Science Education Tracker 2023

Wave 3

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Background

The Science Education Tracker 2023 (SET 2023) is the third in a series of studies which track evidence on key indicators for science engagement, education, and career aspirations among young people in England. Previous surveys were conducted in 2016 and 2019. All surveys have been carried out by Verian, formerly known as Kantar Public.

For SET 2023, Wellcome provided the Royal Society with a grant to manage the project. The Royal Society then entered into an agreement with EngineeringUK, its delivery partner, to manage the research contract for the project, with the Society and EngineeringUK working together closely with Verian on questionnaire development, fieldwork, data analysis and reporting, steered by an Advisory Group established by the Royal Society.

The SET 2023 survey covered 7,256 students in school years 7–13 in state–funded schools across England, a sample of c.1,000 students per school year. The survey sample was drawn from a combination of the National Pupil Database (NPD) and the Individualised Learner Record (ILR)[1], and was administered online.

How has young people's engagement with science changed over time?

In general, between 2019 and 2023, and in some cases over the longer term since 2016, there has been a negative shift in young people's engagement, aspirations and participation in science at school. Given that the 2019 to 2023 interval included the COVID–19 lockdowns, it is likely that these trends are at least partly attributable to the educational disruption experienced by young people during school lockdowns, as well as the longer-term impacts of the pandemic.

Between 2019 and 2023, young people were less interested in science and computing with this decline in interest being more pronounced among younger cohorts.

- The percentage who rated each subject as very or fairly interesting decreased over this time period: among year 7–9s, from 76% to 71% for science and from 60% to 56% for computing; and among year 10–13s, from 74% to 71% for biology, from 59% to 55% for chemistry.
- Over this period, overall interest in science dropped more steeply among year 7s and year 8s, while remaining more stable for year 9s. It might be hypothesised that this is because younger students, who transitioned to secondary school after the pandemic, were less prepared for secondary school than older cohorts.

Between 2019 and 2023, year 7–9 students were less confident in their abilities across most subjects, including science and computing.

- The percentage of younger students who thought they were 'good' at different subjects including maths, English, science and computing has fallen over this period. The drop in perceived ability was sharpest for science (from 56% to 49%) and computing (from 50% to 43%).

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[1] Databases of students maintained the Department for Education and Education & Skills Funding Agency, respectively.

Between 2016 and 2023, there was a marked reduction in young people's access to more interactive forms of practical science, with these trends most accentuated between 2019 and 2023.

- The percentage of GCSE students (years 10–11) doing hands–on practical work at least fortnightly dropped from 44% in 2016 to 37% in 2019 and to 26% in 2023, with a similar pattern of decline in watching teacher demonstrations of practicals at least fortnightly (47%, 38%, 32%).
- Conversely the percentage of year 10-11s watching a video of a practical at least fortnightly increased over time (39% in 2016, 41% in 2019, 46% in 2023).
- Reduced frequency of hands–on practical work was accompanied by rising levels of unmet demand for this: 68% of year 10–11 students wanted to do more practical work, up from 57%–58% in 2016 and 2019.

Between 2019 and 2023, there was a decline in the percentage of year 7–9 students who aspired to learn science beyond GCSE, and to go on to university.

- The percentage of year 7s who thought they might continue with science beyond GCSE fell from 70% in 2019 to 64% in 2023, while the percentage of this age group who had already rejected science beyond GCSEs increased from 26% to 32%.
- The percentage of year 7–9s intending to go to university was lower in 2023 (70%) compared with 2019 (76%), with the percentage of this age group definitely considering university decreasing from 40% to 31%.

Between 2019 and 2023, there were declines in access to careers information and work experience. However, these declines were concentrated among year 12s and 13s indicating that this decline was mainly related to pandemic disruption.

- The use of many types of careers information fell between SET 2019 and SET 2023 including consulting parents or teachers, searching online and attending a careers event or fair.
- There was also reduced access to work experience (STEM or non–STEM) in 2023 compared with 2016 (57%, down from 69% in 2016 and 67% in 2019), although the percentage doing STEM work experience remained stable (between 13% and15% over this time) which might be due to increased opportunities for remote work experience for these sectors (this is covered below).
- The declines noted above were mostly concentrated among year 12 and 13 students, who would have been in Years 10–11 during the most pandemic–disrupted academic years, when many schools tend to arrange such careers and work experience activities.

Between 2019 and 2023, an increased percentage of students viewed science careers as accessible.

- The percentages of students in years 10–13 agreeing that science careers are 'suitable for someone like me' increased between 2019 and 2023, reversing a previous reduction between 2016 and 2019: 36% in 2016; 32% in 2019; 39% in 2023. The percentage of year 10–13s who agreed that science careers require high grades has decreased over time from 89% in 2016 to 78% in 2019 and 75% in 2023.

There is some evidence of widened gender gaps within the youngest cohorts over time, although not all in the same direction.

- In years 7–9, the decline in interest in science (see above) was more accentuated among females: so while there was no year 7–9 gender gap in interest in science in 2019 (males 77%; females 75%), there was a relatively wide gender gap in 2023 (males 76%; females 65%).

- In years 7-9, females continued to be more likely to consider university, but this gender gap has widened over time: in 2019 the gender difference was 79% females vs 73% males, which had widened to 76% females vs 65% males in 2023.

Key 2023 findings

Students were more likely to see science as relevant to wider society than to their everyday life, with a minority regarding science as relevant to their everyday life.

- Only 25% of young people in years 7–9 selected ‘relevance to real life’ as a motivation to learn science.
- Two in five young people in years 7–13 (42%) considered an understanding of science as important to their everyday life. Year 7–13 students were more likely to regard science as being important to wider society (57%) than to their everyday life (42%).

Young people access science outside school in a variety of ways, with most students accessing science content online. However, most young people did not trust science information accessed via social media.

- Students typically accessed science content through reading about it online (63% had done this in the last month), via TV or streaming (27% in the past month), or through books, newspapers or magazines (24% in the past month).
- However, only 12% of young people in years 7–13 trusted social media content completely or a great deal. The most trusted sources were healthcare professionals and scientists, both trusted by at least seven in ten young people.
- Just under half (47%) of year 7–13 students had visited a science–related attraction or activity such as a zoo, science museum or science festival in the past year. A third (43%) had participated in the past year in an extra–curricular school science event such as a talk from a STEM–based employer, a school STEM club, or a science or maths challenge or competition.

One in ten young people were classified as having a strong science identity, while a third of young people felt that science was ‘not for me’.

- Among young people in years 7–13, 9% were classified as having a strong science identity, that is actively seeking out science news, events or activities, 54% were interested in science but didn’t make a special effort to stay informed, while a third (32%) felt that science was ‘not for me’. Females, and students with a white or mixed ethnicity, were most likely to consider that science is ‘not for me’.

Experience of hands-on practical work is key to motivating students in science, especially among the least engaged in science. However, most students in 2023 encounter practical work via videos.

- Practical work was considered the most motivating aspect of science lessons at school, especially for students in years 7–9. When selecting from a list, 52% of year 7–9s chose practical work as a motivation to learn science.
- However, access to hands–on or teacher–demonstrated practical work[2] becomes less common as students progress through school. In year 7, 65% reported doing this at least once a fortnight, but this percentage fell steadily by school year, such that only 39% reported similar frequency of interactive practicals in year 11.

[2] This is the Gatsby definition of good–quality practical work (Gatsby, 2017)

- Among all students in years 7–11, the most common form of access to practical science was via video: 49% reported watching a video of a practical at least once a fortnight, compared with 44% watching a teacher demonstration, and 38% doing hands–on practical work.
- 71% of students in years 7–11 wanted to do more practical work than they currently do. A desire to do more practical work was most common among students who did hands–on practical work least frequently, and with lower engagement in science, such as those with the lowest interest in science, who regard science as 'not for me' and who were taking double rather than triple science GCSE.

Most practical work done in groups or pairs. Most students were unable to relate practical tasks in school to real life contexts.

- When doing practical work, most Year 7–11 students did so in groups or pairs (81%) rather than independently (38%), and relatively few (29%) undertook fieldwork–style activities.
- While most students (66%) said that they understood the aim of the practical tasks rather than just following instructions, only 34% said that the teacher always or usually explained the relevance of the practical work to everyday life.

In general, engagement and aspirations in science and STEM were highest in the early years of secondary school, thereafter, declining by school year.

- Young people in years 7–9 were more likely than students in years 10–13 to have visited science–based attractions and taken part in STEM–related extra–curricular activities. Years 7–9 were also more likely than older students to see science as important to their everyday life, although years 10–13 students were more likely to value the importance of science for society in general.
- In the first three years of secondary school, students increasingly rejected science as a future pathway: the percentage who said that they did not plan to study science after GCSE increased from 32% in year 7 to 37% in year 9.
- Interest in a STEM career declined between year 7 and years 12–13. 82% of year 7 and year 8 students were interested in a STEM career, though this gradually dropped thereafter to only 69% and 72% of students in years 12 and 13, respectively.

Students regarded science as a difficult subject and, compared with other compulsory subjects, they were less likely to rate themselves as 'good' at it.

- Perceptions of difficulty (40%) and volume of work (37%) were the strongest disincentives to learn science among students in years 7–9. Among year 10–13s, perceived difficulty was also a strong disincentive to learn Chemistry and Physics (40% and 39% respectively cited difficulty as a disincentive).
- When asked to compare maths, English and science, students were most likely to rate themselves as good at maths (61% in years 7–9, 57% in years 10–13) and English (60% in years 7–9, 58% in years 10–13). They had lower self–belief in science: 49% felt they were good at science in years 7–9, and in years 10–13 this percentage ranged from 38% in chemistry to 48% in biology.

From years 10–13 when the sciences are studied separately, there were substantial differences in levels of engagement across the three individual sciences (Biology, Chemistry, Physics).

- In years 7–9, when science is often studied as a combined subject, it is ranked towards the bottom (6th out of 9 subjects). In years 10–13, when sciences are studied separately, biology was the most enjoyed science subject (3rd out of 11), while physics was least enjoyed (8th out of 11). Chemistry was ranked between these (7th out of 11).
- Compared with the other sciences, students were more likely to link biology to subject interest, a good teacher, relevance to real life, getting good marks, fitting with future plans and finding it

easier than other subjects, while chemistry was more associated with enjoyment of practical work. Conversely, chemistry and physics were linked to a wider range of barriers including subject difficulty, not getting good marks, and finding the maths difficult.

Most year 10–13 students said their school offered triple science as part of the school curriculum although it wasn't always available to individual students.

- While most students in years 10–13 taking a non–triple science course were content with this, 19% of them would have liked to study it if the option had been available to them: 3% said their school didn't offer it on the curriculum, while 15% said the option was not available to them personally.
- Compared with double science, studying triple science was linked to raised levels of interest and confidence in ability in science, more timetabled science hours and hands–on practical work, and increased knowledge and interest in STEM careers.

When making post–16 choices, students were more likely to opt for a non–STEM than a STEM pathway. STEM subjects were most likely to be studied as part of a mixed pathway.

- Of all year 11–13 students who had made post–16 subject choices, 84% chose non–STEM subjects and 56% chose STEM subjects (42% chose a mixture of the two). The most popular post–16 STEM subject choices in order were maths, biology, chemistry, physics and computing.
- About two in five (43%) of year 11–13 students who had made post–16 choices chose non–STEM subjects only, while 14% chose STEM subjects only. Therefore, most students taking STEM subjects did so as part of a mixed STEM/non–STEM pathway. A similar STEM vs non-STEM pattern was evident in relation to higher education aspirations.

A fifth of students felt that they were not able to choose the subjects they wanted when making post–16 subject choices.

- While 72% of year 11–13 students who had made post–16 choices were happy with their choices, 20% said they would have preferred to take a different number or combination of subjects or courses. The main barriers to choosing subjects were the school or college not offering the course or a failure to meet minimum grade requirements.
- When year 12–13 students were asked to reflect on their post–16 choices, 38% indicated that they would have liked to have chosen different subjects when originally selecting them or in hindsight. Of these, almost half (49%) would have chosen different subjects and one in four (24%) would have like to study more, or a wider range, of subjects.

Experience of STEM–based work experience was rare. The COVID–19 pandemic restricted opportunities for young people who were in years 12–13 in 2023.

- 57% of year 10–13 students had completed work experience, though only 15% had completed a STEM–based placement.
- A quarter (26%) reported that they had wanted to secure STEM–related work experience but had been unable to do so. For year 13s who had not been able to secure STEM work experience, half (46%) cited the pandemic as a barrier to STEM–based work experience.
- Among students who did take part in STEM work experience, 80% had participated in–person and 36% had participated remotely, though students in years 12–13 (41% and 48%, respectively) were particularly likely to have participated online.

Three–quarters of students in years 7–13 were interested in at least one type of STEM career, although knowledge of different STEM careers was relatively low.

- Three–quarters (77%) were interested in at least one type of STEM career, with interest in individual STEM areas ranging from 46% for engineering, to 45% for science, to 38% for both maths and computing/technology.
- Motivations for pursuing a science career focused mainly on interest, pay, being 'good' at related subjects, and range of career options while barriers mainly focused on lack of interest and having alternative plans.
- Between 32% and 38% of those in years 7–13 considered themselves to know at least a fair amount about careers in each of science, engineering, maths, and computing and technology.

About half of students were interested in an engineering career although enthusiasm for this fell with school year. A third considered engineering as a suitable career 'for me'.

- Just under half (46%) of year 7–13 students expressed some level of interest, with interest highest among year 7 students (55%) and lowest among year 12 (36%) and year 13 (39%) students.
- Three in ten students in years 7–13 (30%) agreed that engineering was a 'suitable career for someone like me'.
- Interest in engineering was raised among males, Asian and Black students, students with many family STEM connections, and those who had undertaken STEM work experience.
- Amongst all young people in years 10–13 who expressed an interest in an engineering career, 36% indicated a preference to pursue a technical or vocational route while 28% indicated a preference for a university route.

Two–thirds of students in years 7–13 were interested in issues related to climate change, with interest higher among females. One in three were interested in a career to help tackle climate change.

- 64% of students in years 7–13 were interested in issues related to climate change and interest was higher among females, students with many family STEM connections, and students living in the least deprived area quintile.
- Interest in climate change issues by school year decreased among males (from 65% in year 7 to 54% in year 13) but remained stable for females with around seven in ten females expressing interest across all school years.
- 35% of year 7–13 students were interested in a career that will help tackle climate change and interest was higher among students interested in an engineering career (42%).

Differences between demographic groups

There was a wide male–female gender gap in STEM engagement, participation and aspirations, across several metrics.

- Across years 7–9, males were more interested in the school subjects of science (76% vs with 65% of females) and computing (68% vs 42%).
- Among students in years 11–13 who had made post–16 choices, males were more likely to choose maths, physics and computing, while females were more likely to choose biology (as well as many arts and social science subjects). In higher education subject aspirations among year 10–13 students, computing and engineering were more popular among males, while healthcare was more popular among females.

- Females were much less likely than males to rate themselves as good at maths, computing, science (years 7–9) and physics (years 10–13). By contrast, there was no gender gap for chemistry and history, and for English and biology the gender gap was reversed.
- Female students in years 7–9 mentioned more barriers to learning science than male students, and were especially likely to say that they had been put off by factors related to difficulty (50% of females, 31% of males), quantity of work involved (44% of females, 30% of males) and lack of interest in the subject (42% of females, 26% of males). Males were over twice as likely as females to say that nothing had put them off learning science (19% vs 7%).
- There were strong gender divides in relation to the 'TEM' (technology, engineering and maths) aspect of STEM careers, while knowledge and interest in science careers was more balanced by gender.
- Females expressed a wider range of reasons for being disinclined towards a STEM career and were more likely than males to be discouraged by a lack of enjoyment or preference for other subjects, or because they lacked confidence in their ability in science.
- Across years 7-13, females were more interested in topics related to the environment, including climate change, biodiversity loss, sustainable fashion, and diet. When asked specifically about climate change issues, 70% of females were interested compared to 59% of males.

