks CEng IntPE CMgr BEng (Hons) FIET MCMI, Electrification and Power Discipline Lead, AECOM Eur Ing Savvas Savvides DipEE MBA MCGI CEng, IET Honorary Fellow Eva McClean, EDI and Member Networks Manager, Institute of Physics and Engineering in Medicine (IPEM) Gareth Caple BSc FIET, Associate Director, Accenture Gavin Dunn, Chief Executive, Chartered Association of Building Engineers (CABE) George O'Neill BSc MSc CEng, IET Honorary Fellow Giles Thomas, Phase 1 Engineering Director, HS2 Ltd Glyn Shawcross CEng FIET MInstMC FSeng (TÜV Rheinland), Engineering and Design Director, BGEN Gordon Burrows BEng (Hons) CEng MIET Greenpower Trust Hannah Lawrence, Cyber Investigator, GE Aviation EdisonWorks

Hannah Russell FRSB, Chief Executive, The Association for Science Education Heather Burtenshaw CEng MIMechE BEng (Hons) PGCE (FE&T), Principal Engineer, BAE Sytems Land UK and STEM ambassador Helen Kellaway MEng (Hons) CEng MIET AMIRSE, Assistant Chief Engineer, Rail Infrastructure at Siemens Mobility Limited Henrietta Heald FRSA, Writer and Historian of the Women's Engineering Society Hilary Leevers, Chief Executive Officer, EngineeringUK Ian Ratcliffe BSc (Hons) CEng MIET, Senior Principal Engineer, Dstl Institute of Explosives Engineers Institution of Civil Engineers Ir Dr N F Chin Hon FIET Jack Pendle MBA CEng FIMechE FIET FPWI, Engineering Director, Volker Rail James Billingham BSc DMS CEng MIET, General Manager, Tata Motors European Technical Centre plc James Crouch, Engineering Director, Burns & McDonnell Jamie Davey, Director of Engineering, Arrow Electronics Jamie Everest BSc(Hons) CEng MBCS, Principal Engineer, General Dynamics Missions Systems Jim S. Al-Khalili CBE FRS, Professor of Theoretical Physics and the Public Engagement in Science, University of Surrey John Baxter CEng FIET CEnv FSOE CFIOSH, Asset Governance Manager, EON UK John McCollum CEng FRAeS, Engineering Director GCS Mobilisation, BAE Systems Maritime Naval Ships John Quinn CEng MIET, Principal Software Engineer, Siemens Katherine Paynter MEng MIET, Defence and Security Accelerator, Dstl Kay Hussain, CEO, WISE Kevin Wellman, Chief Executive Officer, The Chartered Institute of Plumbing and Heating Engineering Kim Hollands, Engineering Training Manager, South Eastern Railway Larry Aiyedogbon BEng MSc CEng MIET, Associate Utilities, Stantec LCA Group Lee Derbyshire BEng (Hons) MIET, Engineering Director, LCA Group Lewis Gorford, Senior Electronics Engineer, Analox Group Louise Hazelton MSc IEng, Senior Engineer, Dstl Lt Col (Retd) David White BSc CEng MIET MCGI REME, Corps Secretary, MOD Luke Folwell CIWFM CMgr IEng, Head of Technical, Equans Group Major Tim Peake CMG, British ESA astronaut and IET Honorary Fellow Mark Baker, Head of Engineering, Allied Bakeries Mark Heath, Director of Engineering, McLaren Mark Josko, Engineering Specialist, Schneider Digital Mark Plant, CEng FIET MIHEEM, Regional Director, Services Design Solution Martin Belshaw BSc CEng MInstMC, President, Institute of Measurement and Control Matt Kirk CEng FIET, Sumitomo Electric Wiring Systems (Europe) Ltd Melanie Wardle, Group HR Director, VVB Engineering (UK) Ltd Michael Hetherington MIET CEng Michael Singleton BSc (Hons) MSc CEng MIET, Information Advantage Technical Integration Manager, BAE Systems Mike Bentman, CBRE GWS, UK Director of Technical Operations Milo Noblet MEng (Hons) MIET, Graduate Electronic Engineer, Dstl Mohammed Y. Tageldin Younes MSc PMP CEng, Head of Engineering, Linxon UK Ltd Nathan Clow BEng (Hons) MEng CEng SMIEEE FIET, Principal Engineering, Dstl Neil Griffith CMgr IEng, Head of Operations and Support, Collins Aerospace Neil Owen CEng FIET MINCOSE, Principal Engineer, Dstl Nigel Fine CEng FICE FIET, Former Chief Executive and Secretary, The Institution of Engineering and Technology Oliver Mangham BEng (Hons) MIET, Applications Director, Fairfield Control Systems Ltd Olivia Flaherty, Cyber Researcher, MOD Ore Oduba BSc and Honorary Doctor of Bournemouth and Loughborough universities, television presenter Paul Dale BSc (Hons) IEng MIET, Technical Director, Powell

