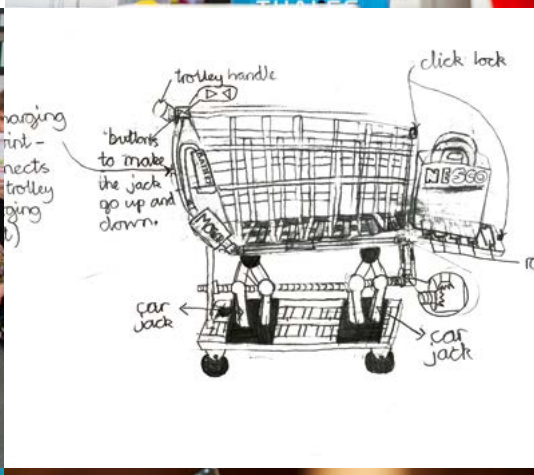
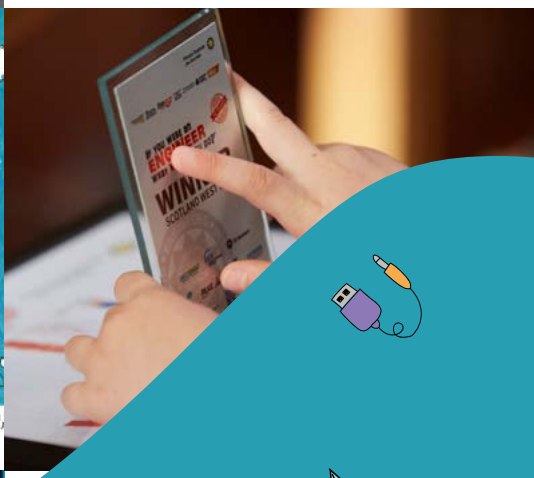
10 YEARS OF ‘MAKING A RIPPLE’

Primary Engineer’s ‘If you were an engineer, what would you do?
Leaders Award Report 2023

SUMMARY





IF YOU WERE an ENGINEER WHAT WOULD YOU DO?®

Primary Engineer®
...the first step

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This report and its outlined analysis have been developed by Dr Rory McDonald with support from the team at Primary Engineer. Dr McDonald is an experienced evaluator of educational programmes and researcher of STEM education, most recently examining the concept of ‘engineering capital’ amongst young learners. He has collaborated with Primary Engineer for a number of years in an evaluation and research capacity.

Introduction

Introduction: Making a Ripple

Primary Engineer was founded in 2005 and delivers a programme of engineering-themed content via teacher training and resources, as well as by linking engineers into primary classrooms. Its core aim was to increase the number of young people able to recognise engineering as a career for them.

The challenge was a significant one; our approach was to offer engineering taught in a whole class settings, using a cross-curricular, project-based approach that offered learners an opportunity to apply and reinforce learning, build resilience and develop curiosity. These learners and their teachers knew little about engineering and had little idea as to the breadth and range of engineering we were trying to open a door onto.

In its original format, the Leaders Award was one of our earliest project ideas, although the format in late 2005 was quite different to that of today. Then, we had only three levels (primary, secondary and advanced), and the challenge for learners was to write magazine-style interviews with engineers focusing on different themes: females in engineering, the use of maths in engineering and so on. We then chose the best learners from the three age groups and presented awards. To launch the award, we arranged a series of interviews with a group of secondary learners who we took to meet Nobel prize winner Sir Harry Kroto and fellow scientists at the Royal Society in 2005. In this format, the learners were able to ask the questions that they, and others like them, wanted to know the answers to. This provided the insight we needed to create the competition format we have today, where we enable learners to ask questions rather than provide them with answers.

At this early stage, the learners would find the engineers and we would publish their articles. While some amazing interviews took place and insights were gleaned, the number of learners was always limited, and the award was often an extra-curricular activity, so we needed to adapt to fulfil our aim of reaching more learners.

The Leaders Award rolled on in this way for a number of years, and it wasn’t until 2012, when we began to work in Scotland, that we saw an opportunity to reshape and adapt the programme so that it could reach many more learners, teachers and engineers. A new focus on problem solving would demonstrate the breadth of engineering and associated careers, and this shaped the current format of the **’If you were an engineer, what would you do?’** Leaders Award competition.

The new idea was simple: give learners the opportunity to interview engineers about their work and use that information to identify a problem and find a solution for it. Later, the idea of adding a letter to engineers explaining why their proposed solution should be made was introduced. This was the origin of the strapline **‘Make a Ripple’**; engineers taking the time to talk to learners about their work would be like a pebble thrown into a pond, its impact radiating out and inspiring everyone involved in the competition.

At first glance, engagement with an engineer goes only one way; engineers give their time, and learners and teachers gain insights and knowledge. However, the engineers’ role doesn’t stop there. As engineers recognised the interest from their audiences and saw the quality and ingenuity of their competition, it gradually became clear that the engineers we hoped would inspire learners were being inspired themselves. All involved will remember a question or a solution to a problem they have been awestruck by, and many will still be dining out on those stories!

The competition is aimed at individuals, not teams, allowing all pupils to consider what engineering means to them on a personal level, and to follow paths reflecting their own interests and experiences. This level-playing-field approach focuses on the quality of the solution, not the quality of the drawing or the grammar of the explanation; we ask engineers to look past that and focus on the problem and the solution. At the outset, we hoped to see a range of problems that learners wished to solve, but what has proved overwhelming has been the types of issues that learners have identified as requiring a solution: learners of all ages look to make life better for others, to take care of the environment and to tackle climate change, transport, accessibility, mental health and wellbeing, frequently solving problems that we didn’t know needed solving while remaining mindful of others.

We have been privileged to have been given insights into the challenges young people see around them and what they see as requiring engineering to be resolved. What can we take away from this? That young learners see engineering not only as creative problem solving, but also something that is innovative, entrepreneurial, sensitive, caring for those that need help, and the solution to climate change, transportation and big society challenges. That’s what these learners, from 3 to 19 years of age, see engineering as being; quite literally, it is the answer to all our problems.

For all involved, the feeling you are left with is the recognition that these young people ‘have it’, that everything is going to be okay; we, the adults, are the ones left inspired and grateful. Our role now is not only to continue and grow the opportunities for even more learners to engage, but also to ensure that the support is in place to help them realise their ideas, encouraging their onward journey into engineering and to making the world a better place.

Thank you to all that have joined us on this journey so far for your continued support.

Susan Scurlock MBE
CEO and Founder Primary Engineer

Report Summary

Since 2012, Primary Engineer have offered the 'If you were an engineer, what would you do?' Leaders Award competition, a creative, problem-solving engineering education competition for learners across the United Kingdom.