Family and especially parents are very influential in shaping young people's education and career choices. However, family science connections are more concentrated among students from more advantaged backgrounds, which perpetuates inequalities in access to STEM.

- Parents were cited as the most influential sources for students seeking guidance about careers.
- Using a specially constructed Family Science Connections Index, stronger family science connections were found among students from more advantaged backgrounds as measured by low area deprivation and parental attendance at university.
- Stronger family science connections were linked to higher access to informal science learning (such as science museums), participation in extra–curricular science activities, triple science take–up, STEM work experience, a wider range of careers advice, and greater knowledge and interest in STEM careers.
- Students with stronger family science connections were also more likely to take up STEM subjects after GCSE and to aspire to STEM–based higher education and careers. More widely, students with stronger family science connections displayed more interest and motivation in school science and were more likely to rate their ability in this.

Students with an Asian background, and in some cases also those from a Black background, were most likely to engage in science and STEM at school and beyond.

- Students in years 7-13 with a white or mixed ethnicity were most likely to consider that science is 'not for me' (35% white and 30% mixed vs 26% Black and 22% Asian).
- Year 7-9 students from Asian (78%), Black (66%), and mixed (67%) backgrounds much more likely than white students (58%) to say they that they would definitely or maybe study science after GCSE. Interest and confidence in ability in science at school was in general stronger among students from a Black or Asian background.
- Triple science GCSE take–up among year 10–13s was higher Asian students compared with white students.
- Compared with white students, Asian and Black students displayed higher rates of knowledge and interest in STEM careers.

1. Introduction

1.1 Background and objectives

The Science Education Tracker 2023 (SET 2023) is the third survey in a series of studies which track evidence on key indicators for science engagement, education, and career aspirations among young people in England. Previous surveys were conducted in 2016 (SET 2016) and 2019 (SET 2019). All surveys have been carried out by Verian, formerly known as Kantar Public.

Although the surveys are part of the same series, the commissioning and funding arrangements have changed over time. The survey series was initially commissioned by Wellcome, in 2016, with support from the Department for Education (DfE), the Royal Society and the (then) Department for Business, Energy & Industrial Strategy (BEIS). Wellcome also commissioned the 2019 survey, which was supported by the Royal Society, DfE, and UK Research and Innovation (UKRI).

For SET 2023, Wellcome provided the Royal Society with a grant to manage the project, with the Society's Head of Education as its Principal Investigator. The Royal Society established a delivery partnership with EngineeringUK and an Advisory Group to provide intellectual oversight and guidance for the project. In particular, the Advisory Group informed the research instruments and reviewed survey data and an early draft of this report. The membership of the Advisory Group was as follows:

Professor Ulrike Tillmann FRS (Chair)	Chair, Royal Society Education Committee, and Director, Isaac Newton Institute
Professor Louise Archer	Karl Mannheim Chair of Sociology of Education, UCL-Institute of Education
Dr James Briscoe FRS	Crick Institute and Member, Royal Society Education Committee
Ms Nan Davies	Head of Culture and Society Transition, Wellcome
Mr Daniel Evans Ms Samina Kiddier (from July 2023)	Assistant Director, Maths and Science Curriculum, Department for Education Head of Computing and Science, Department for Education
Mr Peter Finegold	Head of Policy, Education and Skills, Royal Society
Dr Hilary Leevers	Chief Executive, EngineeringUK
Dr Olga Maslovskaya	Associate Professor in Survey Research and Social Statistics, University of Southampton
Dr Claudia Mollidor (December 2022–March 2023) Ms Becca Gooch (from April 2023)	Head of Research, EngineeringUK
Ms Michaela O'Connell	Head of Work, Education and Skills, ESRC
Mr Charles Tracy OBE	Senior Adviser, Learning and Skills, Institute of Physics
Mr Anthony Whitney	Head of Public Engagement with Research, Department for Science, Innovation & Technology

Under the agreement established by the Royal Society with EngineeringUK, a SET Project Team was created, overseen by the Principal Investigator. The Society's Senior Policy Adviser, David Montagu, was the Project Manager, responsible for governance and project oversight, supported by Ms Alice Kwan, Programme Coordinator. In parallel, EngineeringUK's CEO had oversight of the research work, which was led by the Head of Research, assisted by Mr Joseph McGettigan, Research

Officer. EngineeringUK led the procurement process, through which Verian was contracted, and managed the contract with Verian.
The SET 2023 survey covered 7,256 students in school years 7–13 in state–funded schools across England, which represents a sample of c.1,000 students per school year. This was based on a similar survey design to SET 2019. The SET 2016 survey was smaller in scale and only covered students in years 10–13.

Although many existing questions were retained to allow tracking with SET 2016 and SET 2019, the SET 2023 survey content was adapted to allow for changes in the educational policy landscape since the last survey, and to address some more specific policy requirements of the Royal Society and EngineeringUK. The key differences between SET 2023 and SET 2019 were as follows:

- While many tracking questions still focused on 'science', there was more differentiation in survey questions to allow separate analysis of the separate components of STEM (science, technology, engineering and mathematics).
- More differentiation of the different components of school science (biology, chemistry, physics).
- An expanded focus on practical science in schools.
- A new module on knowledge and attitudes towards engineering as a career.[3]
- A new module on interest in climate change.
- New questions on trust in information sources about science.
- An increased focus on vocational STEM pathways.

As in previous SET surveys, all survey data were collected via an online survey platform. The survey was branded the Pathways Survey in all correspondence with young people.

1.2 Impact of the COVID–19 pandemic on time trends

Although the COVID–19 pandemic was not a specific focus of the SET 2023 survey, it is important to view observed changes between SET 2019 and SET 2023 in the context of the significant educational disruption experienced by students during the school lockdowns that occurred between April 2020 and March 2021, the further disruption they experienced in the latter part of the 2021–2022 academic year when schools were focusing on helping students catch up and exams were replaced by teacher assessment, and the longer–term impacts beyond this. The impact of the pandemic on survey trends is discussed within the individual chapters of this report, with broader insights relating to this covered in the Executive Summary.

[3] Questions built on selected questions from the Engineering Brand Monitor (EBM) surveys, which have explored similar themes among young people at secondary school in the UK (see EngineeringUK, 2022 for the most recent report).

1.3 SET 2023 methodology

Further information about the survey background and methodology can be found in the detailed Technical Report, which will be published in 2024. The key details are summarised below:

- The sample was a random sample of young people in school years 7–13 (aged 11–18) attending state–funded education in England. It was drawn from a combination of the National Pupil Database (NPD)[4] and the Individualised Learner Record (ILR)[5]. Following stratification of the sample frame by key variables such as gender, school performance, region, IDACI[6] quartiles and establishment type, a systematic sample was drawn from within each year group based on a target achieved sample size of 1,000 interviews per school year.
- All sampled individuals were sent a letter inviting them to take part in the online survey. The contact approach for young people varied depending on their age at the start of fieldwork:
    - Young people aged 16 or over were written to directly with no requirement for parental consent.
    - For young people aged 13–15, all correspondence was directed via parents; parents were asked to hand over the survey invitation letter to their child if they were happy for them to take part.
    - For children aged under 13, an additional level of consent was required[7]. Before the selected child could access the survey online, parents were asked to complete a short consent survey to confirm that they were happy for their child to take part.
- Respondents were asked questions about a range of topics including their experience of science education, their future plans, and their attitudes towards STEM–related careers. Many questions were tailored to suit students of different ages.
- The average interview length was approximately 20 minutes.
- All questions about experiences at school related to the September 2022–July 2023 school year, which respondents had recently completed.
- Respondents could complete the survey on any online device, including laptops, PCs, tablets and mobile phones. All new questions were cognitively tested with young people prior to administration.
- A total of 7,256 respondents completed the survey between 4 July and 3 September 2023, representing an overall response rate of 47%[8].
- This response rate was achieved after sending an initial invitation and up to three reminders. Later reminders were targeted at groups with the lowest response rates to maximise the representativeness of the sample. The achieved sample closely matched the population on a range of demographic variables.

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[4] A database about pupils in schools and colleges in England, maintained by the Department for Education.
[5] A database of students enrolled in further education and work–based learning in England, maintained by the Education & Skills Funding Agency (an executive agency of the Department for Education).
[6] Income Deprivation Affecting Children Index.
[7] To meet consent requirements under GDPR.
[8] Response rate is calculated as the number of completed interviews/number of cases issued. This corresponds to Response Rate 1, as calculated by the American Research Association for Public Opinion Research (AAPOR, 2016, Survey Outcome Rate Calculator 4.0).

1.4 Interpretation of the data in this report

Interpretation of changes over time

The SET survey series consists of three cross-sectional surveys in 2016, 2019 and 2023 that have a high degree of repetition of question content. Changes over time (e.g. recorded increases or decreases) indicate changes between the time points corresponding with these surveys. However, as surveys were not conducted in the intervening years between these time points, it is not possible to ascertain whether these changes are part of a continuing trend between each stated time interval (i.e. 2016–2019, 2019–2023, or 2016–2023). We are only able to detect change between the time points that correspond with matching questions in each survey.

Linking survey responses to administrative data

All respondents were asked their permission for administrative data from the NPD to be linked to their survey answers: 86% gave permission for their data to be linked. These administrative data included (amongst other data):

- eligibility status for free school meals;
- whether English is the young person's first language;
- special educational needs (SEN) status;
- academic results from key stage 2 and key stage 4[9].

The 14% of respondents who did not consent to data linkage were asked some additional questions about qualifications achieved to cover some of the items that would have been drawn from the NPD.

Due to a delay in receipt of the NPD-linked data, analysis by NPD is not covered within this report and will reported on in a separate paper, to be published at a later time point.

Gender

All analysis by gender is based on a comparison of male and female students. The subsample of students who identify in any other way (*n* =117) was relatively small; this subgroup is included in analysis throughout the report except when results are compared by gender where results are shown for males vs females.

Throughout this report, female students and male students aged 11-18 are generally referred to as 'females' and 'males'. This shorthand ensures a more consistent terminology. Other terms, such as 'girls' and 'boys', are normally applied only to young people aged 11-13.

Ethnicity

Where analysis by ethnicity has been conducted, we have in general compared findings across four subgroup categories: white, mixed, Asian and Black. There was also an 'other' ethnic group (defined as 'Arab or any other ethnic group'). However, the base size for this group (*n*=165 in total)

[9] For students in year 7 and year 8, key stage 2 data are missing because year 6 assessments were cancelled in 2020 and 2021 due to the COVID–19 pandemic. Key stage 4 data were only available for young people who had already completed GCSE exams. These were primarily young people in years 12 and 13.

was too small to allow any detailed analysis where the analysis is based on a subsample that is smaller than the total sample size. The 'other' group has therefore been used in selected figures.

Social disadvantage

There are significant challenges to asking young people directly about parental income or parental socio–economic group. In this report, the Income Deprivation Affecting Children Index (IDACI) quintiles[10] were used as a proxy for family income levels. Entitlement to free school meals will be used as a further measure of disadvantage once these linked data are available (see 'Linking survey responses to administrative data' above).

Reporting conventions

All differences commented on in this report are statistically significant at the 95 per cent level of confidence[11]. All percentages reported are weighted to account for differential non–response.

In some figures, rather than showing comparisons for all groups, only significant differences are highlighted; for example, the Figure may only show selected ethnic groups, rather than all comparisons.

Where percentages do not sum to 100 per cent or to net figures, this will be due to either (i) rounding or (ii) questions which allow multiple answers.

Respondents were able to refuse to answer any question by selecting 'Prefer not to say'. 'Don't know' and 'Prefer not to say' responses are included in the base for all questions reported except where otherwise specified.

[10] Income Deprivation Affecting Children Index: a measure of the percentage of children in an area living in low–income households. Respondents' addresses have been grouped into quintiles, from most deprived to least deprived.

[11] When comparing percentages, a design effect of 1.06 was used for the 2023 study, 1.06 for the 2019 study, and 1.09 for the 2016 study. These design effects were estimated at the overall level and were calculated as = $(1 + cov(W)^2)$ – where cov(*W*) is the coefficient of variation of the weights. When conducting modelling, robust standard errors accounting for both the weighting and stratification have been calculated.

2. Science outside the classroom

This chapter considers the level of engagement that young people have with science outside the formal classroom setting, for example by visiting science attractions, accessing science–related resources online, and through measuring the role of science within the family network. The chapter includes new measures on science identity and the extent to which young people trust different sources of science news and information. Findings are compared with previous survey years where relevant.

Key findings

Changes over time

Visits to some science attractions decreased between 2019 and 2023. Young people in years 7–13 were less likely to have visited a science festival or event (12% vs 17% in 2019), and a science talk or lecture outside school (7% vs 11% in 2019) in the last 12 months. Attendance at other science–related attractions remained unchanged.

Compared with young people in 2019, young people in 2023 were somewhat more likely to value the importance of science in a wider context beyond school. The percentage of young people in years 7–13 who agreed that science is important in their future career increased from 42% in 2019 to 45% in 2023 (this increase being solely attributable to students in years 10–13), while the percentage who agreed that science is important for society in general increased from 54% to 57%.

2023 findings

As in SET 2016 and 2019, young people from less affluent backgrounds were less likely to have family science connections. A Family Science Connections Index (FSCI) was constructed to measure the strength of young people's family science networks. This index was based on people they knew in science–related jobs, parental interest in science, and whether they knew people they could talk to about science outside of school. Stronger family science connections were found among students from more advantaged backgrounds as measured by low area deprivation (IDACI) and parental attendance at university.

There was a strong relationship between family science connections and engagement in science outside school: 18% of year 7–13s had many family science connections, and this group were more likely than those with no such connections to have visited science attractions in the past 12 months, taken part in extra–curricular STEM activities through their school, and to place trust in more established sources of science news and information (doctors, scientists, UK government etc.).

Attendance at science–related attractions was related to ethnicity and disadvantage. 47% of year 7–13s had visited a science–based attraction and 48% an arts or cultural attraction or event in the past year. Attendance at science–based attractions was lower among young people from Black backgrounds and those living in more deprived areas. While Asian students were as likely as white students to visit science–based attractions, they were less likely than white students to visit arts or cultural attractions.

43% of students in years 7–13 had taken part in STEM–related extra–curricular activities through their school. This included STEM–based careers activities (17%), talks with an external speaker (15%) and school clubs (12%). While only 8% of students had taken part in a STEM–related project outside lesson time and 4% in a project working with a STEM specialist, these two activities were perceived by students as being most likely to encourage them to carry on studying STEM subjects.

Only one in ten young people in years 7–13 were classified as having a strong science identity while a third felt that science was 'not for me'. The remainder were interested in science, but didn't make a special effort to keep informed. Females, and students with a white or mixed ethnicity were most likely to consider that science is 'not for me'.

A majority (63%) had seen or read about science online in the last month. However, trust in information about science content viewed on social media was very low. Only 12% of young people in years 7–13 trusted social media content completely or a great deal, while the most trusted sources were healthcare professionals and scientists, both trusted to the same degree by at least seven in ten young people.

