



The Big Bang Competition: 2021/2022 evaluation findings

November 2022

Introduction

The Big Bang Competition recognises and rewards young people's science and engineering project work. The Competition is free and open to all students aged 11 to 18 studying in the UK. Projects are judged and moderated by experienced STEM professionals and students have the opportunity to win a range of prizes including the core prizes of Young Engineer and Young Scientist of the Year.

This report presents feedback from students and teachers who took part in The Big Bang Competition in 2021/22, gathered via a mix of online and in person surveys as well as through virtual and face-to-face interviews.

Feedback from students enables us to better understand their experiences and any impact they feel the programme has had on their skills, their interest in engineering careers or in taking part in more STEM related activities. It also helps us to explore more generally their attitudes towards STEM.

Feedback from teachers provides insights into their perspective on the

programme's impact for students, any additional benefits for the school, and what they feel they have gained from participating.

This information allows us to continually improve the programme and the processes of delivering it, and to gain some understanding of how far the programme is meeting its aims of informing and inspiring young people into further STEM study and careers.

We also ask for teachers' recommendations and suggestions for further inspiring young people in STEM. These views help to shape future iterations of this programme and the wider work of EngineeringUK.

Who participated in The Big Bang Competition?



Who took part in the evaluation?

The Big Bang Competition was evaluated using a mix of surveys and interviews to provide insights into how successfully we meet our aims and to support improvements in delivery.

- 73 students completed a feedback survey
- 8 teachers and parents took part in a short feedback interview
- 5 teams took part in a interview at The Big Bang Competition Finals

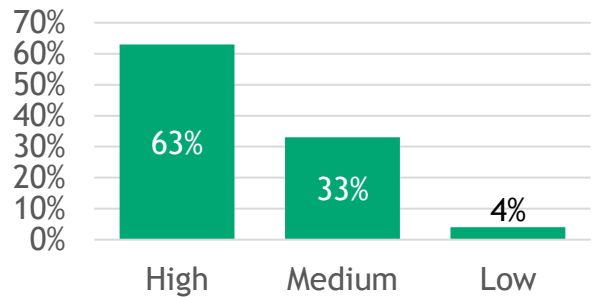
		N (%) students included in evaluation survey
Total competitors		50 complete and 23 partial responses (15% response rate)
Age category	Junior	28 (58%)
	Intermediate	10 (21%)
	Senior	10 (21%)
	Missing	(25 responses)
Gender	Female	22 (47%)
	Male	22 (47%)
	Non-binary	3 (6%)
	Missing	(26 responses)
Ethnicity	Asian	10 (21%)
	Black	3 (6%)
	Mixed or multiple	5 (10%)
	White	29 (62%)
	Other	-
	Missing	(26 responses)
SEND		Not asked in survey
FSM	Yes	6 (16%)
	No	28 (76%)
	I don't know	3 (8%)
	Missing	(28 responses)
EDI school	Yes	12 (16%)
	No	38 (52%)
	Missing	23 (32%)

How do students engage with STEM?

We asked students a series of questions to explore their pre-existing engagement in STEM. Nearly all students responding said they participate in science related activities outside of school, with around two thirds (63%) reporting high STEM engagement.

We categorised students into three groups based on their STEM activity score (the total number of activities they said they do). Those who said they do no STEM activities were classed as 'Low', those who do 1 or 2 are classed as 'medium' and those who do 3 or more are classed as 'high' STEM engagement.