This competition invites learners aged 3 to 19 to imagine what problem they would most like to solve if they were an engineer. From there, learners complete a series of activities to develop a richer understanding of engineering and the importance of its role in society. Participants are encouraged to interview an engineer, ask questions that engage their curiosity and identify a problem that engineering can solve. Having identified a problem that matters to them, they next design, draw and annotate an engineering solution, before writing a letter explaining to an engineer why it should be built. The creative design experience of the Leaders Award competition aims to guide learners to develop stronger understandings of engineering and its practice in the world around them, broadening their knowledge of the engineering sector and careers within. These activities provide learners with the opportunity to practise a range of skills relating to creativity, observation, critical thinking, problem solving and visual, written and verbal communication.

More than a quarter of a million entries have been submitted to the competition in its decade of operation, each of which represent a young person engaging in a substantial engineering learning experience.

In 2022/23 alone, an estimated 384,416 hours of engineering learning took place in support of the Leaders Award competition.

The competition is designed to also benefit the teachers and engineers who deliver and support the project.

What is the Leaders Award

Since 2012, Primary Engineer have offered the annual 'If you were an engineer, what would you do?' Leaders Award competition, a creative engineering education project for learners aged 3 to 19 in the United Kingdom. This competition challenges learners to take on the role of Engineers in the Making™ to design an engineering solution to a real-life problem they find in the wider world. In the past decade, 255,401 competition entries have been submitted, representing over a quarter of a million engineering learning experiences for young people across the UK. During this competition, learners are expected to interview an engineer, explore engineering in the world around them, create their own annotated engineering design and write a persuasive letter to convince an engineer why their design is needed and should be built.

The Leaders Award competition was created to bring engineering into the heart of the classroom and to encourage a greater understanding of engineering, its breadth of practices and what engineers do. This involves highlighting the rich diversity of roles and practices that fall under the umbrella of 'engineering' in the UK. The competition is intended to be undertaken by whole classes of learners; this approach allows the competition to address engineering equality, diversity and inclusion challenges in the UK and to ensure a broad range of individuals participates in engineering learning experiences.

The project is designed to benefit not only the learners taking part in the competition but also their teachers and schools; they can advance their teaching proficiencies and curricula through the introduction of engineering design. The project has been carefully mapped to national curricula to support wider learning outcomes for subjects such as English, science, design and technology and, to an extent, art and design.

All competition entries are graded by engineering professionals and awarded personalised certificates to recognise the work of learners, teachers and schools. Regional events are hosted to further celebrate these future engineers through awards and public exhibitions of their work. Each year, in each of the regions, at least one submitted design is chosen and manufactured into a working prototype by a team of engineers at partner universities or, as of 2023, partner engineering companies.

The Leaders Award competition is offered at no charge to schools, who only need to fund the postage to submit their entries. Through participation, engineering is distinguished as an important creative and engaging practice that young people can get involved in now and in their future. The competition is designed to empower learners to believe in their own engineering problem solving abilities.

In 2012, the year of the competition's launch, 1,823 entries were received to great success, with participating engineers and schools eager to take part again. Participant numbers increased each year, providing the opportunity to grow the project and diversify its resources and experience.

Further events were introduced, as were online interviews and podcasts to support schools with access to a broader range of engineers and engineering insights. These resources provide learners with the opportunity to discover what an engineer looks or sounds like and learn more about engineering, as well as about the personal stories of engineers as they went from school into an engineering pathway. ProtoTeams have also been introduced and tasked with selecting and building one of the designs submitted by learners each year. These builds have culminated in the awarding of Primary Engineer MacRobert Medals to acknowledge both the innovative work of participating ProtoTeams and the learner responsible for the design the team create.

The competition is now offered in both Welsh and English languages across the whole of the UK and is supported by dozens of influential partner organisations, including government departments, foundations, universities, leading engineering companies, trade bodies and professional engineering institutions. These key supporters are listed at the end of this report.

The Leaders Award

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The Leaders Award is made up of many elements that have been designed to enhance the learning experience of its participants, namely learners, teachers and engineers

The 'If you were an engineer, what would you do?' Leaders Award competition

Is the starting point of the award, where pupils aged 3 to 19 are invited to interview an engineer, find a problem and draw and annotate a solution to it. Learners also write a letter to an engineer explaining their design to accompany their annotated drawing. These designs and letters are then sent to Primary Engineer.

Engineer Interviews:

Engineers are interviewed face to face, online or through the Primary Engineer YouTube Channel. Engineers are guided through the interview process, giving short presentations and reserving more time for questions from learners. A list of notable recorded interviews and online links are included at the end of this report.

Grading Days and Judging Panels:

Engineers, engineering professionals and university engineering undergraduates and apprentices are invited to read and grade every competition entry. This enables every learner to receive a personalised certificate with a grade awarded by an engineering professional.

In 2023, across 25 locations in the UK, a judging panel was formed to select two of the best ideas from the shortlisted graded entries in each year group. Two additional entries per year group are often designated as "highly commended". The judges then agree on an overall winner to be presented on the evening as the "judges' favourite".

Exhibitions and Awards:

In each of the 25 locations across the UK, an exhibition featuring all shortlisted entries from the region takes place. Awards evenings invite winners, highly commended entrants and family and friends to congratulate these participants.

ProtoTeams:

Each year, university and industry partners choose one or more idea to prototype in each of the regions. These teams collaborate with the learner who designed the chosen entry as their "client" and engage them and their class in the prototyping process, sharing the ups and downs of the build. These prototypes are then unveiled the following year at the exhibition and awards events.

The Primary Engineer MacRobert Medal:

This prestigious medal recognises the innovation and public engagement of the ProtoTeams. Teams submit an application outlining the journey of the prototype from a drawing on a piece of paper to a physical working prototype. A judging panel of engineers awards gold, silver and bronze medals to the engineers and learners who created the original idea at a public event.

'If you were an engineer...' Podcast (series 1 – 3):