Students were more likely to regard science as being important to wider society than to their everyday life. 57% of year 7–13s felt than an understanding of science was important to society in general compared with 45% who felt this was important to them for a future career and 42% who felt it was important for their everyday life.

Younger children were more engaged in science outside school: Young people in years 7–9 were more likely than students in years 10–13 to have visited science–based attractions, taken part in STEM–related extra–curricular activities, and to get involved in creation of computer–based content such as games, websites etc. Years 7–9 were also more likely to see science as important to their everyday life, although years 10–13 students were more likely to value the importance of science for society in general.

2.1 Context

Engagement with science does not only happen within the classroom environment. There are several ways in which young people can connect with science outside of school, and these connections can help build scientific literacy, make science feel more relevant and accessible, and help young people to better understand the diversity of science–related career opportunities.

In recent years, the concept of 'science capital' has been developed to better understand how individuals, including young people, engage with science in their everyday life. Ultimately, the concept is an attempt to provide insight into why some people participate in and engage with science while others do not. The science capital measure developed by Louise Archer and her team, currently based at UCL Institute of Education[12], comprises several dimensions which together encapsulate the ways that young people can feel 'connected' to science in their lives. In this chapter we explore some of those dimensions, including participation in informal science learning

[12] https://www.ucl.ac.uk/ioe/departments–and–centres/departments/education–practice–and–society/science–capital–research

(science attractions and science media); family science connections; extra–curricular school activities; science identity; and whether young people feel that understanding science is relevant to their everyday life.

Family background in particular is hugely influential in shaping young people's attitudes towards science and throughout this report we repeatedly find evidence of a strong link between interest and aspirations in science and having family members with connections to science and STEM.

Digital channels continue to be an important source of science information for young people outside school, especially as the use of social media is now almost ubiquitous among young people. According to recent Ofcom data (Ofcom, 2023) around 90% of those aged 12–17 have a social media profile, and more specifically the 2019 Public Attitudes to Science survey (BEIS, 2020) found that 36% of 16–34–year–olds selected social media as a main source of new scientific research findings, a figure which is likely to have increased since. Social media therefore greatly increase the potential for engaging with young people about science. However, social media also bring a risk of confusion and misinformation; for example, misleading information spread by climate change deniers or people who oppose vaccination. In order to provide more insight on this issue, the SET 2023 survey included new questions on how much young people trust different sources of science information.

Patterns of engagement with science by demographic subgroups outside of school continue to be important to monitor. The SET 2019 survey found that young people from more disadvantaged backgrounds were less likely to have attended science attractions and to have engaged with science outside of school through other channels, and SET 2023 confirms that many of these unequal patterns still hold.

2.2 Family Science and STEM connections

Parents and wider family networks can be highly influential in the formation of scientific interest and aspirations. The ASPIRES study (Archer et al., 2013) established a clear association between the level of 'science capital' in the family and children's future science aspirations (section 2.1). This includes family science skills, knowledge and qualifications; knowing people in science–related jobs; and opportunities to talk about science outside of school (Archer et al., 2016). These types of connections can help young people better engage with and understand science in the wider world, as well as the careers and pathways linked to this.

To help measure and explain variation in family connections to science, the Family Science Connection Index (FSCI) was developed for SET 2016, based on young people in school years 10–13. In 2019 the FSCI was expanded to include young people in school years 7–13, and a similar FSCI measure was used in SET 2023.

However, compared with previous surveys in the SET series, the SET 2023 focus shifted to cover more detailed questions on STEM i.e. technology, engineering and maths (TEM) as well as science (S). Moote et al. (2020) explored the extent to which science capital can be extended to the related 'TEM' disciplines and concluded that, while it strongly related to engineering and physical science future study aspirations, it was not strongly related to attitudes and aspirations in relation to technology.

To help take account of this variation, a second FSCI measure was developed in SET 2023. The FSCI–Science index continues to measure family science connections as per the previous surveys in 2016 and 2019[13], while the FSCI–STEM index is an adaptation of the original index, and also includes family connections to engineering, computing, and technology. Throughout this report, when looking at differences in survey measures by level of family science/STEM connections, we have used the most appropriate measure depending on the focus of the question.

These indices were constructed by scoring and combining responses across different questions. FSCI–Science was built from questions which covered whether the young person: knows people they can talk to about science issues outside of school; has parent(s) interested in science; and has family members who work in science or medicine. FSCI_Stem used the same questions but added in two additional questions on whether the young person had family members working in engineering and technology. The detailed construction of these two indices is included in Appendix B.

In summary, this provides two classifications as follows, with the FSCI_STEM producing a higher percentage of students with many connections given the expansion of the index to cover family members working across all STEM areas:

FSCI_Science

Low score – no science connections – score of 0 (24% of respondents);
Medium score – score of 1–3 (58% of respondents);
High score – many science connections – score of 4–6 (18% of respondents).

FSCI_STEM

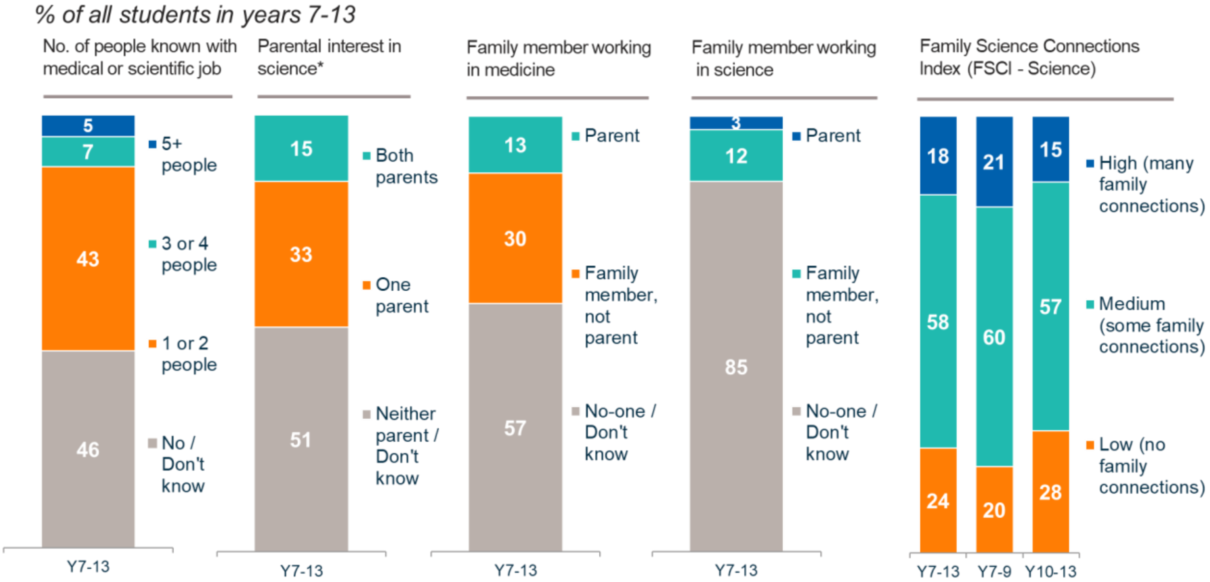
Low score – no STEM connections – score of 0 (14% of respondents)
Medium score – score of 1–3 (61% of respondents)
High score – many STEM connections – score of 4–6 (25% of respondents)

Figure 2.1 shows the results for the three questions that produced the FSCI–Science index and the overall FSCI–Science. This shows that nearly half (46%) of young people in years 7–13 did not know anyone in a medical or scientific job that they could talk to about science issues outside of school; 57% did not have a family member working in a medical role; 85% did not have a family member working in a scientific role; and about half (51%) did not consider that their parents were interested in science. The percentage of young people who did not have any of these family science connections (i.e. were assigned the lowest FSCI score) was 24%.

It is also evident from Figure 2.1 that year 7–9s were more likely to say they had science connections compared with year 10–13s. This is mainly driven by a higher percentage of year 7–9s who said they had at last one parent interested in science, although younger members were also slightly more likely to say that they had family members working in medicine. It is possible that parents of year 7–9s are more involved in their child's education during these early years, for example helping with homework or talking about their school day, and therefore show more interest in school–based science; this age group may also hold a broader interpretation of what counts as 'medicine'.

[13] The measure is not exactly the same as in 2016 and 2019. In previous surveys the measure included questions on family members working in science and medicine combined, whereas in 2023 the measure built on two separate questions relating to i) medicine and ii) science.

Figure 2.1: Constituents of Family Science Connections Index – Science (2023)

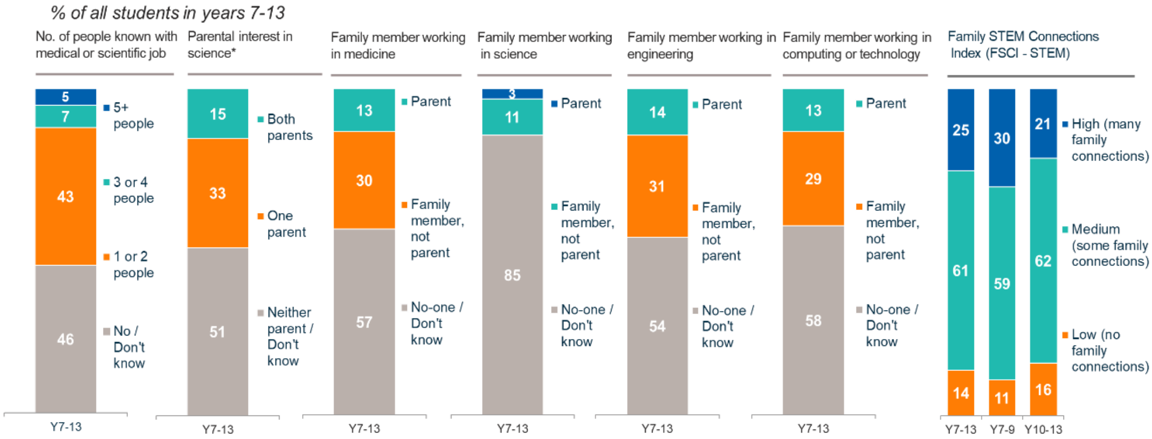


Apart from your doctor, do you know anyone with a medical or science–related job that you could talk to about health, medicine or other scientific issues outside of school? (SocNSci) Do you think your parents are interested in science? (IntYPPar) Does anyone in your family work in medicine? (SciParA) Does anyone in your family work as a scientist? (SciParB) Family Science Connections Index (FSCI–Science): combining responses to these three questions

Bases: All year 7–13s (7,256); all year 7–9s (3,077); all year 10–13s (4,179) Note: 'Not applicable' responses have been excluded from the base for the 'Parental interest in science' results.

Figure 2.2 similarly charts the constituent parts of the FSCI–STEM index. The two additions that make this distinct from the FSCI–Science index are the additional inclusion of measures of family connections in the fields of engineering (45% of young people reported having a family member working in this area); and computing or technology (42% reported having a family member working in this area). The findings by age group, with young people reporting more family STEM connections, are similar to findings for the FCSI_Science index.

Figure 2.2: Constituents of Family Science Connections Index – STEM (2023)



Apart from your doctor, do you know anyone with a medical or science–related job that you could talk to about health, medicine or other scientific issues outside of school? (SocNSci) Do you think your parents are interested in science? (IntYPPar) Does anyone in your family work in medicine? (SciParA) Does anyone in your family work as a scientist? (SciParB) Does anyone in your family work in engineering? (SciParC) Does anyone in your family work in computing or technology? (SciParD) Family STEM Connections Index (FSCI–STEM): combining responses to these three questions
Bases: All year 7–13s (7,256); all year 7–9s (3,077); all year 10–13s (4,179)
NB: 'Not applicable' responses have been excluded from the base for the 'Parental interest in science' results.

Consistent with SET 2019, family science connections were unevenly distributed across the sample of young people.

Across years 7–13, overall 24% of young people had a low FSCI_science score, that is they lack any family science connections. An absence of family science connections was most highly represented among young people from the following groups:

- More disadvantaged families: 31% of young people living in the most deprived area quintile, declining through the quintiles to only 16% of those living in the least deprived area quintile.
- Without a parent who had been to university: 13% compared with 30% who had a university–educated parent.
- White students: 26% compared with 18%, 20% and 21% from Black, Asian and mixed ethnic backgrounds respectively.

Conversely, having many family science connections (18% overall) was most highly concentrated in the following groups of young people in years 7–13:

- More advantaged families: 24% in the least deprived quintile compared with 14% in the most deprived quintile.
- With a university–educated parent: 28% compared with 9% without such a parent.
- Black and Asian students: 26% and 22%, respectively, compared with 16% of white students.

Similar patterns emerge in relation to number of family STEM connections, although there is less variation by ethnicity.

2.3 Science attractions outside school

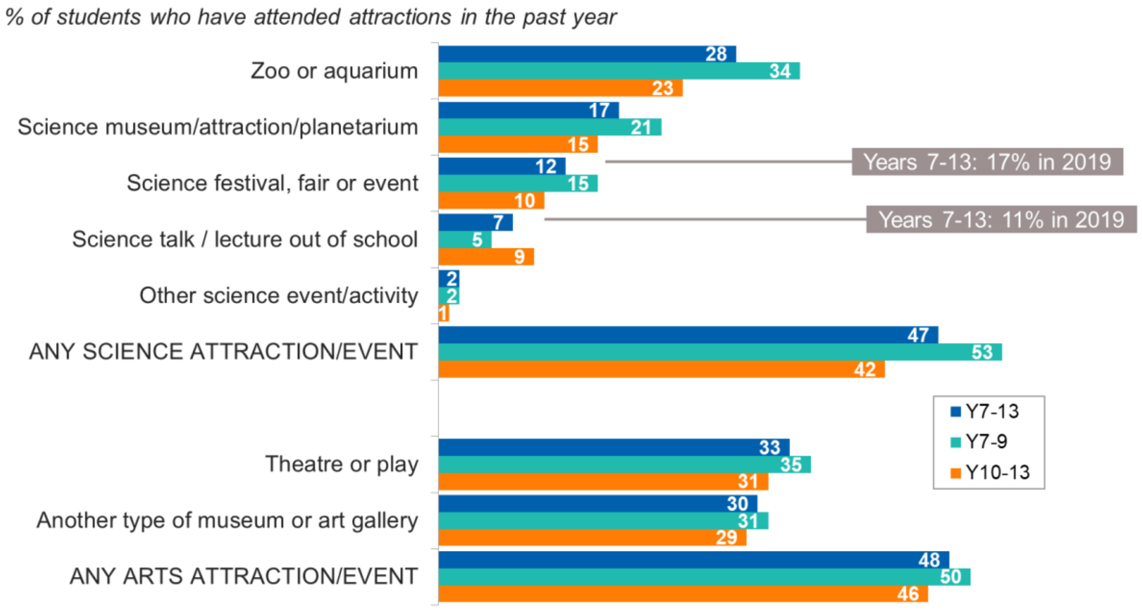
Consistent with 2019, young people in years 7–13 were asked whether, in the last 12 months, they had visited a range of attractions related both to science and the arts. Attendance at these events could include trips with family or friends and/or with their school. Whilst the percentage making visits to most attractions remained largely unchanged since 2019, there were small drops in the percentages of young people indicating they had made visits to science festivals or events, and attending a science lecture (see Figure 2.3).

Overall, based on the items included in the question, 47% of years 7–13 had visited a science–based attraction or event and 48% had visited an arts–based attraction or event.