Level of STEM engagement (n=51)

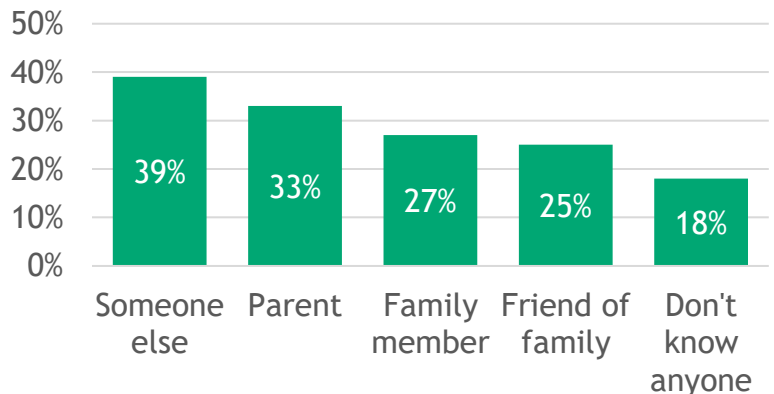


The most frequently named STEM activities are listed below in order:

	The Big Bang Competition (n=51)
Watch science programs on TV or online (e.g. YouTube)	73%
Visit science exhibitions / museums	59%
Read science books (including science fiction)	53%
Read about science on the Internet	49%
Go to a science and engineering fair	43%
Attend a science, technology, engineering or maths club	41%
Create my own computer games, website, or animation	41%
Listen to a podcast or radio programme about science	20%
None of these	4%

Another indicator of STEM engagement is having a parent or family member who works in STEM. Over four fifths (82%) of students said they know someone working in STEM, and a third of students had a parent working in STEM.

Know someone working in STEM (n=51)



Project themes

Students completed projects on a range of different themes. In most cases students were given the freedom to choose what topic to do their project on. In some cases the topics were influenced by teachers or other STEM competitions or schemes the students were participating in.

The most popular themes for projects are listed in order in the table below. These themes suggest that young people are highly motivated by finding solutions to real-world problems and helping others.

Theme	% of projects
Environment	32%
Health & Medicine	32%
Sustainability	27%
Digital technology	18%
Education	17%
Climate change	14%
Energy	14%
Food	12%
Materials & textiles	9%
Water	9%
Mental health	8%
Conservation	8%
Humanitarian	7%
Future cities	7%
Transportation	7%
Space exploration	6%

Environmental sustainability

Finding solutions to the climate crisis was a key theme for many young people who entered the competition.

42% of projects entered into the competition were of an environmental, sustainability or conservation theme.

67% of students said they learned about the role that scientists and engineers play in creating technologies that are better for the environment.

67% of respondents would like to work in a job that helps solve environmental problems like climate change.

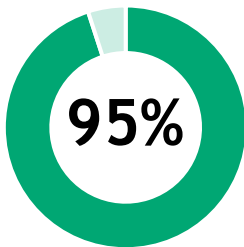
“The reason why he came up with that idea was because my parents, specifically my dad, he’s disabled and he has to have certain medications at certain times. It was one day where my dad, I think he couldn’t quite remember if he’d taken a particular pill or not and [student] just thought, oh, you know, maybe I could. I could think of something that would be helpful for him.” - Parent

Student and teacher experience of The Big Bang Competition



Students' experience of the Competition

The Competition aims to inspire young people to consider further STEM study and careers by providing an experience that is enjoyable and engaging. Students overwhelmingly enjoyed taking part in The Big Bang Competition.



of competitors agreed (33%) or strongly agreed (62%) that they enjoyed taking part in The Big Bang Competition.

“What I have enjoyed about the Big Bang competition is the fun experience, learning how to work in a team, doing science related work and over all it is the best competition I have ever entered.”
- Female student, year 8

Students particularly enjoyed...

