EngineeringUK
INSPIRING FUTURES TOGETHER

THE BIG BANG FAIR 2024

Evaluation results summary

About The Fair

The Big Bang Fair is the UK's largest free celebration of science, technology, engineering and maths (STEM) for young people. In 2024, a total of 20,608 students aged 10 to 14 and 2,625 educators attended one of 6 3-hour sessions at the NEC Birmingham over 3 days in June.

The Fair aims to inspire and encourage all young people to discover exciting possibilities in STEM by challenging perceptions and connecting young people to inspiring role models. It offers hands-on activities, workshops and careers panels, together with the opportunity to meet people working in wide range of roles in STEM. EngineeringUK is determined to make the event inclusive and accessible for every young person, as well as a positive experience for teachers and other educators.

About the evaluation

Surveys were completed by 2,414 students and 276 educators at The Fair towards the end of each session. In terms of student demographics:

- 44% of students surveyed were female
- 42% were from UK minority ethnic backgrounds
- 17% were disabled
- 27% receive free school meals

Results are presented mainly in percentages, with statistically significant differences between sub-groups added where relevant. Analysis makes use of a Theory of Change developed for The Big Bang Fair and the COM-B model, which are explained in the main body of this report.

More specifically, the Theory of Change for The Big Bang Fair highlights the following as key short-term outcomes:

- students and educators learn about a range of STEM careers and understand their benefits (opportunity)
- students enjoy the activities and perceive STEM activities and careers as desirable, both in general and for themselves (motivation)
- students leave The Fair feeling like a STEM career would be suitable to someone like them and that they have the skills needed for a career in these fields (capability and motivation)
- students are motivated to do more STEM engagement activities in the future (motivation)
- educators are aware of and motivated to do more STEM engagement activities in the future (opportunity and motivation)

Based on research related to students' career pathway[1], the Theory of Change makes an assumption that by influencing students' and educators' capabilities, opportunities and motivation, The Fair contributes to the long-term goal of helping young people make an informed choice about pursuing a career in STEM, and more of them choosing to do so. However, both the COM-B and Theory of Change models acknowledge that there are individual differences in how a given activity may lead to a certain outcome, so an important component of the evaluation is exploring whether The Fair was experienced differently for different groups of students and educators.

[1] Hamlyn et al. (2024). **Science Education Tracker 2023**.

Key findings

What were students' experiences of The Fair? An extremely high 91% of students enjoyed The Fair. This is slightly higher than the previous 2 years. Being fun was the most common reason given for why students liked stands and activities, followed by:

- learned something new
- were interested in the content
- the exhibit was 'cool'
- found the topic interesting

The mix of types of activity that worked particularly well and should be repeated in future was as follows: enjoyable, first-hand experiences, exhibits perceived as 'cool', making and creating, using scientific equipment and doing informative quizzes and puzzles.

What did students learn at The Fair?

79% of students agreed that, since arriving at The Fair, they had learned a little or a lot more about what engineers do. The equivalent figure for people working in technology jobs was 80% and for scientists was 74%.

Also, 85% of students agreed that The Fair had shown them how engineering and technology is used in their daily lives, while 77% of students agreed that The Fair had shown them solutions to environmental problems. Almost half the students (45%) said they would like to find out more about this topic.

Did The Fair motivate students to engage in more STEM activities in the future?

There was considerable evidence that The Fair had an overall positive impact on students' self-perceived capability and motivation, as the majority responded positively to items tapping their interest and motivation towards STEM activities and careers:

- 80% of students said The Fair had made them interested in doing more activities about science, engineering and technology, which is an increase from 71% in 2023
- three quarters (75%) of young people reported that The Fair made them want to find out more about STEM jobs
- 65% had been inspired by The Fair to consider a job in STEM
- 82% said The Fair had made them more interested in a future job in engineering, compared with 77% for technology and 72% for science

Did The Fair have a positive impact on students' views about pursuing a job in STEM?

62% of students agreed or strongly agreed that The Fair had shown them that engineering careers would be suitable for someone like them. This figure was the same for science and slightly higher for technology (65%). Three quarters of students felt that they would be able to do a job in engineering (75%) or technology (74%) in the future, if they wanted to.

What were educators' experiences of The Fair?