As in SET 2019, wildlife–based attractions were the most popular science–based attraction, with 28% of all young people visiting a zoo or aquarium in the last 12 months. One in six (17%) had been to a science attraction such as a museum or planetarium in the same period. As also found in 2019, younger students in years 7–9 were more likely to visit science attractions, with higher percentages going to both of these attractions compared to older students in years 10–13. This was consistently the case with the exception of science talks, attended by 9% of years 10–13 and 5% of years 7–9.

Including arts–based attractions in the question allows for a comparison between the arts and science. In SET 2023, one in three young people (33%) had attended a theatre or play in the last 12 months, and a similar percentage (30%) had visited another type of museum or art gallery. Compared with science–based events, there was much less variation in levels of attendance at arts–based events by school year, with attendance remaining more stable by year group.

Figure 2.3: Visits to science and arts attractions in the last 12 months among all students in years 7–13 (2023)



Which of these have you been to in the last 12 months? (SciVisit)
Bases: All years 7–13 (7,255), all years 7–9 (3,076), all years 10–13 (4,179)

Figure 2.4 compares the demographic variation in attendance at science–based attractions and arts–based attractions in the past year.

Focusing first on the percentage who had visited at least once science–based attraction in the past year, attendance was higher among young people from the following groups:

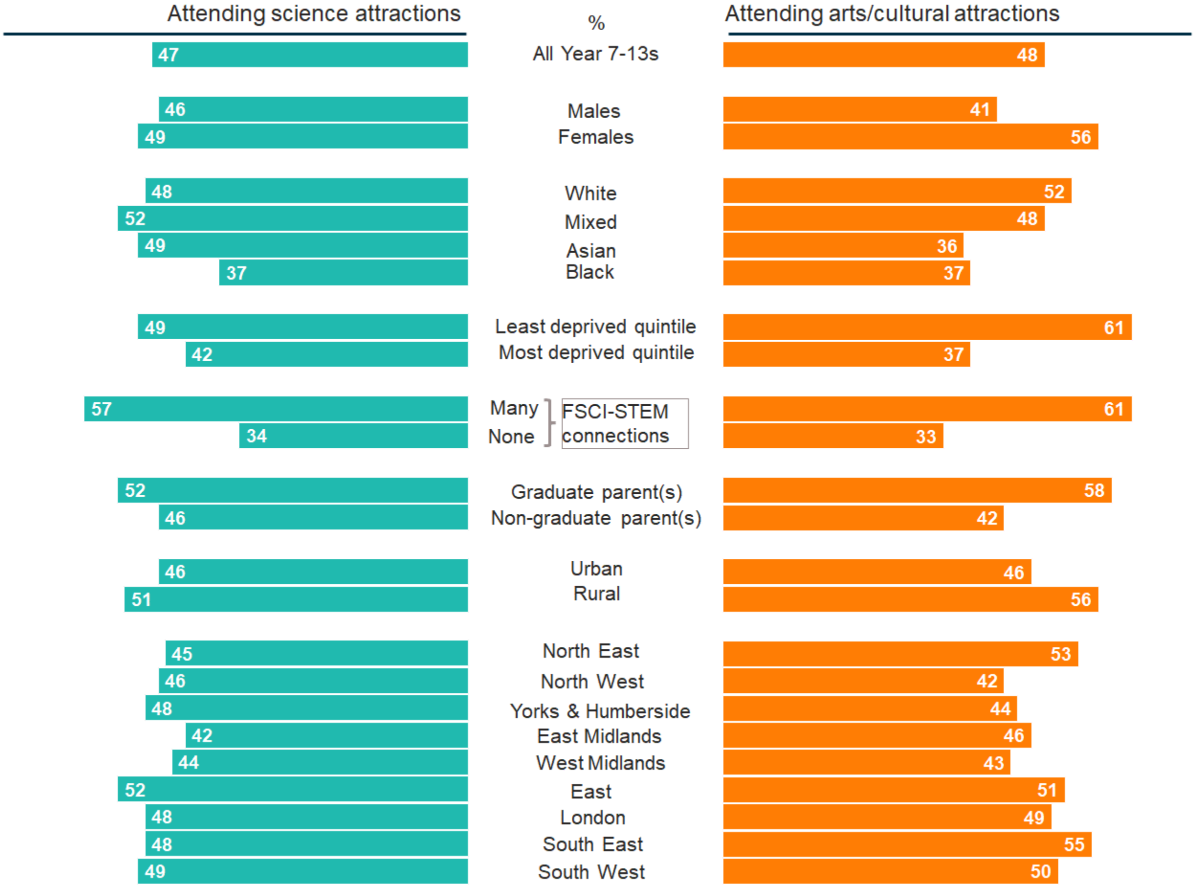
- Those living in the least deprived IDACI quintile.
- Those with the most family STEM connections.
- Those whose parent(s) attended university.
- Students living in rural areas and in the East of England.

On the other hand, participation in science–based activities was lower among the counterpart groups to the above and was also notably low among Black students.

The socio–demographic differences for arts–based attractions were similar, with raised attendance among students from families with many STEM connections, with a university–educated parent, and who live in more affluent areas and rural areas.

However, there were also some different patterns of attendance between the two types of activity. For arts–based attractions, there was a much wider gender gap with females much more likely to attend, and attendance was also higher among students from white and mixed ethnic backgrounds, and notably lower among students from Asian as well as Black backgrounds. The regional pattern was also different, with arts–based participation highest in the South East and North East.

Figure 2.4: Visits by year 7–13 students in last 12 months to science attractions and arts/cultural attractions by demographic subgroups (2023)



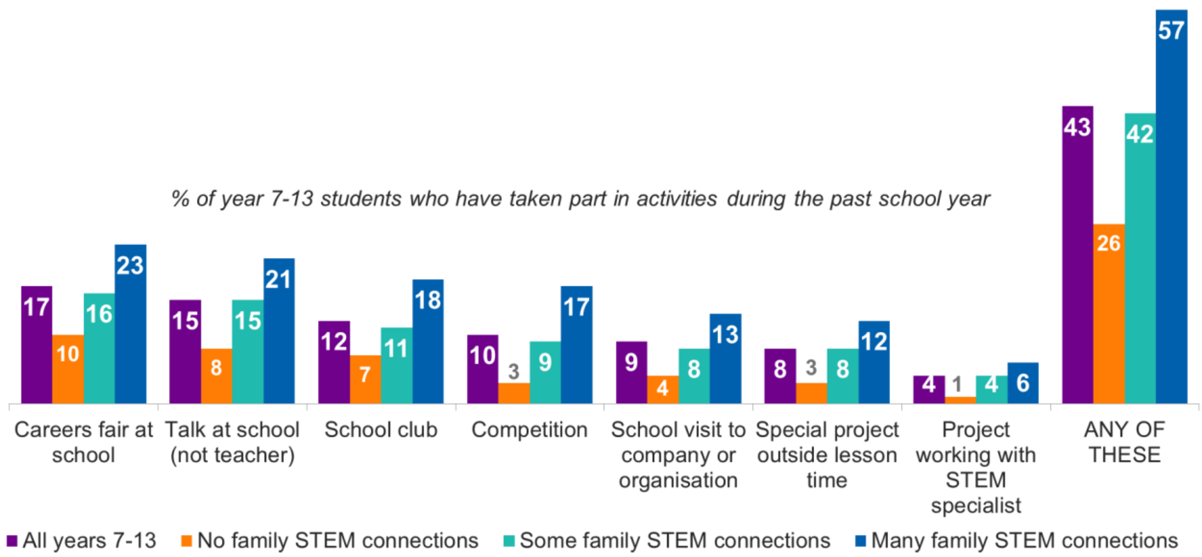
Which of these have you been to in the last 12 months? (SciVisit)
Bases: All years 7–13 (7,256); males (3,428), females (3,601); white (5,115), mixed/multiple (450), Asian (935), Black (487); Least deprived quintile (1,358), Most deprived quintile (1,703); No FSCI–STEM connections (960), Many FSCI–STEM connections (1,898); Graduate Parent(s) (3,536), Non–graduate parent(s) (3,022); Urban (6,048), Rural (1,203); North East (314), North West (926), Yorks & Humber (724), East Midlands (676), West Midlands (826), East of England (808), London (1,070), South East (1,188), South West (712)

2.4 Extra–curricular STEM involvement in school

Young people in years 7–13 were asked about their participation in extra–curricular STEM–based activities through their school during the previous school year. The most common activities, which at least 10% had participated in, were a careers fair that included finding out about STEM–based future pathways (17%), an external talk from someone working in STEM (15%), school STEM clubs (12%) and competitions (10%). Overall, 43% had taken part in at least one of these types of STEM–based activities.

The results, when analysed by family STEM connections, indicate a link between family connections and take up. For example, 17% of young people had taken part in a STEM–based careers fair at school, but this ranges from 10% of people with no family STEM connections to 23% of those with many family STEM connections. This pattern is repeated for all the activities measured in this question as shown in Figure 2.5, and the percentage of people who had taken part in at least one of these activities was double amongst students from families with many STEM connections (57%) compared with those with no family science connections (26%).

Figure 2.5: Engagement in STEM–based extra–curricular activities through school among students in years 7–13 (2023)



During this past school year, have you taken part in any of these activities related to Science, Computer science, Engineering or Maths? (STEMPrac)
Bases: All years 7–13 (7,256), No FSCI–STEM connections (959), Some FSCI–STEM connections (4,398), Many FSCI–STEM connections (1,898)
NB. Some answer codes are hidden due to low response

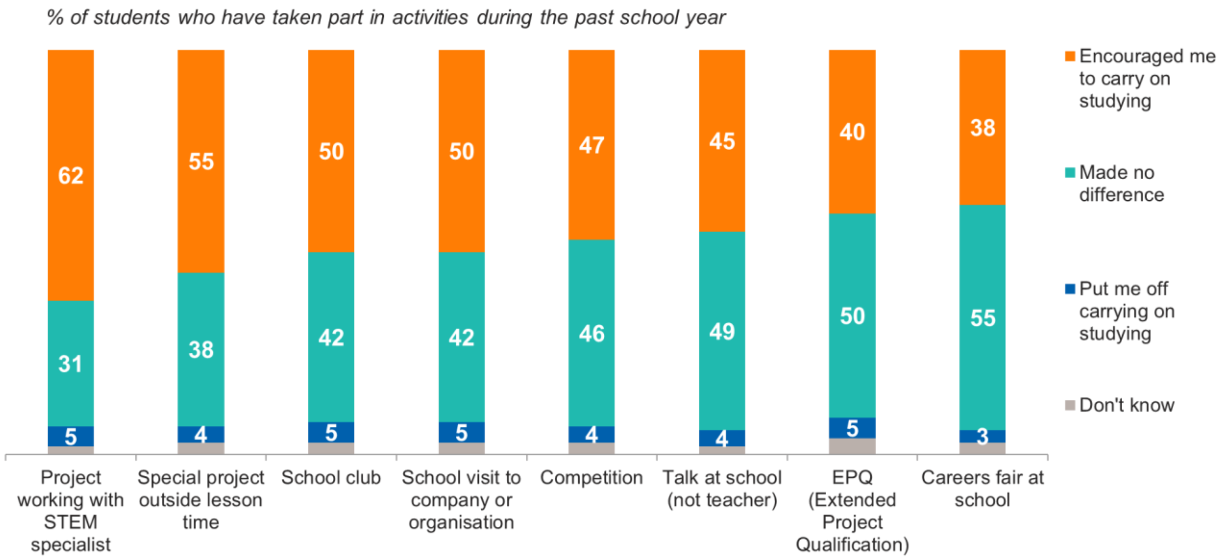
Participation in STEM–based extra–curricular activities also varied by demographic subgroup and level of interest in a STEM career. By age, students in years 7–9 were more likely to have taken part in almost all the activities in comparison to those in years 10–13, and 48% of those in years 7–9 had participated in at least one of these compared with 40% in years 10–13. Students in London were more likely than in other regions to have participated in at least one of these activities (50% compared with 43% overall).

There was also a link between participation in STEM–based activities and level of interest in a STEM career. Of those who had taken part in any of the STEM–based activities in Figure 2.5, 88% were interested in a STEM–based career compared with 69% who had not participated in any such activities.

The study also measured the impact of these activities on further STEM learning more directly (see Figure 2.6 below). For each activity participated in, young people were asked whether taking part had encouraged them to carry on learning science, computer science, engineering and maths (STEM), whether it had put them off, or made no difference.

Two activities stood out in terms of helping to encourage students to carry on learning STEM: 62% of those who had worked with a STEM specialist and 55% of those who had undertaken a special project said this had encouraged them to carry on studying STEM–based subjects. However, although these activities appeared to be impactful for students, very small percentages had taken part in these (4% and 8% respectively).

Figure 2.6: Extent to which extra–curricular activities have helped encourage young people in years 7–13 to carry on learning science, computer science, engineering and maths (2023)



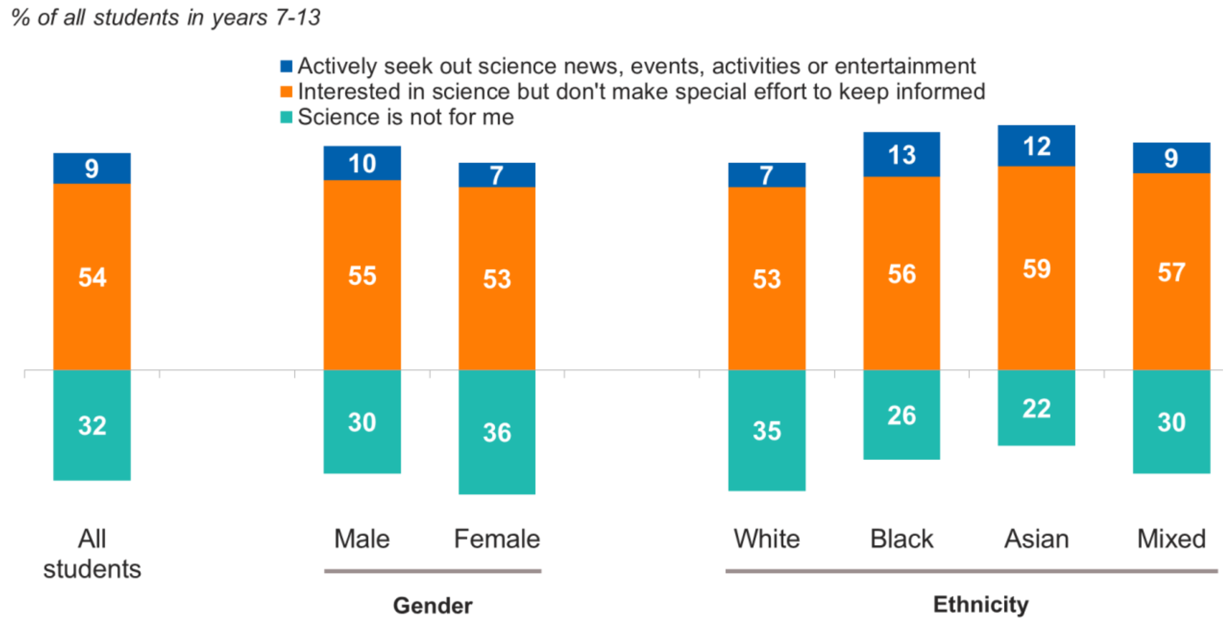
Which of the following statements comes closest to your view? Taking part in this activity has…(STEMImp)
Bases: All years 7–13 who have taken part in last 12 months: EPQ (119), School club (902), Competition (792), Special project (578), Working with specialist (292), Talk at school (1,195), Visit to company/organisation (659), Careers fair (1,295)

2.5 Science identity

As noted in section 2.2 above, it was not possible to include a full measure of science capital. However, a new question, taken from the ASPIRES research (Archer et al., 2020), was included to measure the extent to which young people might be considered to have a relationship with science or whether they regarded science as 'not for me'. Throughout this report, this measure is referred to as 'science identity'.