- Having the freedom to explore a topic they are interested in
- Getting the opportunity to do practical project work
- Learning new skills
- Working on solutions to real world problems
- Getting feedback from experienced professionals
- Getting a sense of achievement from their work
- Going to the Big Bang Fair
- People showing interest in their work
- Seeing other teams' projects
- Working as a team with friends
- Learning about the scientific process

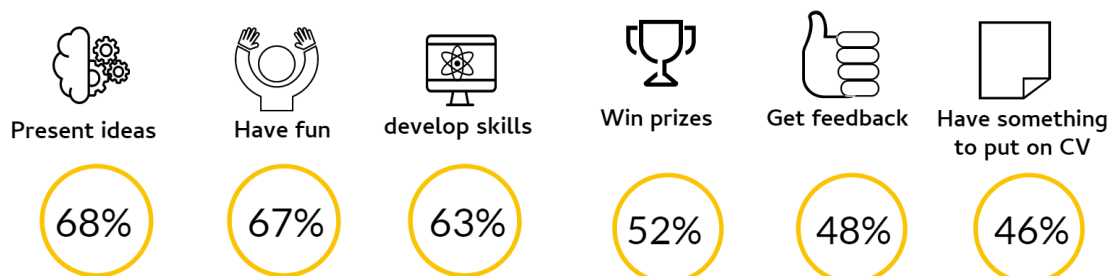
“[I enjoyed] presenting my product to all the different ranges of people at the fair, I also enjoyed the interview stage and development of my product during making it.” - Male year 11 student

“I have really enjoyed the sense of individuality that completing my project has given me. I have particularly enjoyed researching and learning more about a developing topic, that directly influences (and, in the future, will influence) my life.” - Student (gender and year group missing)

Motivations for taking part

Students were asked why they decided to take part in the Competition.

The top reasons given for participating in the Competition were to...



Teachers and parents were also asked why they decided to take part in the Competition and what they hoped the competitors would achieve through taking part.

Teachers and parents wanted their young people to take part in the Competition because...

- It is seen as a prestigious national competition
- The competition provides a clear structure and a goal to STEM enrichment activities
- It provides students an opportunity to have fun and develop their enthusiasm and confidence in STEM
- It helps them to develop many skills including project planning, organisation, researching, report writing, presenting, designing and building, creativity
- It gives students more experience of the world outside school and provides real applications of things they encounter in the curriculum
- Students get useful feedback from judges
- It provides an opportunity to do something practical which enables students who struggle with curriculum based learning to engage in STEM

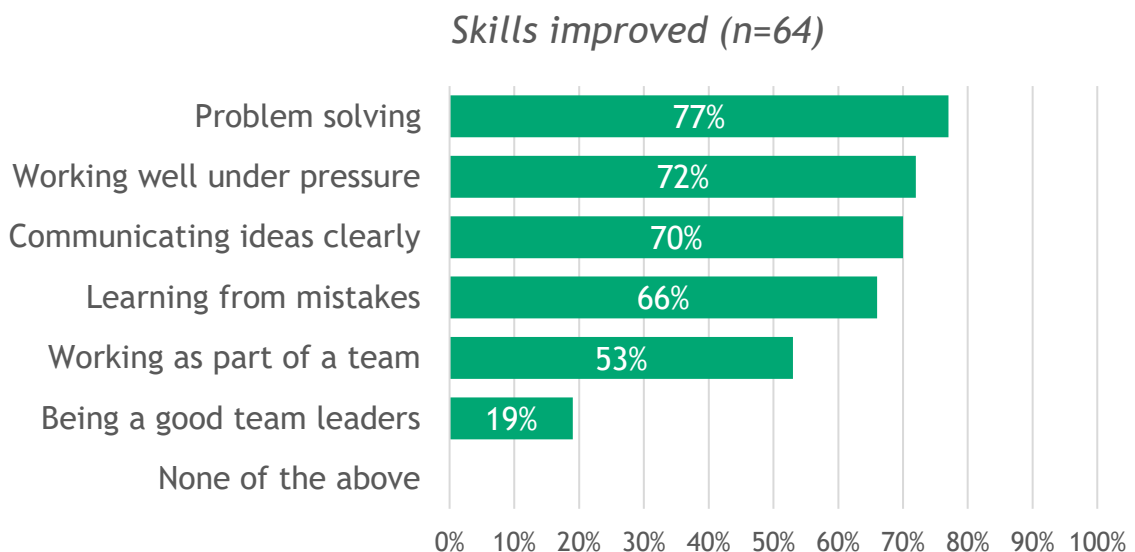
“It gave a structure and a goal to the enrichment activity that was really good for the kids. It allowed me to give them some real-world examples of things that we’re encountering in the curriculum” - Teacher