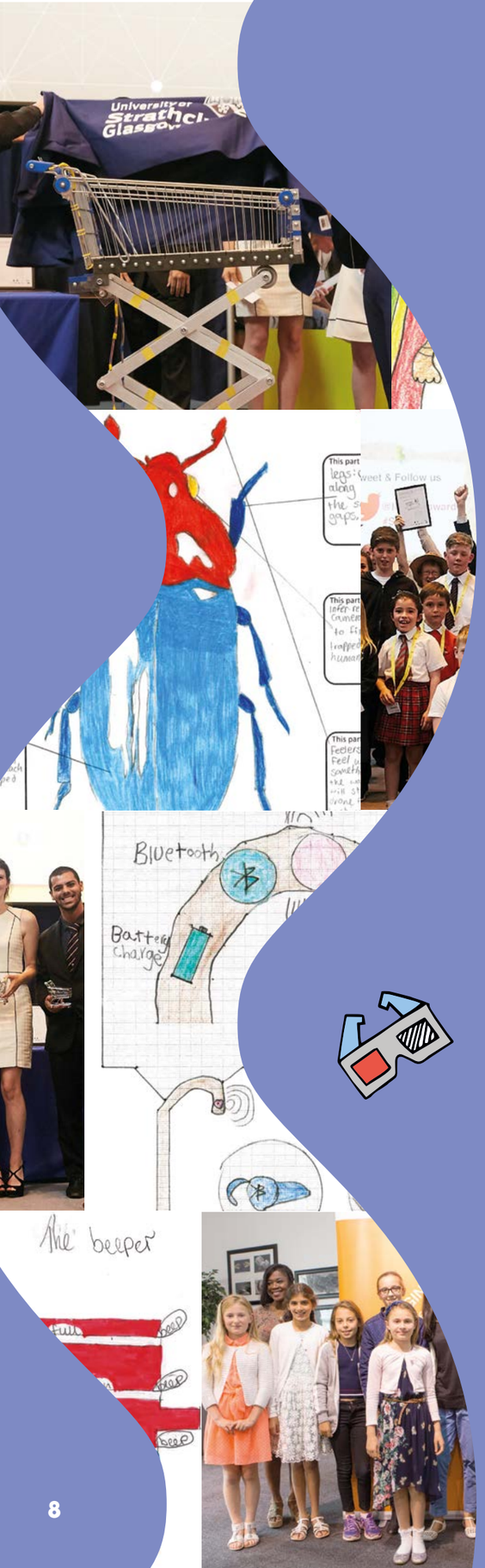
Interviews with engineers explore their backgrounds and journeys into engineering. Engineers talk about their time in school and experiences from their engineering careers. Learners also feature in the podcasts, sharing the problems they have used engineering to solve. Season special episodes include engineers at the Royal International Air Tattoo and the Primary Engineer MacRobert Medal Winners.

'If you were an engineer, what would you do?' Leaders Award Competition Book:

A published book of engineers' favourite entries, drawing on the first 10 years of the competition.

10 Years of Making a Ripple, 10 Years of 'If you were an engineer, what would you do?' Leaders Award Competition Report:

An impact report examining how the Leaders Award competition has supported learners, teachers and engineers in the UK.



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The 'If you were an engineer, what would you do?' Leaders Award competition sits within Primary Engineer's larger Leaders Award programme, which provides a suite of resources to support engineering learning in schools. These resources include recorded engineer interviews, podcasts, regional grading days, exhibitions and awards across the UK, a book celebrating 10 years of competition designs and the prestigious Primary Engineer MacRobert Medals for ProtoTeams involved in turning submitted competition entries into working prototypes. Teachers are encouraged to draw on these resources to support them in their participation with the competition and to reinforce the celebration and awareness of engineering more generally within their practice.

Although the Leaders Award competition has grown to reach tens of thousands of learners each year, the underlying objectives of the programme have remained the same: to provide opportunities for young learners to engage with engineers, learn more about engineering and its breadth of practices and to celebrate the pure innovation of learners who can use engineering to solve problems whether large or small. The competition is carefully managed to ensure it is accessible and manageable in the classroom. Teachers are only required to complete a short registration, supervise the completion of entries and submit these via post to Primary Engineer. In return, learners, teachers and schools are provided with rich learning experiences and resources designed to provide a range of benefits and outcomes.

Learners who take part in the competition are given the opportunity to build on their understanding of engineering as informed by the work of engineers in real engineering settings. This experience may be the first contact a learner has with the world of engineering and can provide a rich and personal experience that supports greater understanding and aspirations. By identifying a problem and developing their own engineering design solution, learners are supported in developing important engineering competencies through first-hand experiences as Engineers in the Making™. The grading of entries by engineers, and the awarding of personalised certificates, is designed to endow learners with a greater confidence in themselves and their potential as future engineers.

Teachers who take part in the competition are also provided with opportunities to learn more about engineering and the ways in which engineering can support learning in the classroom. Participating schools are supported to develop links with local engineers and engineering companies to establish a network of support to enrich learning. Curriculum learning and statutory guidelines for careers education in schools are also supported by the competition process and Primary Engineer's learning resources.

By offering a meaningful and engaging engineering learning experience to young people during their education, it is hoped that ripples of long-lasting impact will support increased study and practice of engineering in the future. The journey through this competition experience is, therefore, designed to benefit learners, teachers and schools in a multitude of ways that can, cumulatively, support future generations of UK engineers.

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Evaluating the Leaders Award Competition

The following sections of this report explore the effectiveness and impact of the 'If you were an engineer, what would you do?' Leaders Award competition. This analysis is informed by both historic and new datasets to provide a rich overview of the competition and its benefits.

The Leaders Award competition has been previously evaluated in each of its 10 years of operation to examine its reach and impact. Over time, the methods adopted for these evaluations have changed in response to insights from previous evaluations, developments to the project and new research findings in engineering education literature. As the competition approached its tenth year of operation, additional efforts were made to explore the programme and its legacy of impact.

This included an enhanced end-of-year survey for the 2021/22 and 2022/23 academic years (with 150 teacher responses), a survey for engineers who have taken part in the competition (with 127 responses) and a survey for teachers who have historically taken part in the competition (with 79 teacher responses).

Additionally, a range of interviews with students, teachers and engineers were conducted to explore first-hand experiences with the Leaders Award competition. Previously submitted reports and testimonials from teachers were also drawn upon.

This broad dataset has been brought together and analysed in this report to examine the value of the Leaders Award competition as an engineering educational experience. It was not possible to apply statistical significance testing with collected survey data; however, emergent trends within this data were examined in relation to testimonial and interview findings to triangulate patterns of impact. The following findings are offered as a snapshot of the impact of the 'If you were an engineer, what would you do?' Leaders Award competition. It would be impossible to map every effect and ripple of impact produced by this large project, due to the hundreds of thousands of submissions over the last 10 years. However, the combination of historic data, new survey insights and broad reaching interviews can provide a rich overview of the ways this competition has benefitted learners, teachers and UK engineering.

First, the impact of the Leaders Award competition on learners is explored. This examination considers how learners are supported to develop a greater understanding of engineering, encouraging more positive attitudes towards engineering and aspirations for future engineering education or careers. The analysis also explores how learners can develop key engineering capabilities through their competition experience with engineering design.

Next, the impact of the competition on teachers and schools is considered. The ease with which schools can take part in this competition and its benefits on teacher confidence with engineering are explored. Wider benefits to teaching beyond the engineering learning context are also examined.

Finally, a reflection is drawn on the importance of providing learners with the opportunity to meet and engage with engineers. The benefits of this interaction for learners, teachers and engineers are examined. Case studies are also included throughout the remaining sections of this report. These 'Leaders Award Competition Stories' offer a range of deeper insights into the first-hand experiences of learners, teachers and engineers who engaged with the Leaders Award competition.