The Fair was rated extremely highly by educators in 2024, with 95% saying it was excellent or good, overall. Key measures taken from the Theory of Change were also exceptionally high:

- 99% said The Fair was engaging for their students

- 98% said it highlighted a wide range of engineering and technology careers
- 97% said it was accessible to students of all abilities in STEM
- 94% said it had clear links to the curriculum

Educators particularly liked: the practical, interactive activities; the atmosphere in the exhibition hall with engaging staff; and the links between the curriculum, real world and careers.

Did The Fair increase educators' knowledge of and confidence in providing STEM careers advice?

The large majority (87%) of educators reported feeling more motivated to do more STEM activities for students because of The Fair.

Having attended The Fair, 73% said they were more likely to suggest to their students that they consider a career in engineering, which is an increase from 67% in 2023. For technology, the 2024 figure was 70% and 63% for science (these subjects were not asked about in 2023).

Educators were asked if they felt confident to speak to students about careers in engineering, technology and science before The Fair. Roughly 6 out of 10 said they were more confident in speaking to their students specifically about careers in engineering (64%), technology (63%) and science (58%) jobs because of The Fair.

61% felt more confident speaking to their students about non-degree routes into STEM roles and 79% reported being more informed specifically about technician jobs, having attended The Fair.

Demographic differences

In terms of student demographics, attendance at The Fair was broadly in line with national and regional pupil characteristics, which suggests that the reach and accessibility of The Fair is acceptable. Most notably, the numbers of disabled students taking part in the survey increased dramatically from 11% in 2023 to at least 17% in 2024, bringing attendance in line with national average of 20%.

A key facet of evaluation is to better understand how an intervention or activity works, including whether it works under different conditions and for whom. There were a handful of differences related to students' ethnicity and disability status, mostly in terms of which activities they were attracted to or able to access. Disabled students were also similarly likely to have enjoyed The Fair as non-disabled students, which is particularly positive as this was not the case in 2023. However, compared with non-disabled students, fewer disabled students visited stands and exhibits, participated in interactive activities, or spoke to someone who works in STEM. Disabled students were also less likely to agree that The Fair had shown them what people working in engineering (76%), technology (79%) and science (57%) do, compared with non-disabled students (84%, 84%, and 68%, respectively).

There were also consistent and notable differences related to students' prior engagement with STEM activities and their gender.

Across all items, students with high prior STEM engagement (3 or more STEM activities undertaken in the past 12 months) were more likely to respond positively than those with low prior STEM engagement (2 or fewer STEM activities in the past 12 months). Both groups of students were mostly positive however, and both enjoyed and engaged with The Fair's activities, suggesting that The Fair was effective in terms of sparking interest in STEM amongst students not previously engaged with these fields. Taken together, these results show that The Fair had a positive impact on