“They just love it. It’s really good fun. I mean, it is an enormous amount of fun to build things and to see what works and what doesn’t. They’ll raise money, they’ll get themselves T-shirts they’ll wear ... It’s just good fun.” - Teacher

Skills used during the Competition

The programme aims to help students develop the hard and soft skills needed to succeed in science and engineering. We asked students to select which soft skills they thought they had improved during the Competition out of a list of 6 skills.

All students who responded to the survey said they had improved one or more skills, with problem-solving (77%), working well under pressure (72%) and communicating ideas clearly (70%) being the most selected skills. The average number of skills selected was 3.6.



Students also demonstrated a range of hard-skills that are transferable to careers in science, technology and engineering.

“The Big Bang competition taught me a structured process of doing a research project, which is very useful as this planning, execution, and reviewing process can be used in many other things I do.” - Male year 12 student

“[I enjoyed] researching and doing practical experiments with my partner.” - Female year 11 student

“I enjoyed getting to try experimenting with different materials and learning new skills.” - Male year 9 student

“[I enjoyed] solving practical problems via investigating scientifically and rigorously in this project.” - Male year 11 student

Skills used during the Competition

We also asked teachers and parents in interviews what skills they thought their students had developed through taking part in the Competition.

Problem-solving and digital design skills:

“They were able to start and make digital designs as well. I've seen them for a few weeks trying to figure it out and then finally kind of getting to where they wanted to be with it. It took a long time to get the hang of it, but they managed it. They did it all by themselves.” - Teacher

Confidence in public speaking:

“Initially, there's one or two children who want to talk, and the others have their say but they're very shy. But as the event goes on you see the shy ones coming forward. It rubs off, that's really what I'm saying. The confidence rubs off and they realise that most people talking to them, are happy and interested.” - Teacher

Project management, communication skills, report writing, Excel, using equipment:

“It allowed them to work on their project management skills and their communication skills ... all of those soft skills that you want, but also those hard skills in terms of them having to write a report or use Excel to work out averages and things, ... hands on equipment.” - Teacher

Following the scientific method:

“I think that they get to see the scientific method through to its conclusion in a way that the curriculum doesn't really allow. I think that's very good for them.”- Teacher

Confidence, report writing, communicating and presenting, research:

“I feel like it's really about their confidence. They wrote a report from scratch which obviously was building that skill. But also I think what I was really impressed with was when they did the face-to-face interview and they were actually vocalising what they've done and you could see how much work they put into and how much they've studied and the research behind it so I think they just really were able to build a lot of skills through it.” - Teacher

Taking feedback on board:

“I think it was really great for the kids. Like it really boosted their confidence because they got sort of feedback back from judges that was overwhelmingly positive, even though it gave them things to do to improve. It was so positive that they were happy to take the other bits of the feedback, if that makes sense.” - Teacher

Informing, inspiring and empowering students and those who support them



Informing students

Through their experience in the Competition the programme aims to inform students about STEM careers, what they entail and what they can achieve.

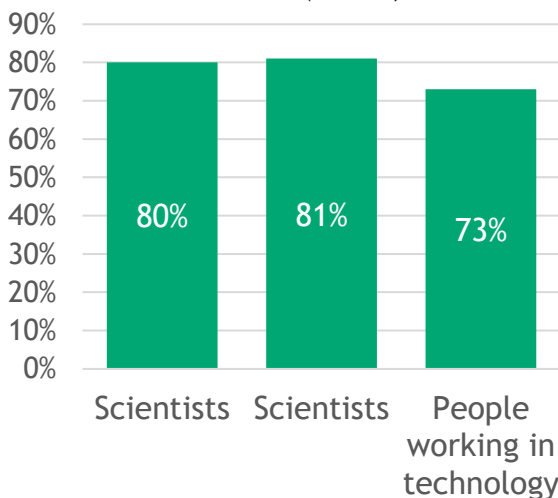
A large majority of students say that they know about the kinds of things that STEM professionals do. For science, engineering and technology, only 9% of young people responded that they *didn't* know about what people did in any of these careers.