Learner Impact

The benefits to learners who take part in this competition are explored below, drawing on over 10 years of evaluative data and interviews with learners, teachers and engineers. This analysis considers how learners develop a greater understanding and interest in engineering, key engineering thinking skills and aspirations for engineering careers, as well as the broader educational impacts because of their Leaders Award competition experience. .

Understanding Engineering and its Importance

The UK faces notable challenges of low awareness and understanding of engineering among its younger generations.

Figures published by EngineeringUK in 2020 found that 47% of 11 to 19 year-olds knew little or nothing about what engineers do,

with some learners found to possess limited definitions that framed engineering as difficult, complicated and dirty work[1]. While some progress has been made in recent years, the challenge of poor engineering literacy remains a significant threat to the study and practice of engineering in the UK.

The Leaders Award competition and wider Leaders Award programme are designed to address this challenge by supporting learners to develop a richer understanding of engineering and its place in the world around them. By engaging with engineers, reflecting on the role of engineering in society and critically undertaking their own engineering design activity, learners gain first-hand experiences from which to develop their engineering literacy. For many, this competition will be their first meaningful engineering experience.

Evaluations reveal that the Leaders Award competition has a positive impact on engineering learning. Survey data reveals that

96% of teachers agree or strongly agree that their pupils now have a greater understanding of what engineering is and its importance following their experience with the programme.

[1] EngineeringUK, 2020. Engineering UK 2020: Educational pathways into engineering.

[3] EngineeringUK, 2019. EngineeringUK: Engineering Brand Monitor 2019.

[4] Hutchinson, J. & Bentley, K., 2011. STEM Subjects and Jobs: A longitudinal perspective of attitudes among Key Stage 3 students, 2008-2010.

One primary school teacher, who has taken part in the programme for more than five years, strongly recognises this benefit to engineering learning:

> **[The Leaders Award competition] certainly helped the pupils to talk about engineering with a level of understanding. They would be able to talk about it in a way that they knew what they were talking about, and they could perhaps give you examples of types of engineering jobs and where we would see [engineering] in the real world.**

Another teacher highlights how the competition has supported learners to develop a rich understanding of the skills and activities that underpin engineering:

> **Pupils reflected on the skills they used to create their designs; maths skills, problem solving, drawing, imagination, thinking, creativity, phonics, writing and being able to try again when things do not work – resilience! They were also able to verbalise some of the future problems they would face in the development and making of their designs… highlighting the thinking process going on, which was more sophisticated than I thought it would be in a Primary 3/4 [age 6/7] classroom. The learning visible throughout this project was astounding.**

Findings such as these evidence that the Leaders Award competition is successful in its aim of advancing understanding of engineering within UK schools.

The engineering literacy developed through the Leaders Award competition stands in sharp contrast against the limited engineering literacy of young learners reported at the national level. The competition therefore allows thousands of young people each year to advance their understanding of engineering in a meaningful way.

Enjoyment and Interest in Engineering

The Leaders Award competition also aims to provide learners with an enjoyable and memorable learning experience. While developing greater engineering literacy is critical, young learners are unlikely to sustain an interest in engineering if their learning experiences are not engaging and entertaining. Fostering a positive impression of engineering is therefore a crucial component of motivating future interest in engineering education or careers. Past research has shown that learners in the UK will often hold fewer positive attitudes towards engineering than towards other subjects such as science or mathematics[3] [4]. If more young people are to be encouraged to consider engineering careers, then these negative perceptions of engineering must be addressed.

Survey data shows that

96% of teachers believed that their pupils had enjoyed learning about engineering while taking part in the programme. Further insights support that this enjoyment positively motivates learners, as 89% of teachers agreed or strongly agreed that their pupils were curious about engineering and 91% of teachers reported that their pupils were inspired to learn more about engineering and STEM following their competition experience.

Another teacher, Kaylee, highlights the excitement for engineering that the competition can encourage:

> **We introduced the competition on a Friday and set a weekend homework task to gather some ideas. One student in my class came in on the following Monday with a poster tube full of rolled up designs, drawings, adverts and a letter! She was so excited!**

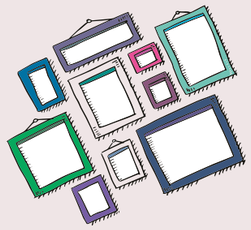
Testimonials also support that the competition can foster a curiosity for engineering that teachers can then draw on in their wider teaching. Another teacher shares how

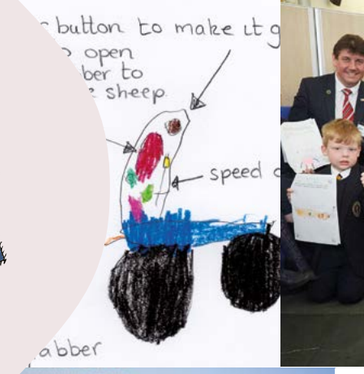
> **[My pupils] are more interested in hearing about links to engineering when looking at everyday life. They are talking more about ways they could create things that could be useful. There are more questions being asked. I have also found myself talking about engineering more often, in subtle ways, in class. I have been able to see links through some classwork that I wouldn't necessarily have thought of before.**

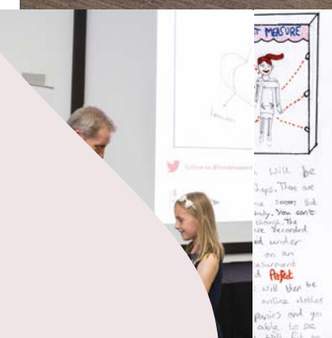
These findings show that the Leaders Award competition experience is a positive one for learners. Engineering is presented in a way that is not only enjoyable but also motivates curiosity and an appetite for more.

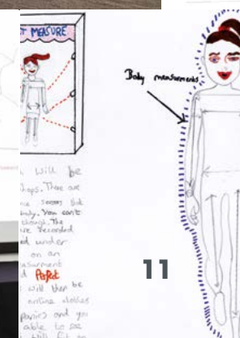
Shaping Learners into Engineers in the Making™

The Leaders Award competition and wider Leaders Award programme also aim to support learners to actively participate with engineering and develop their engineering abilities. During their experience with the competition, learners are supported to adopt the role of Engineers in the Making™ and design their own engineering solution to a real-world problem. This engineering design experience gives learners the opportunity to nurture key engineering skills and proficiencies, as well as an entrepreneurial mindset, that they may not encounter elsewhere in their curriculum. In particular, the competition aims to instil learners with **"engineering habits of mind";** ways of thinking and acting like an engineer.









Engineering Habit of Mind

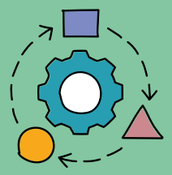
Recent evaluations have drawn on the work of Lucas and Hanson5 who identify six key habits of mind that engineers possess and apply in their work.