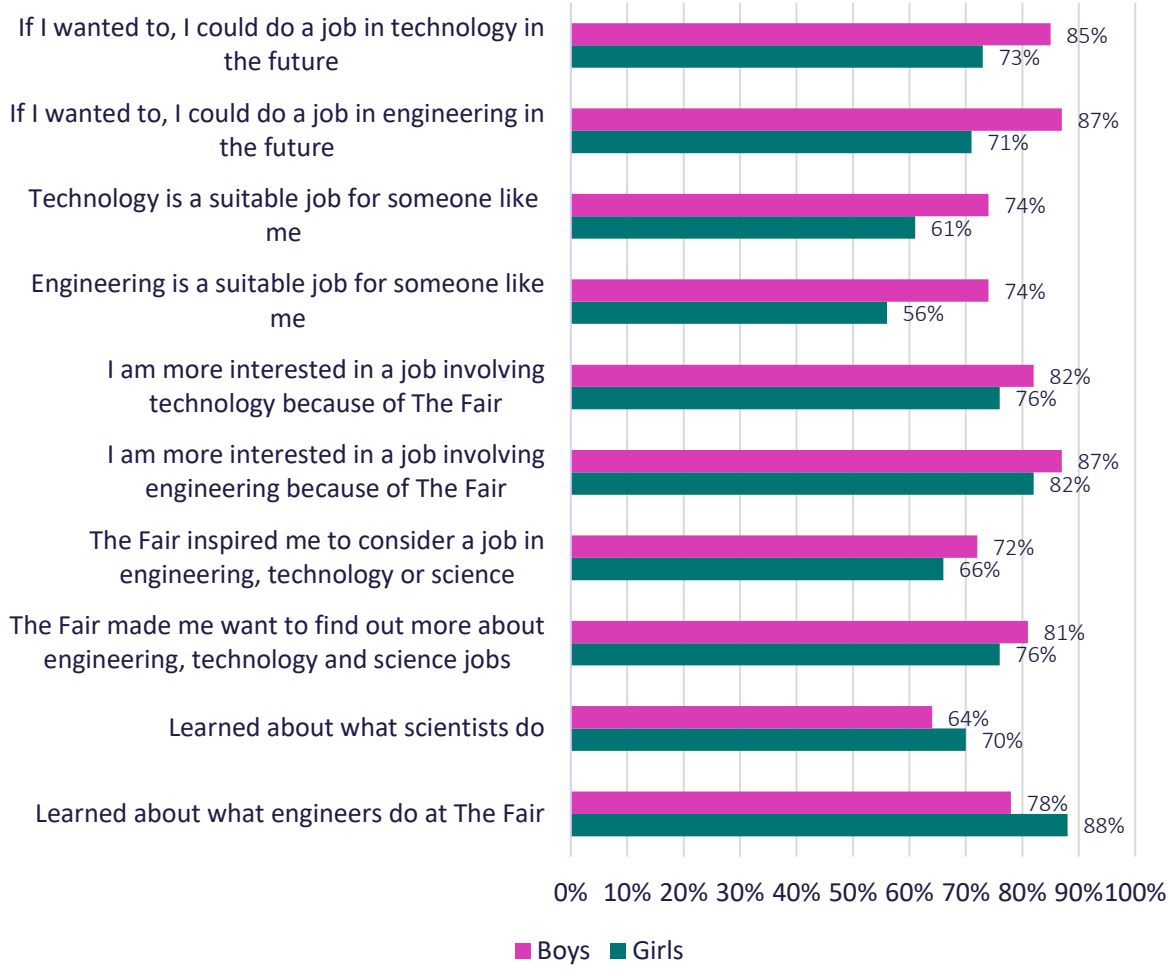
students, regardless of their previous engagement with STEM activities, but this impact was more pronounced amongst students with higher prior STEM engagement.

There was also a pattern whereby the impact of The Fair differed depending on students' gender (Figure 1). For the most part, this pattern was in favour of boys, with boys being more likely to agree that The Fair had:

- motivated them to find out more about STEM jobs
- made them more interested in a future job in STEM
- shown them that STEM jobs are suitable for someone 'like them'
- made them feel they could work in STEM if they wanted to

In contrast, girls were more likely to say that The Fair had taught them about what engineers and scientists do.

Figure 1: Percent agreement across survey items by student gender



What we cannot tell from the current evaluation data is what underpins these gender differences. On the one hand, it could be differences related to how students engaged with The Fair content. Girls being more likely to have spoken to someone who works in STEM or do activities on the Big Bang Explore list, while boys were more likely to have visited stands and exhibits or participate in an interactive activity. It may be that these different activities showed them different things. For

example, doing an interactive activity might help young people build confidence in their skills as they actively accomplish something, which speaking to someone who works in STEM might teach young people about what these people do in their careers.

On the other hand, it is also likely that these are pre-existing differences in young people's perceived capabilities, attitudes, and interest in pursuing a career in STEM. As documented by the Science Education Tracker 2023:

- 34% of girls in Year 7 to 13 believed they definitely or probably could become an engineer in the future, compared with 58% of boys
- only 16% of girls agreed that engineering was a suitable career for someone like them, compared with 44% of boys
- 29% of girls were interested in an engineering career, compared with 63% of boys

Without pre-event measures of participants' perceived capabilities and motivation, we cannot tell if The Fair did anything to narrow these gaps or if the gender differences in young people's ratings of the impact of The Fair remained unchanged.

Finally, it may be that there was more room for improvement in terms of girls' knowledge of what engineers do. SET 2023 showed that only 33% of girls aged 11 to 14 said that they know about the different things engineers do in their jobs, compared with 50% of boys in this age group. It may be that The Fair offered girls the opportunity to learn more about this topic, while boys felt they were already knowledgeable in these areas.