The most recent Engineering Brand Monitor¹, conducted in 2021, asked a representative sample of young people the same question. There, around 55% agreed that they know about the different things engineers do, 63% knew about what scientists do, and 64% knew about what people working in technology do. This

suggests that those participating in the Competition have a substantially better awareness of these careers. This may be due to the higher than average proportion of students (over 80%) who knew a STEM professional personally.

We cannot objectively assess students' knowledge or compare what they know after the Competition with what they knew before. However, if students feel more informed, even if only around some specific STEM careers that interest them, this opens up opportunities that would otherwise not be available to them.

I know about the kinds of things the following people do in their careers (n=64)



"I think they, particularly this year, have got some idea about what an engineer is that they don't necessarily have otherwise and I think that it's given them an opportunity to see that as something they could do. I mean, I've got one young lady who is incredibly scholarly and she's a great problem solver, but I don't think engineer was in her sort of understanding of something she might be good at." - Teacher

Informing students

Knowing the next steps to take to pursue a STEM career is essential for students who may be inspired to pursue a STEM career.

80% of students surveyed said that they knew which subjects they need to take next to become an engineer.

Four in five students said they knew which subjects they would need to study to pursue a career in engineering, though around 14% said that they did not know.

In contrast, the Engineering Brand Monitor found that among a representative sample of young people, only 2 in 5 knew what subjects they would need to take.¹

By Year 9, students will typically have had to think about what subjects to take at GCSE. While some subjects are compulsory at GCSE (maths and sciences), others are optional, including computing and design & technology.

We asked students which subjects they would choose to study, given the option. All but one student would choose to study at least one of these subjects.

The most popular subjects for competitors are Maths, Physics, Computing and D&T.

Subject	Would choose to take subject (n=34)
Maths	71%
Physics	68%
Computing	53%
D&T	53%
Chemistry	35%
Biology	44%
None	3%

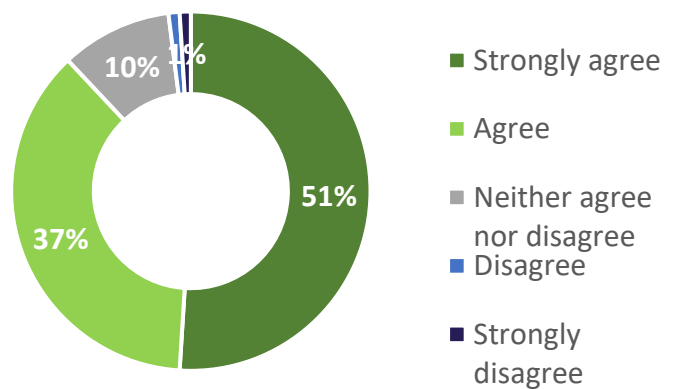
“He wants to do some electronic engineering so you know, he’s recently done his exams and he’s got his grade predictions for the UCAS form, so he’s pretty set on doing engineering.” - Parent

Inspiring students

The Competition aims to inspire students towards further STEM study and careers. In the short-term, however, inspiring students may be more likely to affect their immediate interest in STEM activities. We asked students whether the Competition made them want to do more activities in science, technology, engineering and maths.

88% of young people agreed that the Competition had made them want to do more STEM activities.