Recent programme evaluations show that learners are successfully provided with the opportunity to develop these habits of mind. In 2021/22 and 2022/23 teachers were asked whether they believed that the project had helped their pupils to successfully think like an engineer – the results are outlined below.

Percentage of Teachers Reporting Successful Adoption of Habit of Mind by Learners

Problem Finding 96%

Visualising 91%



Adapting 65%

Systems Thinking 52%

Improving 82%

Creative Problem Solving 78%

These findings offer a positive picture of the capacity for learners to develop as Engineers in the Making™ through their experience with the Leaders Award competition. Not only do pupils who take part in the programme learn about what engineering is and enjoy their learning experience, but they are also provided with the opportunity to develop thinking skills that are applied in engineering activities.

Engineers who have participated with the Leaders Award competition also recognise the way in which learners develop their skills while participating in the competition. Survey findings show that

97% of engineers agreed or strongly agreed that the competition supported the development of essential engineering skills such as problem solving or creativity.

Teacher testimonies further evidence the benefit of the engineering habits of mind developed during the competition. One teacher notes,

> **Even though my class are very young, we are working on and developing our engineering habits of mind and we talk everyday of how we can make things work and make things work better. We apply the concept of adapting and improving in many aspects of our learning and behaviours. It has been great to see how much more open the learners are to standing back and considering where problems may be and can be addressed, this may be in relation to writing tasks, maths, friendships and while working on our Primary Engineer project.**

Engineering Aspirations

The United Kingdom faces a longstanding engineering skills shortage that must be overcome if UK engineering is to operate at its full potential. Encouraging young learners to consider engineering career paths is an important step in solving this skill shortage and bolstering the future health of UK engineering.

The Leaders Award competition aims to encourage engineering aspirations and support learners to see engineering as a fulfilling career through an enjoyable and informative annual engineering learning experience.

Survey data reveals that the programme is successful in encouraging these engineering aspirations:

87% of teachers agreed or strongly agreed that the project had a positive impact on pupils' careers aspirations in engineering and STEM.

Evaluations also suggest that the competition can inspire a wide variety of learners to consider engineering.

Survey data indicates that the competition effectively addresses entrenched ideas that engineering is only for certain types of people:

87% of teachers agreed or strongly agreed that their pupils now feel that engineering is a career anyone can pursue following their competition experience.

Given the wider challenges of diversity and participation in UK engineering, this finding evidences the value of the Leaders Award competition in supporting a robust and diverse supply of future engineers. **In 2023, half of the 48,052 entries were received from girls, highlighting the equality present within the reach and participation of the competition.** Moreover, girls often receive more awards from this competition than boys, demonstrating the capacity of this project to support young girls to excel in engineering. The impact of the Leaders Award on engineering aspirations is clear in learner testimony.

One student, who took part in the Leaders Award competition while in secondary school, recalls how inspirational it was:

> **It really, like, inspires you because through [the Leaders Award] we got to meet engineers, and talk to them, and just see people that look similar to you in aspirational roles. It just inspires you and lets you know it is possible to go down that route.**

The positive effects of the competition on engineering aspirations are also indicated by teachers in their testimonials:

> **Having female engineers inspired the girls in my class to consider these jobs as possible careers, especially the space-related careers. STEM is so important and primary school-aged pupils are sponges ready to absorb what these engineers have to offer.**

The potential for the competition to support career aspirations is also recognised by engineers who meet learners during their engineer interviews. One engineer, Christina, notes that

> **The students I visited didn't have many engineering role models and weren't aware of the strong engineering industries in their own city. So it was really nice to help make them aware of the possibilities open to them!**

These findings show that the Leaders Award competition can nurture engineering aspirations among young learners. Given the national challenge of the engineering skills shortage, this is a meaningful outcome.

Careers-Related Learning and Engineering

Another central aim of the Leaders Award competition is to support learners with a stronger knowledge of engineering careers. While developing aspirations is important, it is also vital that learners develop the insights necessary to realise these aspirations as they progress through their education.

Survey data shows that 81% of teachers agreed or strongly agreed that the programme was of value to the careers-related learning within their school

Interview and survey data further support this conclusion with testimonials from teachers. One teacher comments that

> **The online interviews were very informative and allowed us to discuss careers in more meaningful ways. They were also hugely inspiring and encouraged girls especially to realise that there are many female engineers and it is a career path for all.**

These findings show how the Leaders Award competition can support careers learning in participating schools. Taking part in the competition can provide learners with insights into engineering careers and support teachers to develop their knowledge through contact with engineers. The competition may also support schools to meet statutory guidelines for careers advice such as the Gatsby Benchmarks .

Wider Benefits to Learning

While the Leaders Award competition is, at its core, an engineering learning experience, its activities have also been designed to support a wide variety of skills.

These wider learning outcomes are supported through curriculum-mapping of competition activities to the national curricula of the UK.

Evaluations suggest the programme does offer wider benefits to learning beyond the engineering context. Survey data shows that **79% of teachers agreed or strongly agreed that the programme had a positive impact on student learning in a general manner.** Further insights from the survey show that **88% of teachers believed that the programme was effective at developing pupil knowledge and skills in Engineering; with 89% also recognising effective development in Design and Technology/Technologies; 74% in Science; 63% in English/Literature; and 58% in Art/Design.**

The ability of the competition to draw on learning from other subjects is also highlighted by Tessa, an engineer:

> **I was asked a question by a young pupil about how electricity in a cable moves and doesn't escape. I was so impressed - this question is central to what electrical engineers (and even computer and materials engineers) do, and what the challenges we face are... It was such an insightful question and showed the pupil was inquisitive and had physics on their mind!**

These findings highlight that learning outcomes from the Leaders Award competition do indeed extend beyond the engineering domain to benefit learning more broadly. This is a significant outcome from the competition that highlights its value to learners and schools. These benefits extend beyond subject area learning to classroom behaviours that support a positive learning environment. For example, **92% of teachers agreed or strongly agreed that their learners were focused when taking part in the competition while 72% agreed or strongly agree that their learners worked well with others**

The positive impacts reported here may be linked to the novel way of learning introduced to classrooms by the Leaders Award competition.

Participation in the competition inherently challenges the status quo of classroom practices and provides young people with the opportunity to approach learning in a different way.
The benefits of this for learners who might not flourish in traditional learning contexts are clear. One teacher, Hannah, writes,

> **Children who academically struggle were able to shine, take part as one of the team and showed more pride in themselves and better self-confidence after the experience.**

The value of the competition to teaching and learning for Special Educational Needs and Disabilities (SEND) pupils is also recognised by teachers. One teacher, Susan, notes how

> **A selection of pupils with SEND needs that often struggle with English and Maths did very well in the competition – some even gained merits or distinctions! Their ability to 'think differently' supported the way they accessed and developed ideas.**

These findings highlight the wider value of the Leaders Award competition for schools and learners.