Conclusions and recommendations

Overall, the evidence suggests that The Fair had a positive impact on students' and educators' capabilities, opportunities and motivation. The primary goal of The Big Bang Fair 2024 was to deliver an inspiring in-person event that sparks enthusiasm and curiosity among young people, encouraging them to discover exciting opportunities within STEM through high-quality interactions and engaging activities.

In the spirit of there always being room for improvement, even when ratings are high, the evaluation also highlights what we can learn from the student and educator surveys to enhance the delivery of The Big Bang Fair.

Focus on the activities that worked well for students

Students liked activities that entertained them while they learned something new, simple, fun, and often with friends. For example, throwing objects in a basket, spinning a wheel, dunking an arm in slime, popping a cuboid bubble and watching a robot dog 'dance'. The types of activity that worked particularly well with students offered any combination of the following:

- "cool" exhibits that students could interact with, such as holding a curious-looking yet endearing animal or sitting inside and exploring the features of a tech-filled vehicle from a prestige brand or that features on tv shows
- making, building, designing, creating and sharing ideas
- using scientific and demonstration equipment first hand to examine themselves or solve a challenge
- games, quizzes and puzzles that required students to consider what they think, want and know

Notably, there were group differences in students' interests; for example, female students and students from UK minority ethnic backgrounds were more likely to say that they wanted to know more about solutions to environmental problems. These differences should be considered alongside the above to make The Fair particularly attractive to underrepresented groups.

As with previous years, educators' feedback was overwhelmingly positive about the event content and delivery. They highlighted, for example, the wide variety of activities available, the focus on presenting diverse STEM career opportunities, and the ability of staff on stands to engage and enthuse their students, as well as the atmosphere in the hall. Not surprisingly, the most common suggestion from educators for improvement was for more space, stands and time to enable all students to fully experience The Fair (43%). While there will always be limits to the size and scale of The Fair, future Fairs should maximise the content that engages students within the constraints of the venue and resources.

Amplify messages that register with girls

As noted above, boys were consistently more positive about the impact of The Fair on their interest in STEM jobs, their motivation to pursue these and STEM activities, and their confidence to pursue these in the future. In contrast, the learning reported by girls (about what an engineer does, for example) at The Fair was significantly higher than by boys. This may be tied to the different types of ways boys and girls engaged with The Fair, as girls were more likely to have spoken to someone working in STEM or do the 'Big Bang Explore' activity sheet. It may also be related to the underlying constructs that are being measured in the evaluation, with knowledge being a short-term outcome that is relatively easy to influence. In contrast, perceptions of STEM jobs and their suitability to one's self-identity is something that is built over long periods of time with multiple sources of influence. However, it may be that we can strengthen the messages for girls by centring them in the stands, exhibits and activities that we know girls are particularly attracted to, for example, overrepresenting women working in STEM amongst the STEM professionals at The Fair.

Continue efforts to make The Fair as accessible as possible

Again, there are limits to what can be achieved in this area (for example, the physical accessibility of the venue, the number of people attending The Fair, and so on cannot be changed). However, educators had some practical suggestions on how their and students' experiences of The Fair might be improved. For example, 16% suggested that the content of The Fair, such as a brief description of the stands, a map, and the menu for the venue, be shared in advance so they could plan their visit more thoroughly. For 2025, we should review the content we share with educators in advance of The Fair, looking for opportunities to help them plan their visits and optimise the time they spend at The Fair.

This kind of communication would be particularly valuable for disabled students who may need additional time to get around the stands or who may benefit from additional time to review and decide which content they would like to prioritise. As noted in this report, there was small minority of disabled students who could not access all they had wanted to at The Fair, and some fed back that the floor was busy and hard to navigate or find a quiet place to sit. Sharing a map of the venue's layout beforehand and potentially considering adding more quiet spaces or hands-on support for educators bringing groups of disabled students, could alleviate some of these issues.

References

Archer et al. (2013). **ASPIRES Report: Young people's science and career aspirations, age 10-14.**

Hamlyn et al. (2024). **Science Education Tracker 2023**.

Kontkanen et al. (2023), **Science capital as a lens for studying science aspirations – a systematic review**.

Jones et al. (2022). **Measuring science capital, science attitudes, and science experiences in elementary and middle school students.**