Overall, one in ten (9%) of year 7–13 students said that they took an active interest in science, seeking out science news and events, 54% said they were interested but didn't make a special effort to stay informed, while 32% considered that science was 'not for me'. As with other measures of engagement with science outside of the classroom, there are differences in this measure for males when compared to females, and those from white ethnic backgrounds compared to those from other ethnic groups (see Figure 2.7).

Figure 2.7: Young people's relationship to science (science identity) by demographic groups; all students in years 7–13 (2023)



Which of these statements best describes your relationship with science? (IdentSci)
Bases: All students (7,256), Male (3,428), Female (3,601), White (5,115), Mixed (450), Asian (935), Black (487)
NB. Figures do not add to 100 as 'Don't know' and 'Prefer not to say' not included in chart

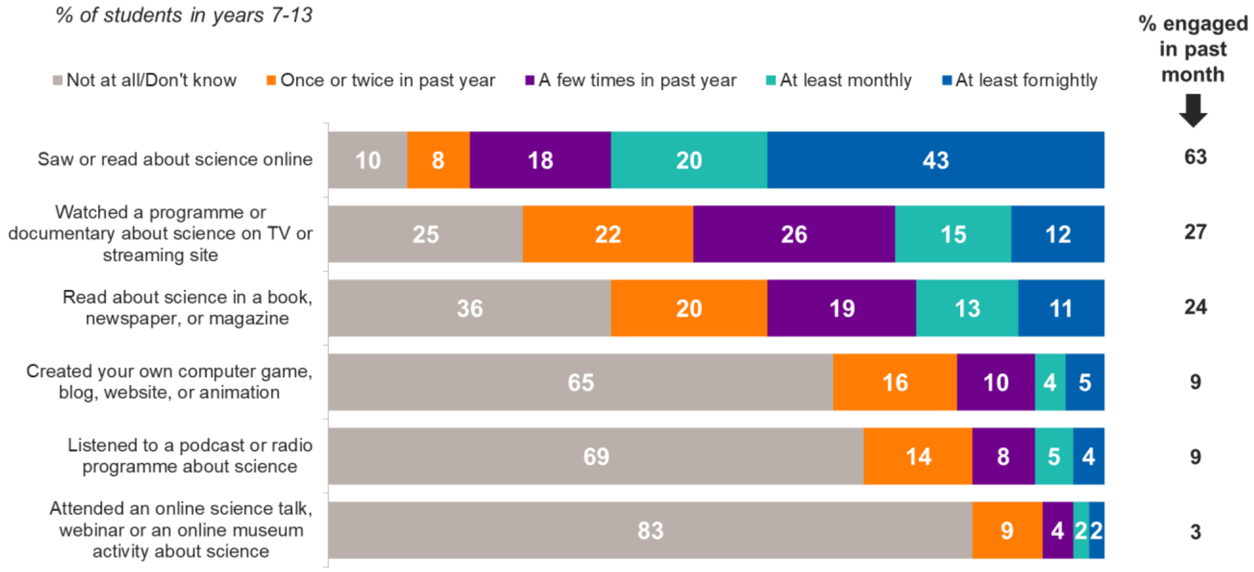
In general, male students and students from an Asian or Black background were more likely to report having a relationship with science. Conversely, the percentage who considered that science is 'not for me' was higher among females compared to males (36% compared with 30%) and among white students (35%) and students from a mixed ethnic background (30%) compared with Black (26%) and Asian students (22%). These gender and ethnicity differences reflect similar patterns in relation to online and media engagement with science (see section 2.6 below).

2.6 Engagement with science via media and digital channels

The study measured the extent to which young people engaged with science via a range of media and digital channels. Due to changes in question wording, these results are not comparable with findings from previous survey years. Figure 2.8 details these findings.

Focusing on the percentage who have engaged with each channel at least once a month, the most common forms of interaction were seeing or reading about science online (63%), watching programmes of documentaries about science (27%) and reading about science in print media or a book (24%). Around one in ten young people had listened to a radio programme or podcast about science or designed a technology–based creation (computer game, blog, website or animation) on a monthly basis (both 9%).

Figure 2.8: Engagement with science through media and digital channels in the last 12 months among years 7–13 (2023)

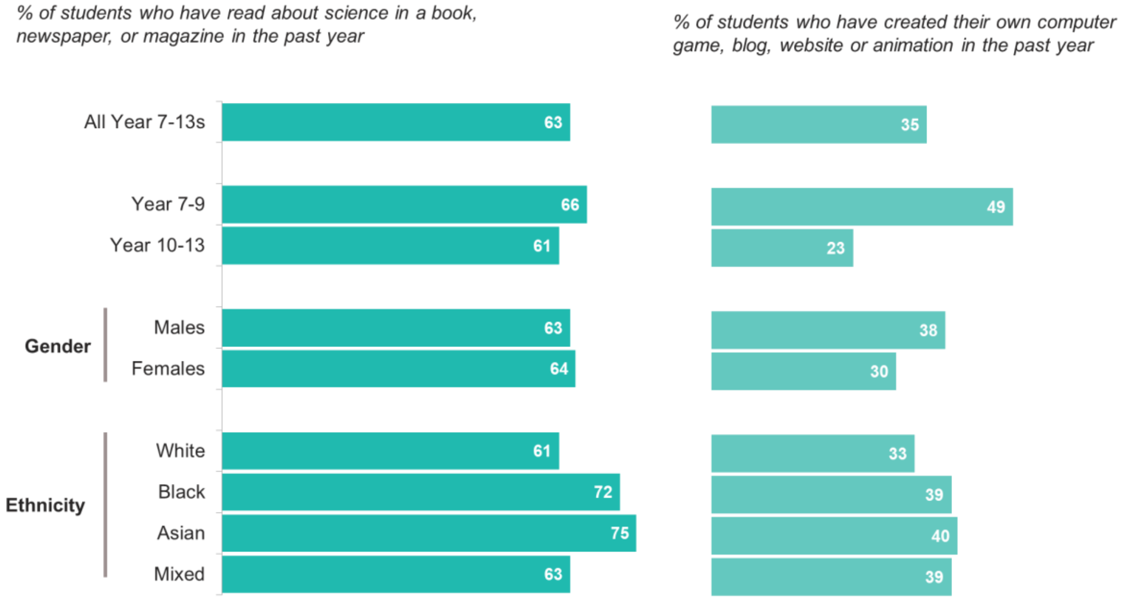


In the past 12 months, how often, if at all, have you done the following outside of school? (SciMediaA–F)
Base: All years 7–13 (7,256)

There was variation in engagement with these resources and activities by demographic profiles. Figure 2.9 displays the demographic variation for two of these measures as an example, based on the percentage who have engaged in these activities at least once a year.

This shows that the tendency to read science in a book, newspaper or magazine was higher among students from a Black or Asian background (72% and 75% respectively compared with 63% overall) while engagement with technology–based activities was higher for students in years 7–9 (49% compared with 23% in years 10–13) and also more common among male students (38% compared with 30% of female students), and students from Black and Asian ethnic backgrounds (39–40% compared with 33% of white students). This mirrors wider themes in this report, which indicate stronger interest in computing and technology amongst male students (see Chapter 5).

Figure 2.9: Percentage of years 7–13 who had i) read about science in a book, newspaper or magazine and ii) created a computer game, blog, website, or animation in the last 12 months by demographic groups (2023)

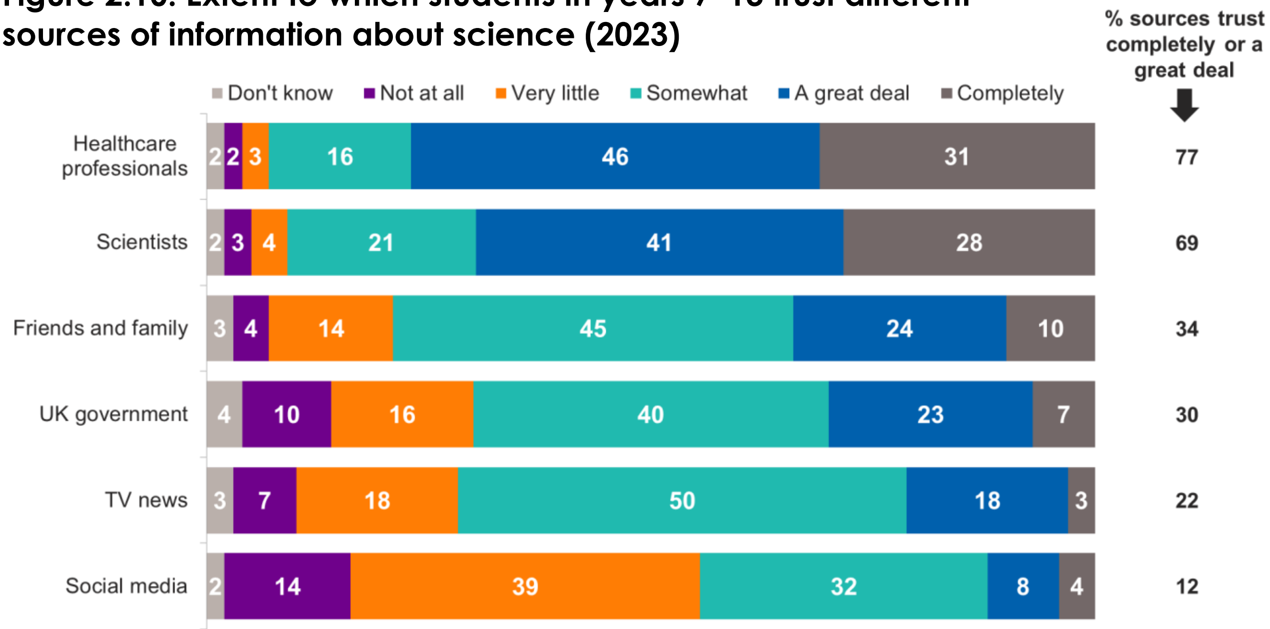


In the past 12 months, how often, if at all, have you done the following outside of school? (SciMediaA–F)
Bases: All years 7–13 (7,256), All years 7–9 (3,077), All years 10–13 (4,179), Males (3,428), Females (3,601), White (5,115), Black (487), Asian (935), Mixed (450)

2.7 Sources young people trust for information on science

Another new measure introduced to the study in 2023 examined the levels of trust young people had in different information sources about science (Figure 2.10). Focusing on the percentage who trusted sources completely or a great deal, more than three–quarters of young people (77%) trusted healthcare professionals, while 69% trusted scientists. Lower levels of trust were observed for friends and family (34%), the UK government (30%), TV news (22%) and social media (12%).

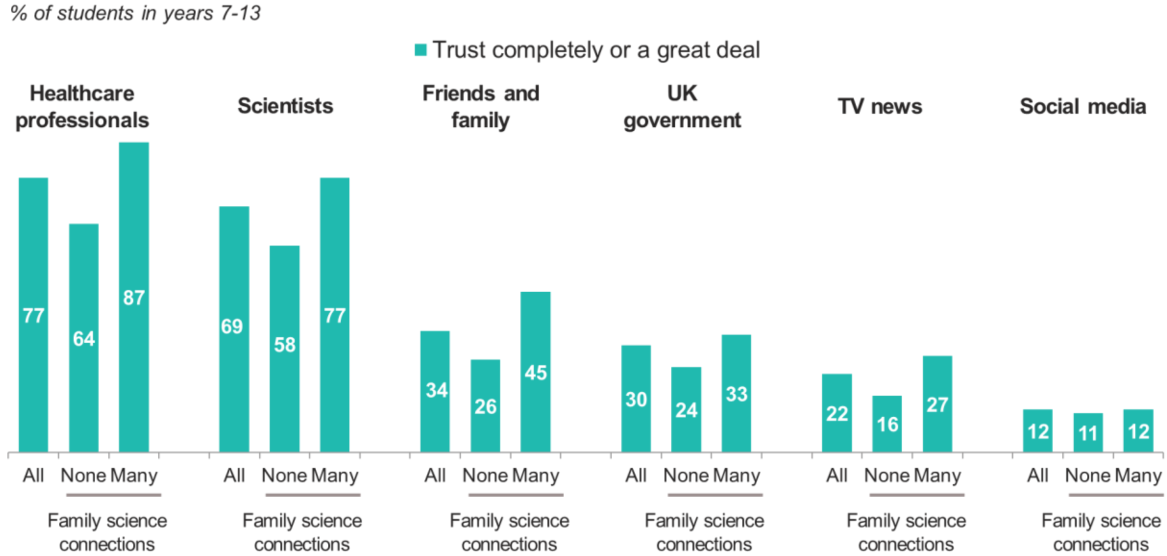
Figure 2.10: Extent to which students in years 7–13 trust different sources of information about science (2023)



To what extent, if at all, do you trust information about science from each of the following sources? (TrustSciA–H)
Base: All years 7–13 (7,256)

Levels of trust in these sources varied by number of family science connections. Other than social media, young people with many family science connections placed more trust in all sources compared to those with no such connections. This is particularly apparent for healthcare professionals (64% of students with no family science connections trust them completely or a great deal compared to 87% of those with many family science connections) with similar differentials for trust in scientists (58% vs 77%) and TV news (16% vs 27%) (Figure 2.11).

Figure 2.11: Level of trust amongst year 7–13 students in sources of information about science by Family Science Connections Index (FSCI–Science) (2023)



To what extent, if at all, do you trust information about science from each of the following sources? (TrustSciA–H)
Bases: All years 7–13 (7,256), No FSCI–Science connections (1,667), Many FSCI–Science (1,320)

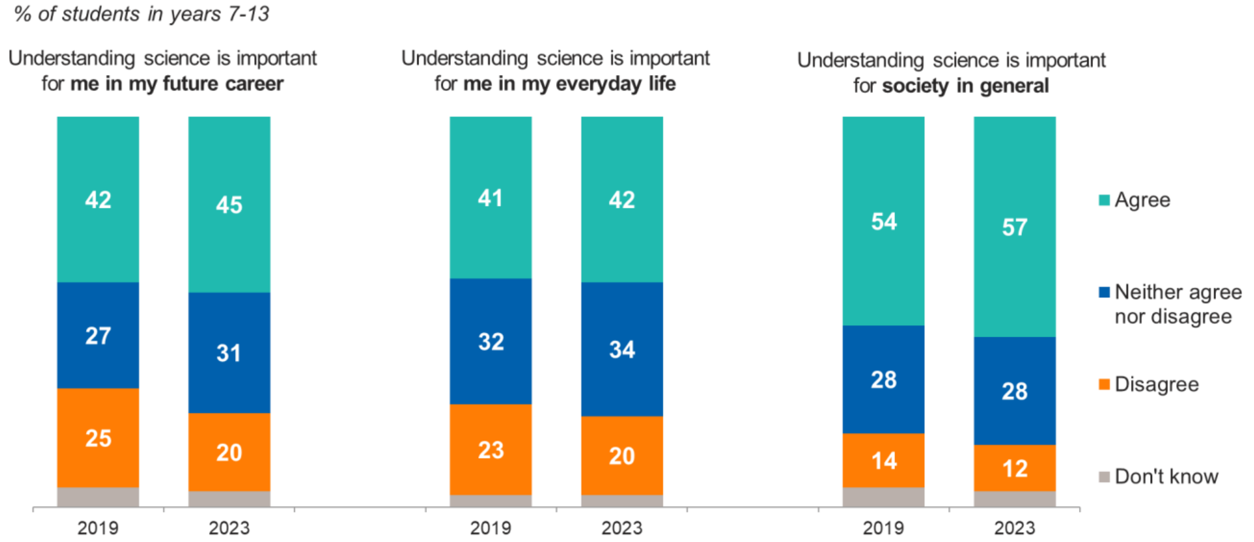
2.8 Importance of science in everyday life

Maintaining engagement with science outside of the classroom helps build scientific literacy in young people and an increased awareness of how science can be used in society and future careers.