Paul Livingston, Chief Executive, Lockheed Martin UK Paul Walker CEng MIET MEI, Electrical Technical Authority, Centrica Storage Ltd Peter Flinn MBA MA CEng FIMechE, President, The Institution of Mechanical Engineers Peter Marshman, Chief Executive Officer, Digit<all> **Primary Engineer** Professor Bob Cryan CBE DL FREng CEng FIET, Vice Chancellor, The University of Huddersfield and President of The Institution of Engineering and Technology Professor Bob Stone FCIEHF CPsychol AFBPS, Emeritus Professor, University of Birmingham Professor Christopher Aiden-Lee Jackson, Chair in Sustainability Geoscience, The University of Manchester Professor Eleanor Stride OBE FREng, IET Honorary Fellow Professor Herzl Aharoni BSc MSc PhD CEng, IET Honorary Fellow Professor Kel Fidler CEng FREng, IET Honorary Fellow Professor Nick Colosimo PgC BSc (Hons) CEng FIET FIKE, FCAS Lead Engineer, BAE Systems UK Air Professor Sir Michael Sterling KB BEng PhD DEng CEng FREng FAEng FIET FInstMC FCSEE CCMI, IET Honorary Fellow Professor Stephanie Haywood CPhys CEng FInstP, IET Honorary Fellow, and Professor Emerita, University of Hull Professor Will Stewart, FREng BSc MSc CEng, IET Honorary Fellow Rev Stuart Poole MSc BSc (Eng) CEng, IET Honorary Fellow Rob Bell MSc, Freelance TV Presenter and Broadcaster and STEM ambassador Rodger Howarth BENG (Hons) CENG MIET, Application Engineering Manager, Siemens plc Sam Greer, Education & Employability Manager, SSE plc Sam Hubbard IEng FIET, Senior Engineer, Urenco and Vice President, The Institution of Engineering and Technology Sarah Gregory, Director of HR, JJ Churchill Ltd Shane Bennison MSc CEng FIET FRAeS, UK Systems Engineering Director, Thales UK Limited Shrouk El-Attar MEng, Senior Electronics Engineer, emm Technology Simon Ratcliffe, UK Group Engineering Director, Wabtec Faiveley UK Rail Sir Julian Young KBE CB FREng CEng FIET, Former President of The Institution of the Engineering and Technology Stacy Von Dolah-Evans, Global Strategic Executive, Schneider Electric Stephen Kitchen BEng CEng MIET MInstMC, Head of Maintenance, Sellafield Ltd Stephen Metcalfe MP, IET Honorary Fellow Steve Ayres BSc CEng FIET, Design Certification Specialist and Technical and Process SME, Thales UK Group Steve Campbell MBA CEng FIET FCIBSE, Technical Director, NG Bailey Steve Markham CQP MCQI IEng MIET FInstLM MCMI MWeldI GradIOSH MIIRSM, Director, STM Quality Limited Steve Tellwright, HR Director, Capula Stewart Gregory, Vice-President, Power Products, Schneider Electric UK and Ireland Suw Charman-Anderson BSc (Hons) FRSA, Founder & CEO, Ada Lovelace Day The Renishaw Education Outreach team, Renishaw plc The Smallpeice Trust Tom Ross, Head of Sales, ALPHR Technology Limited Tom Smith BSc (Hons) MSc CEng Tony Knight BEng(Hons) CEng MIET CMgr MCMI MINCOSE, Lead Systems Engineer, QinetiQ Tony Ryan, Chief Executive Officer, The Design and Technology Association Trevor Grimshaw, IET Honorary Fellow Victoria Conway, Communications Lead for Defence Equipment Engineering Function, MOD Abbey Wood Virginia Hodge, BSc MSc CEng, IET Honorary Fellow W02 ND Brown IEng MIET, Bde YofS, HQ 20th Armoured Brigade Combat Team will.i.am, IET Honorary Fellow, musician, and tech entrepreneur Ying Wan Loh CEng MIET, IET Young Woman Engineer of the Year 2019



#### **Contact information**

#### London, UK

- T +44 (0)20 7344 8460
- E faradaycentre@ietvenues.co.uk

#### Stevenage, UK

- T +44 (0)1438 313311
- E postmaster@theiet.org

#### Beijing, China\*

- T +86 10 6566 4687
- E china@theiet.org
- W theiet.org.cn

#### Hong Kong SAR

- T +852 2521 2140
- E infoAP@theiet.org

#### Bangalore, India

- T +91 80 4089 2222
- E india@theiet.in
- W theiet.in

#### New Jersey, USA

- T +1 (732) 321 5575
- E ietusa@theiet.org
- W americas.theiet.org

#### @ThelET 🔽 🗗 🖸 间 👰



The Institution of Engineering and Technology is registered as a Charity in England and Wales (No. 211014) and Scotland (No. SC038698). The Institution of Engineering and Technology, Futures Place, Kings Way, Stevenage, Hertfordshire, SG1 2UA, United Kingdom.