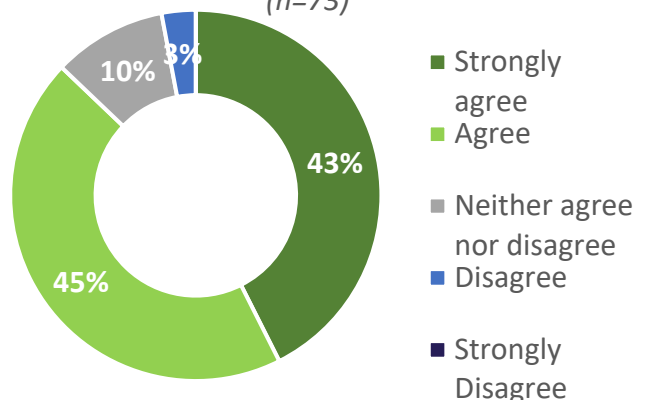
The Competition has made me want to do more STEM activities (n=73)



For students who may have been inspired to consider a career in STEM, finding out more about how to pursue this is an important next step. We asked students whether the Competition made them want to find out more about a career in STEM.

87% of young people agreed that the Competition had made them want to find out more about a career in STEM.

The Competition has made me want to find out more about a career in STEM (n=73)



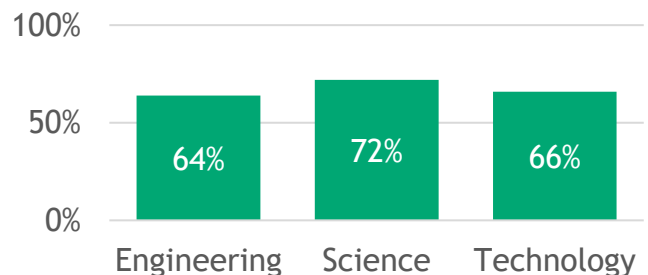
Inspiring students

The Competition aims to increase interest in and the likelihood that young people will pursue a career in science, technology or engineering. While we cannot know if the Competition has been successful in achieving that aim, it is useful to understand what young people think about the likelihood of making this career choice.

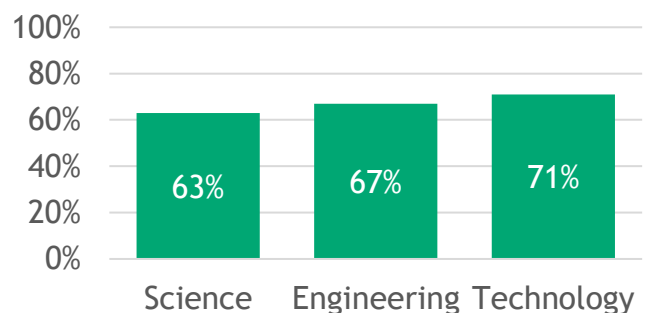
87% of students said that they were interested in a career in at least one of science, technology and engineering.

84% of students said that they were likely to pursue a career in at least one of engineering, science or technology.

Students reporting they were interested or very interested in a career related to STEM (n=47)



Students that said they are likely or very likely to pursue a career in STEM (n=51)



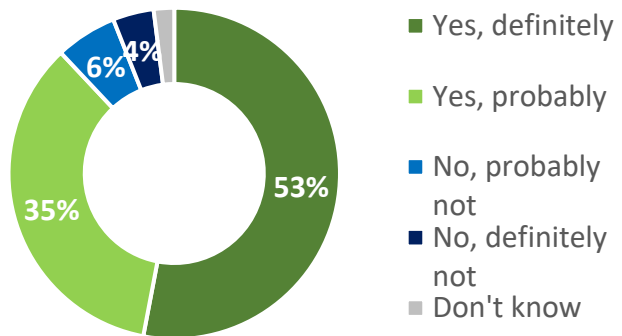
“Sharing my passion and project with other people with similar interests was very much fun. [At the Big Bang Fair] I met a scientist who is also a dancer. I realised that choosing STEM as a career choice does not limit my choices in any way.” - Female year 8 student

Empowering students

As well as being interested in a career in engineering, students need to feel that they could become one if they are going to pursue it. We asked students whether they thought they could become an engineer if they chose to.