Building on similar questions asked in 2019[14], young people in years 7–13 were asked how much they agreed or disagreed that science is important for their future career, everyday life, and society in general.

In SET 2023, 45% agreed that understanding science was important for them in their future career, 42% that it was important to them in their everyday life, while over half (57%) agreed that science had wider relevance and was important for society in general. A comparison of the data from 2019 and 2023 points to an increase in the percentage of young people who believed that science was relevant to their future career (42% vs 45%) and to society in general (54% vs 57%) (Figure 2.12).

Figure 2.12: Extent to which young people in years 7–13 agreed that understanding science is important in different contexts (2019, 2023)

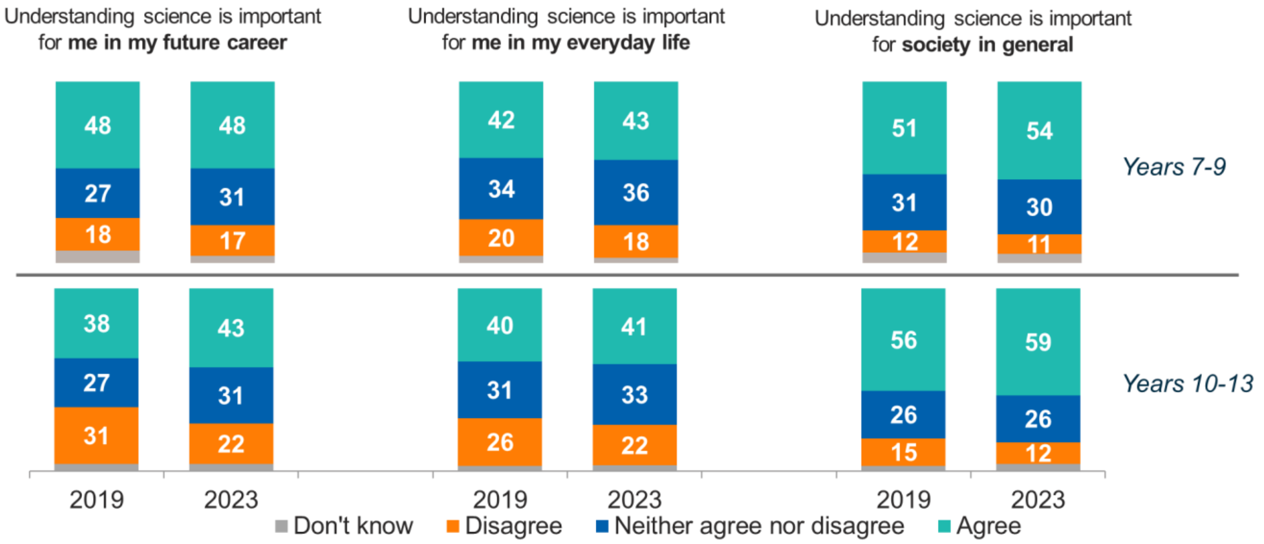


How much do you agree or disagree with the following: Understanding science is important for me in my future career. (SciUse_1) | Understanding science is important for me in my everyday life. (SciUse_2) | Understanding science is important for society in general. (SciUse_3)
Bases: All students 2023 (7,256), 2019 Sample A (3,150)

[14] Whilst a similar question was asked in 2016, results are not directly comparable.

Breaking down these findings by year group, Figure 2.13 indicates that the observed increase between 2019 and 2023 in the percentage who agreed that understanding science was important for a future career was driven by an increase in year 10–13 students who agreed with this (38% vs 43%). However, the increased propensity to feel that science was important for society in general was observed across both age categories. Levels of agreement that understanding science is important for everyday life appear to have remained more stable over time. However, students in years 10–13 were more likely to disagree with this statement than in 2019.

Figure 2.13: Extent to which young people agreed that understanding science is important in different contexts by year groups (2019, 2023)

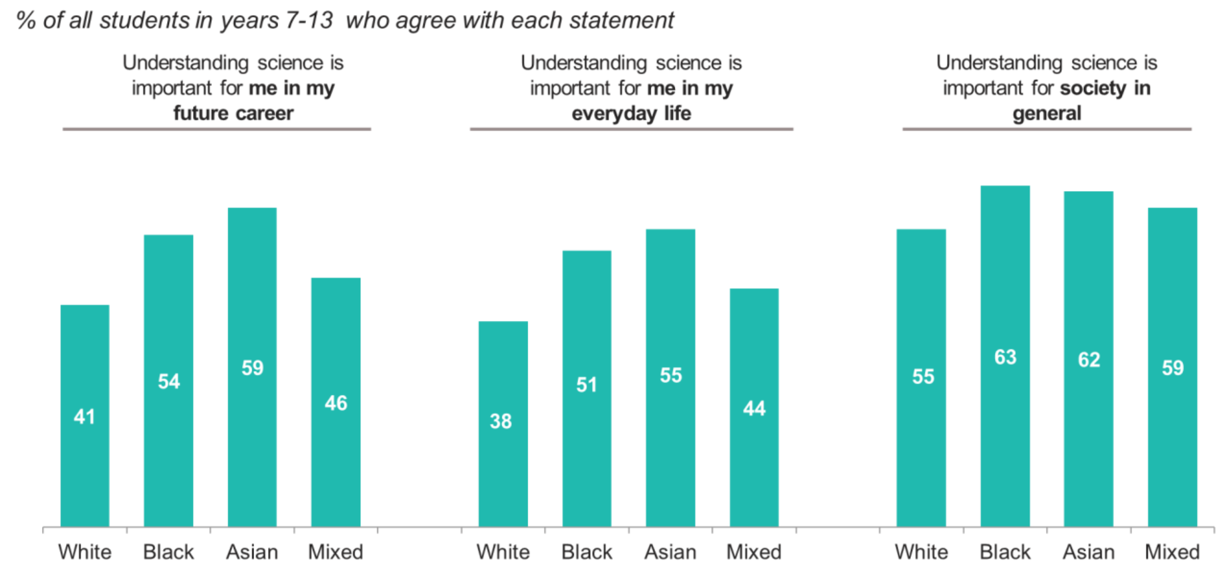


How much do you agree or disagree with the following: Understanding science is important for me in my future career. (SciUse_1) | Understanding science is important for me in my everyday life. (SciUse_2) | Understanding science is important for society in general. (SciUse_3)
Bases: Years 7–9 2023 (3,077), 2019 Sample A (1,153); Years 10–13 2023 (4,179), 2019 Sample A (1,997)

As with several other measures of science engagement outside of the formal school lesson setting, there were differences in the perceived importance of science by different ethnic groups. In response to all three statements about the importance of science, Asian and Black students were more inclined to agree than white students, and in each case, those from mixed–race backgrounds fell somewhere in between (see Figure 2.14).

Over half of Asian and Black students (59% and 54% respectively) agreed that understanding science was important for a future career, compared to only 41% of white students. A lower percentage of white students (38%) agreed that understanding science was important for their everyday life, again below the agreement levels of Black students (51%) and Asian students (55%).

Figure 2.14: Extent to which young people in years 7–13 agreed that understanding science is important in different contexts by ethnic group (2023)



How much do you agree or disagree with the following: Understanding science is important for me in my future career. (SciUse_1–3)
Bases: All students (7,256), White (5,115), Mixed (450), Asian (935), Black (487)

3. Attitudes towards learning science compared with other subjects

This chapter explores students' interest, engagement, and perceived ability in science, with comparable questions asked about other school subjects. In this way, it is possible to gauge the extent to which attitudes towards learning science are specific to science rather than part of a more generic set of attitudes towards school subjects. Results are compared with SET 2016 and SET 2019 where applicable.

Key findings

Changes over time

Between 2019 and 2023, levels of interest in science at school decreased. Among year 7–9s, overall interest in science fell from 76% to 71%, while among year 10–13s interest levels fell for biology (from 74% to 71%) and chemistry (from 59% to 55%) with interest in physics unchanged (53%). As a comparison, there was also a decline in interest in English (from 65% to 60%), which indicates that these changes over time may be part of a wider post–pandemic shift.

The decline in interest in science was more pronounced among younger cohorts. Overall interest dropped from 83% to 72% and from 76% to 70% among year 7s and 8s, respectively, while this remained more stable among year 9s. Students in years 7 and 8 would have been in key stage 2 (primary school) during 2020–21, and it is possible that this change could be a pandemic–related cohort effect, with younger students less prepared for secondary school than older cohorts who transitioned schools before the pandemic.

In years 7–9, the decline in interest in science was more accentuated among females, which has led to the creation of a gender gap. In years 7 and 8 there were larger percentage falls among females compared to males, while at year 9 interest among males rose between 2019 and 2023 but fell amongst females. The net effect of this is that, while there was no year 7–9 gender gap in interest in science in 2019 (males 77%; females 75%), there is a relatively wide gender gap in 2023 (males 76%; females 65%).

Compared with 2019, young people in years 7–9 were less confident in their abilities across most subjects, including science. The percentage of younger students who thought they were 'good' at different subjects including maths, English, science and computing has fallen, and these declines are reflected across both genders. The drop in perceived ability was sharpest for science (from 56% to 49%) and computing (from 50% to 43%).

2023 findings

In years 7–9, design and technology was the most popular of the nine subjects ranked. Science was ranked about midway, and below maths and English. Computing, geography and languages occupied the bottom three rankings.

In years 10–13, biology was the most enjoyed and physics the least enjoyed science subject. Biology was ranked 3rd, chemistry 7th and physics 8th out of 11. The bottom three rankings were the same as in years 7–9, with computing ranked 10th out of 11.

In years 7–9, computing was the second most popular subject for males and the least popular subject for females. In this age group males also ranked maths and science higher than females although the gender gaps were smaller. Among year 10–13s, females ranked biology a little higher than males (a ranking of 3 vs a ranking of 4 out of 11), though males ranked physics higher than females (a ranking of 5 vs a ranking of 9 out of 11).

Compared with maths and English, students were less likely to think of themselves as 'good' at science. In years 7–9 and 10–13, students were most likely to rate themselves as good at maths (61% and 57% respectively) and English (60%, 58%). In comparison, students had lower levels of self–belief in science: 49% felt they were good at science in years 7–9, and in years 10–13 this percentage ranged from 40% in physics to 48% in biology.

Females were much less likely than males to think of themselves as 'good' at maths, computing, science (years 7–9), and physics (years 10–13). By contrast, there was no gender gap for chemistry and history, and for English and biology the gender gap was reversed.

Across all school years, interest and confidence in ability in science at school were generally stronger among students (i) from a Black or Asian background, (ii) with strong family science networks, (iii) who had studied triple science (years 10–13), or (iv) who lived in London and more affluent areas. In contrast, students who self–reported difficulties relating to emotions, concentration, behaviour or social skills were less likely to be interested in, or to rate themselves as 'good' at science subjects.

There was a strong association between perceived ability and interest in science. Across all school years, students who rated themselves as 'good' at science (years 7–9) or in the separate sciences (years 10–13) expressed much higher levels of interest in the relevant subject. For example, 91% of students in years 7–9 who rated themselves as good at science were interested in science compared to 29% who rated themselves as 'not good' at science.

3.1 Context

As explored later in Chapter 4, pupils' strongest motivations to learn science were interest in the subject, the opportunity to do practical work, having a good teacher, and the value of the subject. However, a lack of confidence or perceived ability in the subject ('science can be difficult') and concern about the volume of work ('there is a lot to learn and remember') were the most common barriers to engagement.

The findings in this chapter further show that interest in science is unequally distributed across different demographic subgroups including gender, ethnic background and family science networks, and that the nature of these differences appears to be specific to engagement in science, rather than across school subjects in general.

The SET 2023 findings indicate that engagement in science is very clearly related to perceived ability. Supporting these results, the Trends in International Mathematics and Science Study in England (TIMSS) indicated that confidence was more strongly associated with maths and science achievement than other factors such as subject enjoyment, teaching quality (termed 'instructional clarity') or valuing the subject (Richardson et al., 2020).

Furthermore, findings from this study and elsewhere (Wellcome, 2020; Archer et al., 2020; Richardson et al., 2020) consistently point to a wide gender divide in self–perceived ability. Evidence noted in Chapter 4 indicates that across years 7–9 half (50%) of all females cited perceived difficulty of science as a barrier, compared with 31% of males.

More widely, the SET 2023 results and trends over time need to be viewed in the context of the COVID–19 pandemic disruption to school education within the three years preceding the SET 2023 survey. Survey evidence from SET 2023 suggests that the pandemic may have negatively affected levels of interest and self–perception in science since 2019. Furthermore, the results point to younger cohorts who had more recently transitioned from primary school as having been most affected.

This chimes with a number of recent research studies (for example EEF 2022; Twist et al. 2022; Canovan & Fallon, 2021; Wellcome, 2021) which show a negative impact on attainment at primary schools as a result of the pandemic, and especially among pupils from disadvantaged backgrounds. While there is limited external information on the pandemic impact of attainment on science outcomes, Twist et al. (2022) report that fewer pupils achieved high scores in key Stage 2 maths compared to before the pandemic. In terms of science, Canovan & Fallon (2021) found that a significant percentage of primary school teachers taught a reduced science curriculum during lockdowns, with a consequent narrowing of topics being taught, while Ofsted (2020) noted that nearly all primary schools visited during a series of interim visits at that time said that they were prioritising reading and mathematics, with very few schools focusing on science. This was backed up by Wellcome (2021) who reported that during lockdown, 42% of primary schools said they taught a reduced science curriculum and 34% prioritised other subjects over science.

3.2 Enjoyment of science

Enjoyment of science compared with other subjects

Young people were asked to rank school subjects based on which subjects they enjoyed the most/least. The format of the questions differed according to school stage:

- Students in years 7–9 were asked about a range of subjects which were expected to be compulsory in these school years. As many young people study sciences as a combined subject at this stage, students were asked to rank 'science' as a single subject.
- Students in years 10–13 were asked about the same range of subjects, although the three science subjects (biology, chemistry, physics) were ranked separately. Students in these older years were asked to think back to subjects they had previously studied before narrowing their choices at GCSE.

Figure 3.1 shows the mean rankings per subject for the two school stages.

- In years 7–9, the highest possible rank would be a score of 1 and the lowest would be a score of 9, although in practice mean scores ranged from 4.08 to 6.27.
- In years 10–13, the highest possible rank would be a score of 1 and the lowest would be a score of 11, although mean scores ranged from 4.66 to 7.61.