Evaluations show that the benefit of these positive experiences endures:

87% of teachers who responded to one survey examining the historic effects of the competition recalled a lasting impact of the competition on their learners.

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Impact for Teachers and Schools

Over the past decade, thousands of teachers from thousands of schools have participated in the Leaders Award competition. In 2023 alone, 2,932 teachers took part and delivered the competition in 602 schools across the UK.

By taking part in this competition, teachers are enabled to advance their own understanding of engineering, bring new approaches to STEM teaching and learning into their classroom and develop enduring regional networks with engineers and local companies. In this way, the Leaders Award competition can act as a means of teachers' CPD while supporting schools to bring engineering into their curriculum through an exciting project.

Ease of Taking Part in the Leaders Award competition

To support schools and ease participation, the Leaders Award competition has been carefully designed to minimise the effort schools need to make to get involved. This has been achieved through supportive resources to aid teachers in delivering lessons on engineering and curriculum mapping to align the engineering design activity with existing curriculum lesson content.**Data shows that 71% of teachers agreed or strongly agreed that the competition is easy to integrate into the curriculum.** Survey data shows that **73% of teachers agreed or strongly agreed that they were more confident in contacting and engaging engineers to support classroom learning following their competition experience.** This finding demonstrates how teachers can develop soft skills that can support their teaching practice through engaging with the Leaders Award competition.

> **I have never organised people to come in and talk to pupils at an assembly before. This really had a big impact on my confidence with approaching members of industry and inviting them along. It also helped me build confidence speaking at assemblies.** - Siobhan (Teacher)

Survey data shows that **77% of teachers agreed or strongly agreed that they are more willing to take part in CPD for engineering teaching following the competition**. The Leaders Award competition does not only provide training on how to teach engineering but also leaves many teachers with a growth mindset and eagerness to learn more.

Benefits to Teaching Engineering

The Leaders Award competition offers teachers the opportunity to learn more about engineering through their contact with an engineer and via the detailed learning resources. Taking part in the competition can serve as a supportive framework for teachers to explore how to approach engineering learning within the classroom.

Teachers who take part in the competition also personally develop greater confidence with the subject: **79% of teachers agreed or strongly agreed that they were now more confident answering questions about engineering and 83% of teachers agreed or strongly agreed that they are now more comfortable talking to students about engineering careers.**

The benefits of the competition on teachers are also clear in testimonials. One teacher, Katrina, notes,

> **[TheLeaders Award competition] helped me gain confidence in teaching more STEM and to think outside of the box when planning my lessons to children at all stages of the school.**

Another teacher, Joanne, recognises how the introduction of the competition can prompt a fresh perspective on teaching practice:

> **[The competition] is interesting, it makes you reflect on the purpose of teaching STEM subjects and making the purpose evident to the children. Finding out a bit more about engineering each year has been great.**

These findings demonstrate how effectively the Leaders Award competition can support teachers to develop their professional skills with engineering. This greater confidence in bringing engineering into the classroom will likely endure and offer a legacy of benefit to engineering learning in future years, highlighting the broad value of the competition and its lasting benefits.

Wider Benefits to Teaching

Evaluations of the Leaders Award competition also highlight benefits to teaching practices beyond the subject area of engineering. Survey data shows that **65% of teachers agreed or strongly agreed that participating in the programme built their confidence as a teacher and that 82% of teachers agreed or strongly agreed that the programme was of value to STEM teaching generally within their classrooms.** These findings demonstrate moderate benefits to teacher confidence beyond the engineering context. The benefit to STEM subject learning is expanded upon further: **83% of teachers agreed or strongly agreed that they were now more confident with the subject of Engineering in the classroom, 59% with Science and 68% with Design and Technology.**

> **As science lead, this competition always allows me to promote STEM subjects in school. This is a valuable addition to the curriculum and impressed OFSTED (which is always a positive!).**
> - Teacher

The Importance and Impact of Engaging with Engineers

One of the defining characteristics of the Leaders Award competition is the way in which it supports learners to meet and interact with engineers. This contact is designed to provide learners with realistic and first-hand experiences that shape more informed understandings of what engineering is and who engineers are.

Ease of Accessing an Engineer Interview

Teachers are supported to organise their own class or school interview with an engineer to foster greater understanding of engineering and its breadth of practices. Survey data shows that this is an accessible experience, with

93% of teachers agreeing or strongly agreeing that it is easy to organise their engineer interviews and 85% of teachers also agreeing that it was simple to involve their class with the interview.

These findings highlight the ease with which teachers can draw on the insights of experts to support their teaching. Furthermore, teacher testimonials highlight how receptive learners are to these social experiences. One teacher, Samantha, notes how

> **"The children thoroughly enjoyed finding out about the different career paths in engineering, this prompted thinking about possibilities and what if scenarios."**

The Value of the Leaders Award Approach

Evaluations also demonstrate the value of Primary Engineer's approach to engineering learning through first-hand experiences with engineers. Survey findings emphasise that teachers view this competition and its contact with engineers as relatively distinctive with **91% of teachers recognising the uniqueness of the competition and its contents.**

The value of this experience is also clear to students who have taken part in the competition. One young person who entered the Leaders Award competition at age 14 recalls how

> **"We had like a speed dating event to help us through the competition, to help us see what kind of project we wanted to get involved in. So we got to meet a few different engineers and talk with them... So it was quite nice to meet real engineers, because it can be quite conceptual. It was … nice to meet them and just ask them questions about anything – no matter how ridiculous we thought they were!"**

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Further findings also highlight that the values that underpin this approach to engineering learning are compatible with the views of engineering industries. Survey data collected from engineers who had previously participated in the Leaders Award competition show that **96% of engineers agreed or strongly agreed that the competition was aligned to the values of their engineering companies.** This figure shows that the approach taken to engineering learning in the Leaders Award competition is responsive to the perspectives of engineering industries and their understanding of engineering skills supply.

Testimonials from engineers also highlight the value of Primary Engineer's approach to supporting future engineers through the Leaders Award competition. Mark, an engineer who has been involved with the competition for several years, shared why his team chose to work with Primary Engineer:

> **"We wanted to work in partnership with a company that was listening to us as an organisation but also challenging, and not bookmarking and putting children into pigeonholes. A lot of the companies we dealt with at the time said 'it has to be this way and we want mechanical engineers'. And we thought: this isn't broad enough. What we need to do is start to inspire children to use their imagination and continue to use their imagination to address challenges."**

Benefits to Engineers

It is also possible to consider the benefits offered to engineers who take part in this competition process. For many engineers, meeting young learners, engaging in engineering learning experiences and grading or judging the engineering designs of learners are novel experiences.