88% of young people said they thought they could become an engineer if they wanted to.

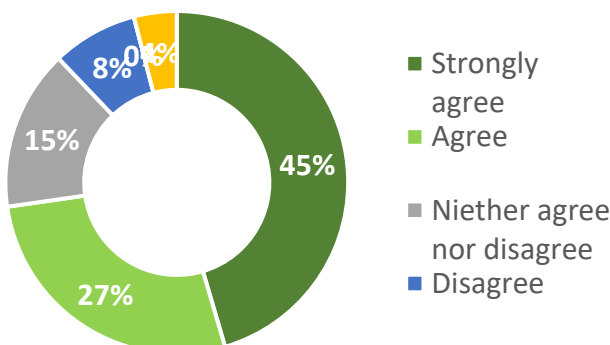
If you wanted to, do you think you could become an engineer? (n=51)



The Competition also aims to expose young people to a range of career options that they might consider and to demonstrate diversity in the engineering workforce to help them see how it might suit them.

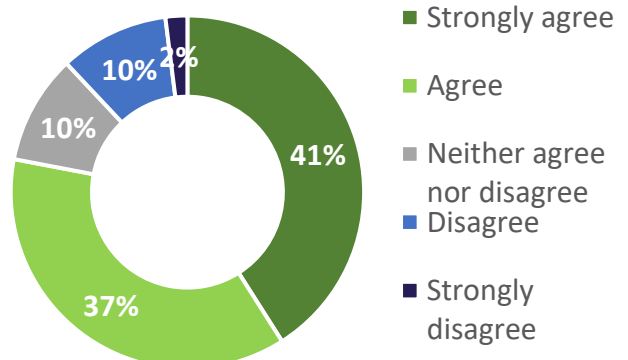
73% of young people agreed that engineering was open to people from all backgrounds

Engineering careers are open to people from all backgrounds (n=51)



78% of young people agreed that engineering would be a suitable career for them

I think that engineering would be a suitable career for me (n=51)



Wider impacts of the Competition

We asked teachers what wider impacts the Competition has had on their school and students.

Selling point for the school

Several teachers said that they share their success in the Big Bang Competition in newsletters, open days and social media which helps the school's reputation and in attracting prospective students.

"It's a selling point for the school. We have posters up at the gate to see with children's pictures saying we won this, it's in the prospectus when you come into the foyer [...] so it's good for the school." - Teacher

"So, there's a lot of buzz created about STEM in our school and especially sort of things like this. So, we would put it on our Facebook page. We talked to parents about it. It goes in some kind of report to the governors and [is] seen as a real success in the school.- Teacher

Part of wider STEM engagement

Some schools embed the Competition within a wider programme of whole-school STEM activities.

"We'll have a STEM day when the whole cohort will be off timetable. They'll be [...] introduced to the project. We'll make a bit of a thing of it. They get themselves into teams and we run the competition through that day. Teams of three or four present to judges in the afternoon and we'll choose some of them."- Teacher

'Success breeds success'

One teacher mentioned how their positive experience of the Competition has meant that their school is more likely to support further involvement in STEM engagement activities.

"And it's because of the respect that has been built up from doing things like the Competition [...] over the years, as people have seen the success, they're more willing to let us do more things like that. So now if we go and say we want to take our students to this final, they will make it so that we can take the students to the final." - Teacher

Students use their experience in applications and interviews

Teachers and parents gave examples of students who have used their success of the Competition in their education and careers.

"In terms of impact, my son has got an offer from Cambridge University and part of that would have been that he [won a prize] last year. So you know, you have to just say it was worthwhile." - Teacher and Parent

"One of the students who went to London was asked in a career interview to say what's the best thing she'd ever done at school and she said it was the STEM project." - Teacher

Equality, diversity and inclusion - barriers

One of the central aims of the Competition is to engage more young people from groups underrepresented in engineering careers. We asked teachers and parents what they barriers to participation might be and what could be done to remove these barriers.