There were some common themes across the two school stages:

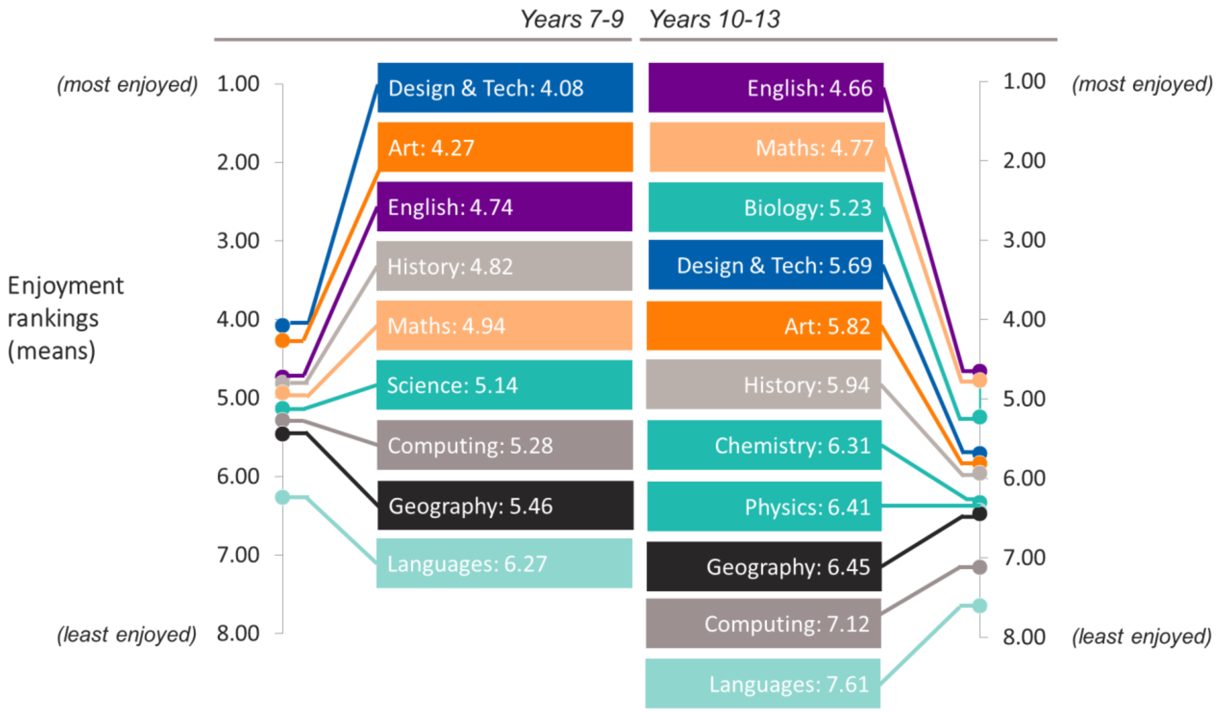
- Maths and English were ranked above science subjects at both school stages, and were ranked highest in years 10–13.
- Computing, geography and languages occupied the bottom three rankings for both school stages.
- Languages were ranked at the bottom in both school stages.

There were also some differences by school stage:

- Design & technology and art were the most popular subjects in years 7–9, though these were ranked lower in years 10–13.
- In years 10–13, when sciences are studied separately, biology was clearly the most enjoyed science subject, and physics was the least enjoyed.

A similar question was asked in 2019, although new subject options were added in 2023: design & technology (for years 7–9) and art and design & technology (for years 10–13). This means that we are unable to make direct comparisons between 2019 and 2023. However, the relative subject rankings for subjects covered in both waves have remained broadly unchanged, with the exception that in 2023 maths was slightly lower in the rankings at both stages compared with 2019.

Figure 3.1: Mean enjoyment rankings at years 7–9 (key stage 3) and years 10–13 (key stage 4) (2023)



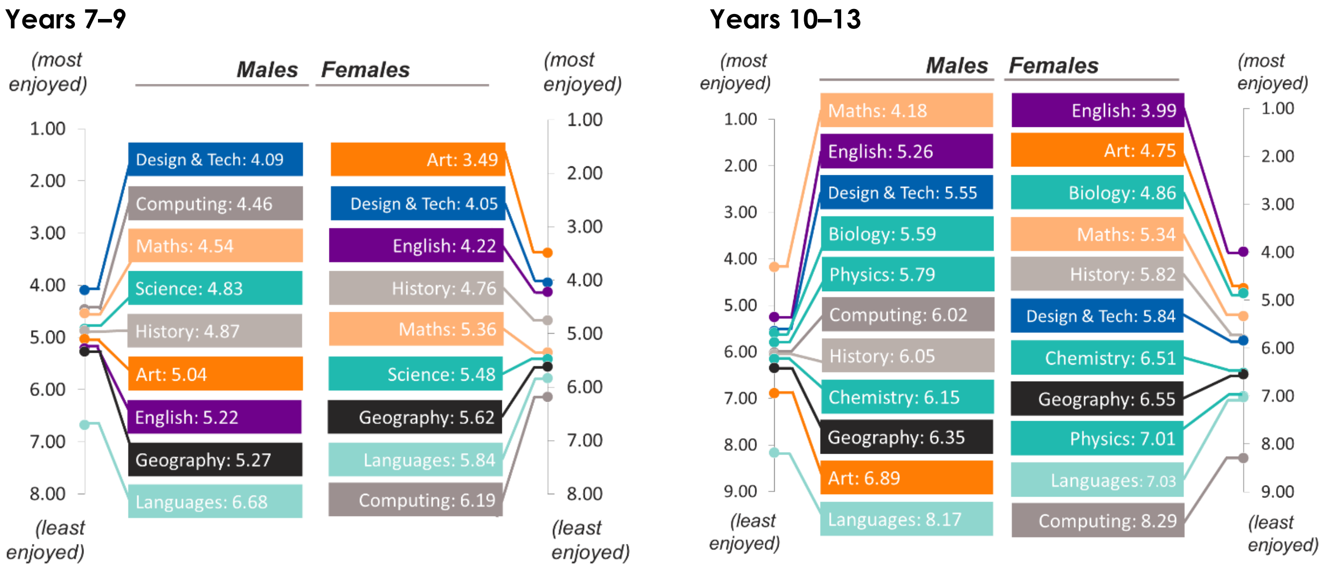
Please scroll through the whole list to the bottom and then rank all these subjects in order with 1 being the subject you enjoyed the most and 11 the subject you enjoyed the least. If you no longer study these subjects, think back to when you were studying them. (SchSubEnj, SchSubEnj2)
Bases: All year 7–9s (3,020); Half sample A year 10–13s (2,042)

Enjoyment of science by gender

Figure 3.2 displays the mean rankings by gender for year 7–9 students and year 10–13 students. Some notable gender differences can be observed:

- Males ranked maths higher than females at both school stages, and it was the highest ranked subject for males among year 10–13 students.
- Males ranked computing higher than females in years 7–9 and years 10–13, though the difference in years 7–9 was especially striking where males ranked it second highest and females ranked it lowest.
- In years 7–9, males ranked science slightly higher than females.
- In years 10–13, the mean ranking for biology was higher for females than for males. However, males were much more likely than females to prefer physics while chemistry was ranked similarly by both males and females.
- Females were much more likely than males to rank art in a top position at both school stages.
- In years 10–13, maths and English were within the top four rankings for both genders, although maths was ranked higher by males.

Figure 3.2: Mean enjoyment rankings at years 7–9 (key stage 3) and years 10–13 (key stage 4) by gender (2023)



Please scroll through the whole list to the bottom and then rank all these subjects in order with 1 being the subject you enjoyed the most and 11 the subject you enjoyed the least. If you no longer study these subjects, think back to when you were studying them. (SchSubEnj, SchSubEnj2)
Bases: All year 7–9 males/females (1,503/1,446); Half sample A year 10–13 males/females (915/1,065)

3.3 Interest in science among young people in years 7–9

Overall interest in science among years 7–9

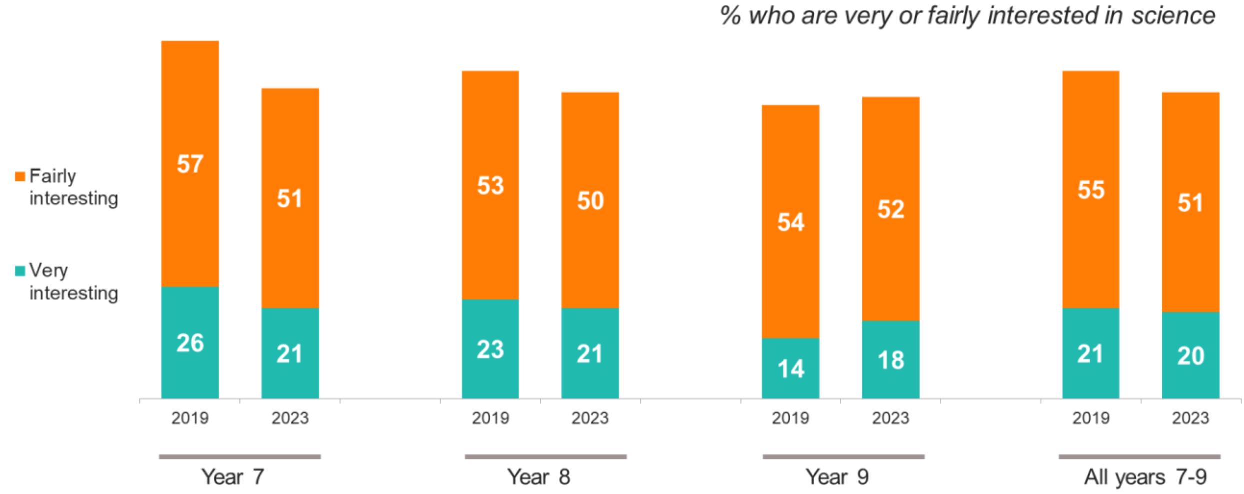
In 2023, 71% of students in years 7–9 found science interesting: 20% found it very interesting and 51% fairly interesting. Three in ten (28%) found it either not very interesting (22%) or not at all interesting (7%) (Figure 3.3).

Figure 3.3 also demonstrates a decrease in level of interest between 2019 and 2023, and especially amongst students in the early years of secondary school. The overall level of interest amongst those in years 7–9 has fallen from 76% in 2023 to 71% in 2023, while among year 7s it has fallen from 83% to 72%, and among year 8s from 76% to 70%. The level of interest has remained more stable among year 9s.

This more pronounced drop in interest between 2019 and 2023 among the younger year groups means that there is a different pattern of findings in 2023 compared with 2019. In 2019 we observed declining rates of interest in science between year 7 and year 9. However, in 2023, this is no longer the case, with levels of interest now remaining relatively stable over the first three years of secondary school.

This could be a pandemic–related cohort effect. Students in years 7 and 8 would have been in primary school years during the pandemic, while those in year 9 were already at secondary school at this time. Ofsted (2020) noted that when schools returned to education after the pandemic, there was evidence that in some primary schools English and maths received more attention than science. It is therefore possible that the disruption the younger cohort faced while at primary school has made the transition from primary to secondary school more difficult, which may partly explain these changes among the younger year groups.

Figure 3.3: Extent to which young people in years 7–9 were either 'very interested' or 'fairly interested' in science, by year group (2019 & 2023)



How interesting do you find the following lessons at school?.....a) Science (SciIntA)
Bases (2023): All year 7–9s (3,077): year 7 (993); year 8 (1,032); year 9 (1,052)
Bases (2019): All year 7–9s (2,314): year 7 (775); year 8 (814); year 9 (725)

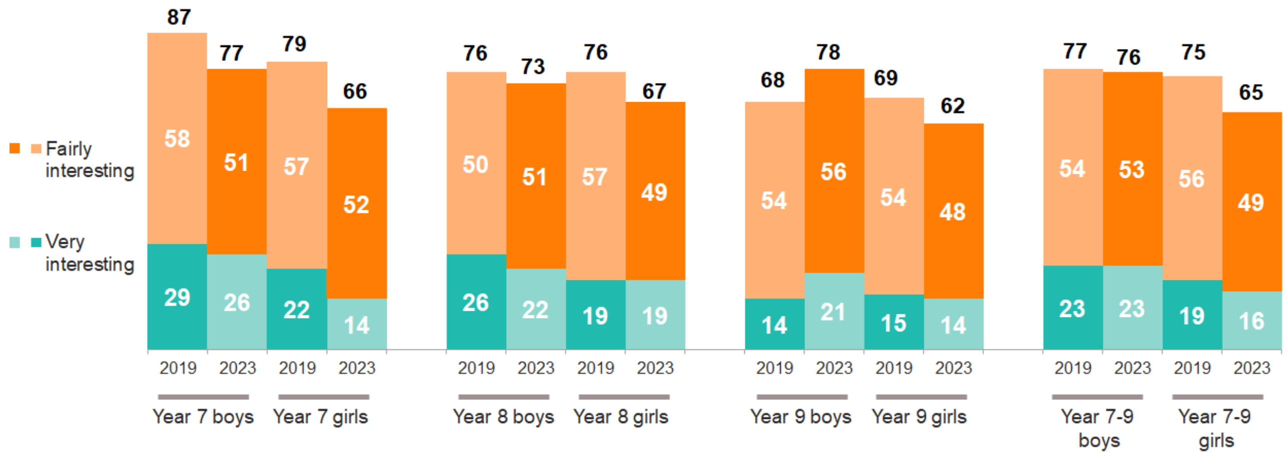
Overall interest in science among years 7–9 students by gender

Although lower levels of interest in science were recorded among all year 7–9 students in 2023 compared to year 7–9 students in 2019, this decrease over time was more evident among females than males (Figure 3.4). For example, in year 7, while there has been a 10 percentage point drop in overall interest among males, for females the drop is 13 percentage points. And in year 8, while there has been a 3 percentage point drop in overall interest among males, for females the drop is 9 percentage points. At year 9, interest among males has actually risen between 2019 and 2023 (from 68% to 78%) but amongst females it has fallen (from 69% to 62%).

This means that, while there was no gender gap in interest in science among those in years 7–9 in 2019 (males 77%; females 75%), there is now a relatively large gender gap in 2023 (males 76%; females 65%). It is unclear why the decline in interest over time is more associated with females than males, although Andrews (2024) notes that the pandemic appears to have had a bigger effect on girls than on boys in terms of attainment outcomes.

Chapter 5 shows that there was a similar pattern of findings in relation to level of interest in computing among those in years 7–9.

Figure 3.4: Extent to which young people in years 7–9 were either 'very interested' or 'fairly interested' in science, by gender (2019 & 2023)

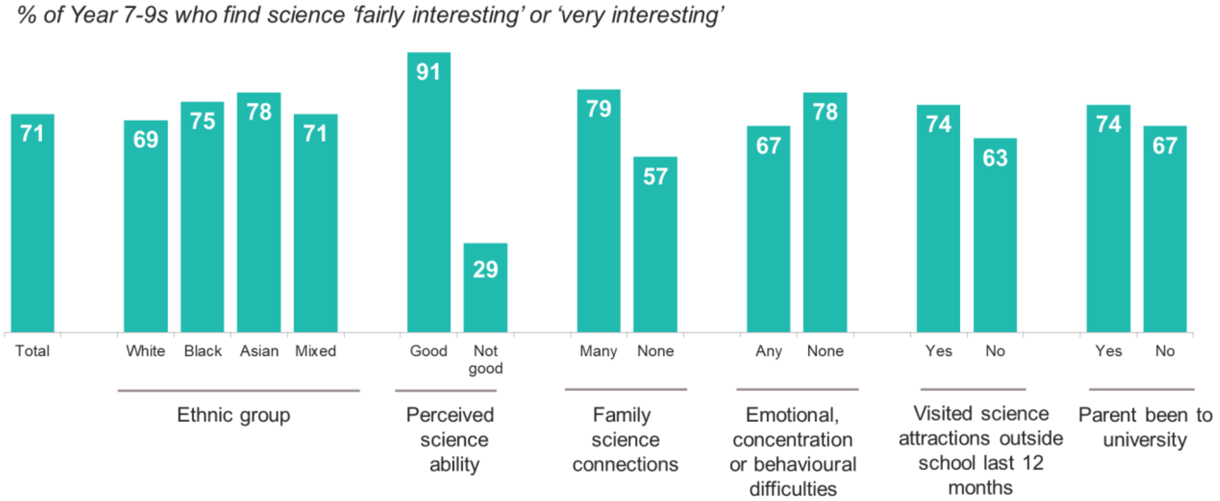


How interesting do you find the following lessons at school?.....a) Science (SciIntA)
Bases (2023): All year 7–9 males/females 2023 (1,535/1,466); year 7 males/females (494/475); year 8 males/females (536/470), year 9 males/females (505/521)
Bases (2019): All year 7–9 males/females 2023 (1,170/1,122); year 7 males/females (412/357); year 8 males/females (407/398), year 9 males/females (351/367)

How does interest in science vary across different groups of young people in years 7–9?