Survey evaluations show that the Leaders Award competition can provide engineers with an experience that inspires a greater sense of the importance of supporting future generations of engineers. Data shows that **49% of engineers surveyed reported that they already recognised such work as important, but 50% developed a greater sense of importance for this work following their competition experience.** These experiences leave engineers in support of the approach taken by Primary Engineer in providing early and engineer-focused experiences for learners; further findings show that **100% of engineers agreed or strongly agreed that early experiences with engineering and with real engineers were deeply important for the future and diversity of engineering.**

These experiences are also notably enjoyable for engineers, with testimonials demonstrating the positivity and validation offered to engineers who take part in the Leaders Award competition. One engineer shares how

> **"All my experiences have been memorable! I just love doing the interviews and answering the barrage of questions that follows."**

> **"I found the whole journey very rewarding, being in conversation with the school children was brilliant, with so many awkward questions to answer! Like, 'How much do you earn?' All the designs were great in their own way, with the technical knowledge of such young children being mind-blowing. I would really enjoy being involved again and would highly recommend to others to get onboard."** - Andrew (Engineer)

For the past 10 years, Primary Engineer's 'If you were an engineer, what would you do?' Leaders Award competition has supported engineering learning across the United Kingdom, receiving over a quarter of a million entries and engaging thousands of learners, teachers and schools. This report has explored the ways in which the Leaders Award competition has impacted those who both participate in and support the project and looked at how successful it has been in supporting the development of our next generation of engineers.

Impacts for Learners, Teachers and Engineers

This report has found that the competition is successful in its aim to provide learners and teachers with a greater understanding of engineering, its breadth of practice and the roles of engineers. Learners who engage with the Leaders Award competition are found to acquire stronger understandings of engineering and its practices, while also advancing their engineering competencies and wider learning skills and developing stronger aspirations to participate in engineering in the future.

The analysis has also confirmed the value of the Leaders Award competition to teachers who participate in the project. Teachers find that the competition is a positive and valuable learning experience that is easy to participate in. Many also report the development of greater confidence for teaching engineering, as well as wider benefits to their teaching practices.

Engineers who support the Leaders Award competition are also found to benefit from the experience, developing stronger views on the importance of supporting future engineers while receiving positive and fulfilling experiences that align with the values of their companies. The competition provides engineers with the opportunity to experience the creativity and innovation offered by the ideas of young people. These findings also validate the underlying philosophy of the Leaders Award competition and its framing of engineers as creative problem solvers who make a difference in wider society.

The designs produced by Leaders Award entrants demonstrate the social-mindedness and innovation present within the thinking of learners. This approach challenges restrictive definitions of engineering or engineers by highlighting the importance of creativity and the potential for all learners to develop into thoughtful and innovative Engineers in the Making™.

Report Conclusions

Long Term Impacts to Support UK Engineering

It is impossible to track the career trajectory of each learner involved in the Leaders Award competition to determine whether they have progressed into an engineering role. However, as this report outlines, learners do develop stronger understanding of engineering careers and more positive engineering aspirations through their Leaders Award experience. These findings align with the competition's objective to encourage learners to see engineering as a creative force for change within society and to be aware that there are a diverse set of roles and career pathways that offer people the opportunity to solve problems through creativity, innovation and entrepreneurship. The report findings suggest that the competition supports greater diversity in engineering aspiration through its "whole class approach" that allows a broad range of learners to experience engineering and develop an understanding that engineering is a career pathway that is open to anyone. Anecdotal evidence from teachers also indicates that several learners who have taken part in the project have gone on to become engineers, suggesting a positive link is present between early experiences with engineering through the competition and eventual access to engineering careers.

The Leaders Award competition has been designed to support substantial, cumulative change over time to build greater support for UK engineering. The competition comprises multiple components (interviews, design activities, persuasive writing, events) with multiple points of contact between learners and engineers. It is hoped that the positive impact of these experiences accumulate into "ripples of change" that have a profound impact over time and across the UK. A learner who has taken part in the project is likely to develop a stronger understanding of engineering, which may prompt them to consider engineering educational pathways as they get older. A teacher who has engaged with the competition will often develop greater confidence with teaching engineering which may help them to introduce more engineering throughout their curriculum teaching for years to come.

Looking Forwards

Making more than a ripple

The 'If you were an engineer, what would you do?' competition continues to grow and evolve. This curriculum mapped, whole class competition has allowed learners aged 3 to 19 to gain insights into the creativity and the enormous possibilities available to them through engineering. By bringing engineers into the classroom and allowing many young people to learn about the industry and profession by asking the questions that matter to them, we have created an immersive environment that is perfect for inspiring the next generation of engineers. This also allows a diverse range of engineers from all backgrounds and disciplines to act as role models to these learners, often then seeing their names listed as one of the engineers who inspired the thousands of incredible ideas submitted to the competition.

Looking forward, we will aim to increase the number of older learners participating in the competition, and we will look to encourage more industry partners – not only universities – to participate in the challenge of forming ProtoTeams and prototyping learners' ideas. This will not only increase the number of submissions and the level of innovation for the Primary Engineer MacRobert Medal but also allow us to share more stories of the design processes and, importantly, ensure that leaners are made aware that only by doing things wrong will they get them right, thus teaching resilience and creativity in all their forms.

Evaluation, insights and case studies will continue to be central to the impact reporting we provide to our supporters and to the stories we share publicly. We will continue to prove the value and impact on learners who experience the creativity and the art of problem finding and solving as they discover the true worth of engineering to the society we all aspire to live in. Primary Engineer will continue to offer this impactful engineering learning experience to schools across the UK. This will see the continuing development of the Leaders Award competition, building on its reach and providing the benefits identified in this report to a wider array of individuals. Efforts will also be made to build on the longer-term tracking of participants to determine the far-reaching impact of the Leaders Award competition experience. Primary Engineer will seek to build greater engagement with engineers to further enrich the learning experiences offered to schools through engineer interviews and to provide more engineers with a fulfilling experience supporting the grading and judging of entries. These findings will be published in case studies and reports such as this one, as well as in a book outlining the creativity and innovation of learner competition entries.

The next 10 years will see more engagement with learners across all age groups, from early years through to college level and across all learning establishments, which will require more engineers to give time to being interviewed and to grading those entries. For teachers, there will be more opportunities to extend their own knowledge of engineering and its place across the curriculum through the new courses and qualifications we will be developing.

This report has shown the success of the 'If you were an engineer, what would you do?' Leaders Award competition over the last 10 years, and the coming decade promises to be an exciting opportunity to further support the engineering industry in the UK.

If learners do only one thing in school that is related to engineering, then this must be it! joined us on this journey so far for your continued support.