Several teachers we interviewed said that parental engagement is a key barrier or enabler for participating in the Competition.

“Those children [who do well in the competition], from our point of view, they have parental support. They can stay behind after school. They're into education in a big way.”
- Teacher

“I had an email at one stage saying that various parents haven't responded to your emails, I'm thinking, oh God, what if they can't submit all that work because one parent doesn't speak English and can't respond to an email?” - Teacher

The requirement to submit competition entries by video was a barrier for some students. One teacher from a SEND schools said that their students were not comfortable to be on camera.

“None of them wanted to be on camera. In fact, one of them didn't even want a photo with their project. Some of them were happy to have a picture taken with their project but weren't happy to be on a video.” - Teacher

The perception that the Competition is only for academically high achieving students was another barrier to participation.

“For some of them [competing] is quite a scary idea. They're like that. If they're confident in their abilities it doesn't put them off, but if they're a bit, you know, unsure, it might a bit more [scary].”- Teacher

“Our academically weak students don't do well in competitions. Uhm, but partly because it's not an activity, it's a competition.”- Teacher

One teacher we interviewed whose students did not submit a project said that their students were intimidated by the level of the projects that were showcased on the website.

Another teacher felt that independent schools have an advantage in the Competition.

“Sometimes it feels a little bit it like weighted towards private schools and but that's because they've got the time and the space and the teachers who've got the ability to do this.”- Teacher

Equality, diversity and inclusion - enablers

Teachers also identified some ways in which the programme was effective at enabling young people from groups underrepresented in engineering to participate in the Competition.

Some teachers said that the format of the competition worked well for their students with special educational needs and disabilities:

“For our [autistic students] it really works because you can tailor a project to their special interests. So you will get something crazy, but you know, it might be about the history of Chernobyl or the best bus or something, but it's a really good way of letting them learn skills by exploring their interests.” - Teacher

“He's a bright kid. He's dyslexic, and he really is struggling with his writing at the moment [...] He was just in the paper and the Big Bang Finals right now and yeah, your judges didn't know that. Your judges just saw a slightly you know slightly quite lad in there with the other two, they didn't see what an impact they've had on him and the fact that his mum's writing me little messages going, 'thank you so much He has loved every minute of it'.” - Teacher

In contrast to what other teachers said, some thought that the format of the Competition worked well for their less academic students.

“The boys I had, particularly when they're not great academics or they don't have fantastic literacy, doing something practical and meeting something early before it's thrown at them in a class where they're going to find it difficult was really good for them...” - Teacher

One teachers thought the Competition format works better for their female students compared to male students.

“All of our successful teams tend to be girls teams. We don't do that deliberately. And I don't mean to be anecdotal, but the girls present better, they are more articulate and they work harder.”- Teacher

Areas for improvement

Students and teachers were asked what could be done to improve the Competition.

Students provided the following suggestions:

- Reward all students for their effort in some way
- Extend the time period for submitting entries
- Go back to holding in-person regional heats
- Give out more prizes along with the main awards
- Provide more guidelines and inspiration for coming up with project ideas
- Provide more information about the specific judging criteria for each award
- Communicate directly with students and send out encouraging emails

“I think there should be more guidelines and inspirations for the product as coming up with an idea was quite hard..” - Student

Teachers and parents provided the following suggestions:

- Provide a preview of the submission form so they know what information they need to find in advance
- Involve STEM ambassadors to support students with their projects
- Level the playing field between independent schools and non-fee-paying schools
- Display a range of projects on the website, not just the most impressive
- Remove the requirement for parents to provide consent
- More guidance about what is expected for students and parents who haven't taken part before
- Offer a bursary to support schools without many resources
- Faster responses to queries
- Allow written entries as well as videos

“From a teacher's point of view, it is definitely a lot of work, a lot of lunchtimes and quite a lot of form filling in and a lot of resource management.” - Teacher