Susan Scurlock MBE
CEO and Founder Primary Engineer

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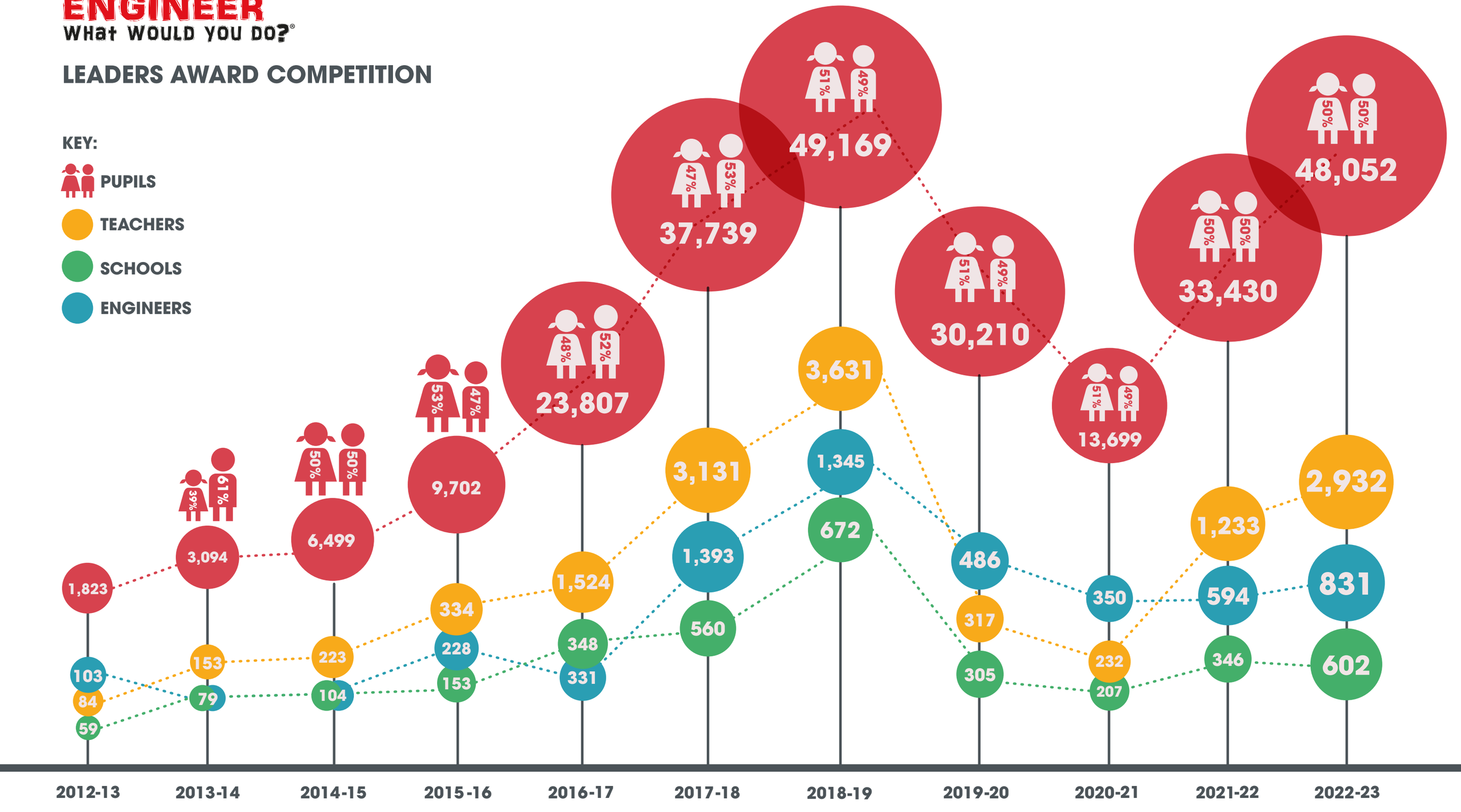
IF YOU WERE an ENGINEER WHAT WOULD YOU DO?®

LEADERS AWARD COMPETITION

KEY:

- PUPILS
- TEACHERS
- SCHOOLS
- ENGINEERS



Project Timeline

Total number of participants: **257,224**

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Partners

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IF YOU WERE an ENGINEER WHAT WOULD YOU DO?®

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A National STEM Competition free to all schools in the UK.
We are asking pupils from the ages of 3-19
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Every school can take part and if you would like to nominate a school simply go to:
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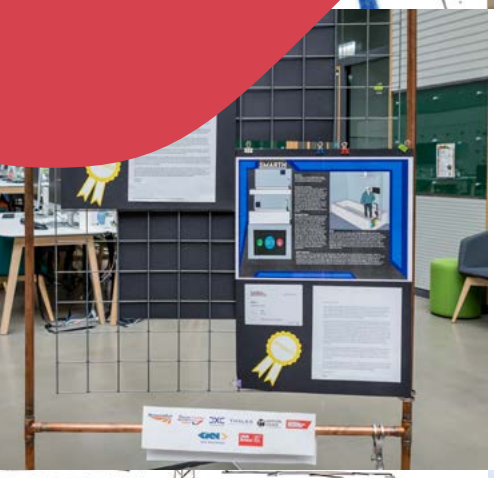

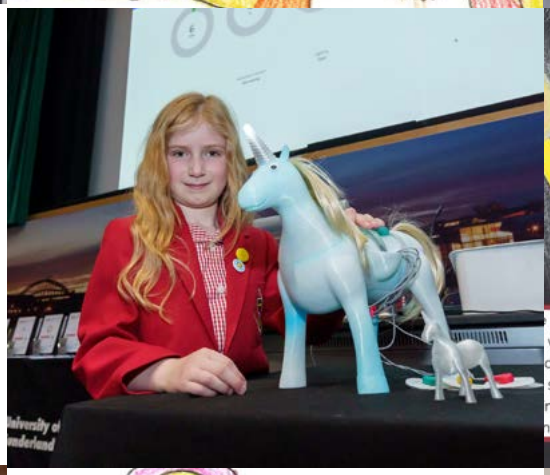

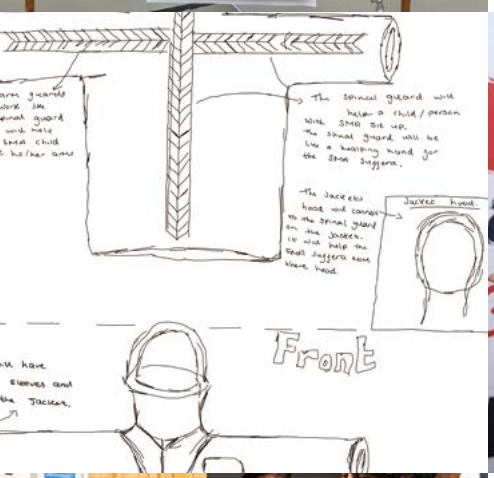

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