Figure 3.4 above displays the gender–related differences in how interested young people in years 7–9 are in science. Figure 3.5 provides a more in–depth look at which other subgroups of young people in years 7–9 find science most interesting.

Figure 3.5: Extent to which young people in years 7–9 were either 'very interested' or 'fairly interested' in science, by various subgroups (2023)



How interesting do you find the science lessons at school? (SciIntA)

Bases: All year 7–9s (3,077): white (2,175); Black (183); Asian (402); mixed (195); perceived science ability good/not good (1,531/486); family science connections many/none (657/579); emotional, concentration, behavioural or social difficulties any/none (1,598/1,320); visited science attractions outside school yes/no (2,201/754), parent been to university yes/no (1,645/1,130)

At an overall level, interest in science among those in years 7–9 was linked to a range of factors. Across all school years 7–9, the following groups were most likely to find science interesting:

- Students from Black and Asian ethnic groups.
- Students who considered themselves 'good' at science.
- Students with strong family networks in science.
- Students who did not self–report any difficulties related to emotions, concentration, behaviour or social skills.
- Students who had made visits to science attractions outside school in the past 12 months.
- Students who had a parent who had been to university.

These patterns of demographic differences reflect similar findings in SET 2019 and in the ASPIRES 2 study, which found an over–representation of young people with science aspirations who were males, high–achieving, from higher socio–economic groups, with high levels of science capital, and from South Asian, Chinese and Black backgrounds (Archer et al., 2020).

There was no difference in level of interest by disadvantage based on IDACI quintiles.

3.4 Interest in science among young people in years 10–13

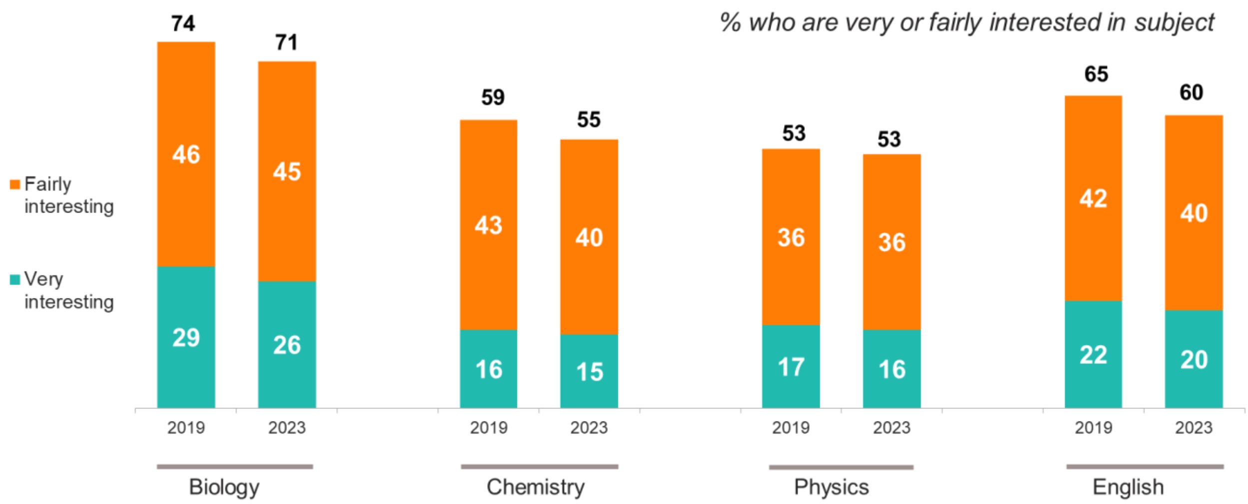
In years 10–13, young people were asked about their interest in each of the three sciences individually; interest in English is also shown as a comparison (see Figure 3.6). As in SET 2019, year 10–13 students were most interested in biology (71%) and least interested in chemistry (55%) and physics (53%), while English (60%) was found more interesting than chemistry and physics. Relative levels of interest in the sciences is consistent with the ranking findings shown in Figure 3.1.

As with students in years 7–9, students in year 10–13 were more negative about science subjects compared with 2019. In comparison to 2019, year 10–13 students in 2023 were slightly less interested in biology (74% in 2019 compared to 71% in 2023) and chemistry (59% to 55%, respectively), while the overall level of interest in physics remained unchanged.,

In comparison, there was also a decline in interest in English (from 65% to 60%) which indicates that these changes over time may be part of a wider post–pandemic shift, and not related only to science.

Among years 7–9, we saw that the decline in interest in science between 2019 and 2023 was more accentuated among females (Figure 3.4). However, this was not evident to the same extent among students in years 10–13. There was a slightly steeper fall in the percentage who were interested in biology among females (from 80% in 2019 to 75% in 2023) than males (from 69% to 67%), although the decline in interest in chemistry was similar for females (from 55% to 51%) and males (from 63% to 58%). For English, the reverse situation was found: interest dropped from 56% to 49% for males and remained stable among females (73% in 2019, 72% in 2023).

Figure 3.6: Extent to which young people in years 10–13 were either 'very interested' or 'fairly interested' in science (2019 & 2023)



How interesting do you find the following lessons at school?..... (OtherInt1,OtherInt2,OtherInt3)
Bases (2023): All year 10–13s (4,179). Bases (2019) All year 10–13s (2,098)

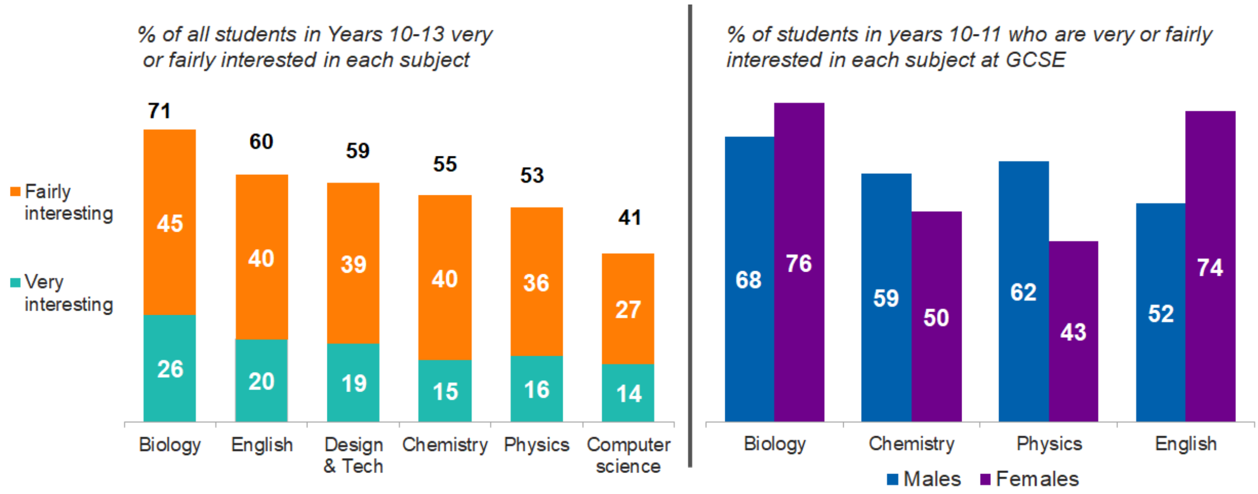
Interest in science compared with other subjects in years 10–13

In years 10–13, students were asked how interested they were in six subjects as displayed in Figure 3.7 (left-hand side). Students who were no longer studying these subjects were asked to think back to when they were studying them at GCSE or beforehand. Of the three sciences, biology (71% interested) was perceived to be more engaging than all other subjects, while English (60% interested) and design and technology (59% interested) were more enjoyed than chemistry (55%) and physics (53%). Computing (41% interested) was least enjoyed of these five subjects – Chapter 5 covers the level of interest and engagement in computing in more detail.

However, among those in years 12 and 13 who had chosen to study the subject at sixth form, levels of interest in these subjects were substantially higher (98% for biology, 95% for chemistry and 93% for physics). However, those studying physics and chemistry at years 12 and 13 were less likely to find their chosen subject 'very interesting' (74% for biology, 60% for chemistry and 65% for physics).

The three sciences, together with English, are compulsory for most students in the GCSE years, years 10 and 11. Figure 3.7 (right hand side) displays the level of interest in these subjects for students in years 10 and 11 by gender. Amongst those studying for their GCSEs, gender differences in levels of interest are observed which correspond with the gender differences by subject ranking shown in Figure 3.2 above. Females were more interested in biology (76% vs 68% of males) and markedly more interested in English (74% vs 52% of males), while males were more interested in chemistry (59% vs 50% of females) and physics (62% compared with 43% of females).

Figure 3.7: Extent to which young people in years 10–13 were either very or fairly interested in different subjects (2023)



How interesting do you find the following lessons at school?.....a) Science (SciIntA)

Bases: a) All year 10–13s (4,179), b) all year 10–11 males/females (989/1080)

How does interest in science vary across different groups of young people in years 10–13?

As noted above, interest in the three sciences was measured separately among those in years 10–13. It is useful to identify some common patterns of demographic differences across the three sciences, and to indicate how this compares with English as a comparison non–science subject. For this analysis, results have been rebased on students in years 10–11 when these subjects are compulsory for everyone, and exclude students in years 12–13 when only small percentages of students decide to study these subjects beyond age 16.

Across the three sciences, the following groups of students in years 10–11 were more likely to be interested in each science subject.

Generic factors (not related to science)

Students:

- From Asian or Black ethnic backgrounds.
- Who have a university–educated parent.
- Who do not self–declare any problems related to emotions, behaviour or concentration (vs those that do).
- Who live in London.

Science–related factors

Students:

- Who perceive themselves to be good at the subject.
- Who have a strong science identity.
- Who study triple science rather than double science.
- Who have many family science connections.

The variation in levels of interest in science subjects among years 10–11 by generic factors was not also observed for interest in English, which suggests that this pattern of demographic variation may be specific to science subjects rather than part of a more general pattern of engagement with school subjects. There were no differences in levels of interest in English by ethnicity, parental university education, or emotional or behavioural difficulties. And while there were regional differences in levels of interest in English, these were different to the sciences: interest in English was no higher in London than average, but instead interest levels were highest in the North East.

For biology (but not chemistry or physics) in years 10–11 there was a gradient by IDACI quintile with those in the least deprived quintile displaying more interest than those in the most deprived quintile (from 64% in the most deprived quintile to 79% in the least deprived quintile). However, for English, this gradient was reversed with interest levels highest in the most deprived quintile (from 65% in the most deprived quintile to 61% in the least deprived quintile).

3.5 Perceived ability in the sciences

Perceived ability in the sciences compared with other subjects

As discussed in section 3.1, students' perceptions of their own ability in science at school can play a central role in shaping their performance. Findings reported in section 4.2 indicate that perceptions of difficulty are greater barriers to engagement in science than interest in the subject, and this is especially the case among females, where 50% of year 7–9 females cited this as a barrier compared with 31% of year 7–9 males.

As in SET 2019, students in SET 2023 were asked about their own level of ability in science and other subjects.

Students in years 7–9 were asked to rate their ability in the following subjects:

- Maths.
- Design & Technology (added in 2023).
- English.
- History.
- Science as a combined subject.
- Computing.

Students in years 10–13 were asked to rate their ability in the following subjects (students in years 12–13 who were no longer studying these subjects were asked to think back to when they were studying them at GCSE):

- Maths.
- Design & Technology (added in 2023).
- English.
- Biology, chemistry, physics.
- Computing.

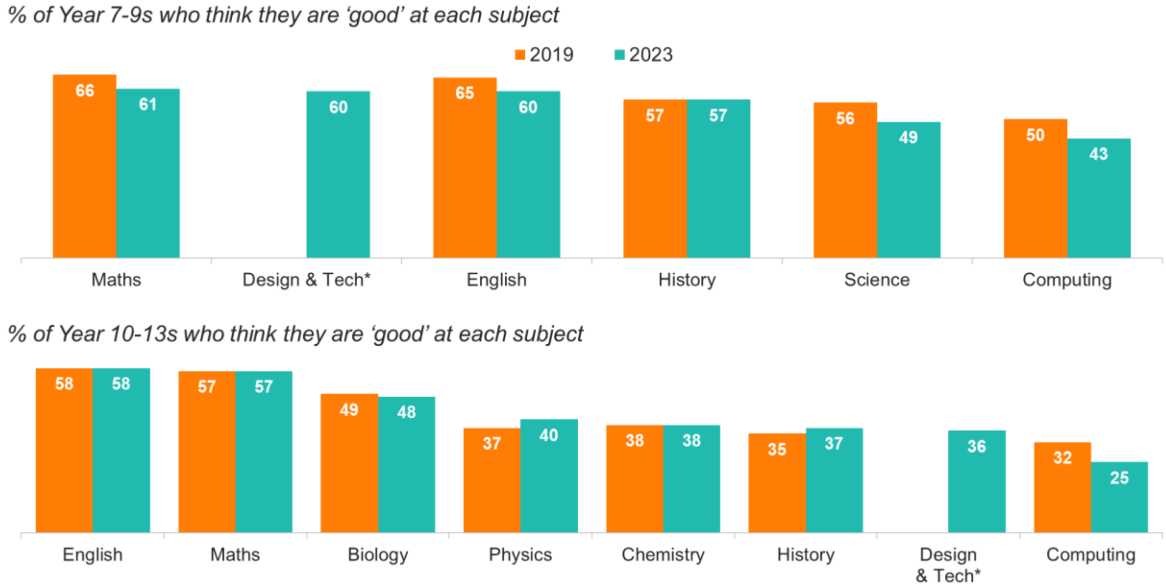
Figure 3.8 shows the percentage of students in years 7–9 (top chart) and 10–13 (bottom chart) who thought of themselves as 'very good' or 'good' at each subject. Findings are compared with SET 2019 for all subjects included in both surveys.

In SET 2023, students in years 7–9 (where all subjects are still compulsory) displayed higher levels of perceived ability in maths (61%), design and technology (60%) and English (60%). In comparison, year 7– 9 students were relatively less likely to rate their abilities in science (49%) and computing (43%).

In SET 2023, there was a similar pattern of results for students in years 10–13, with English and maths associated with the highest self–ratings, and the sciences and computing associated with the lowest. While self–ratings of ability remained fairly stable between years 7–9 and years 10–13 for maths and English, there were declines in self–ratings over the two school stages for design and technology, history and computing. This is not surprising since many students will have dropped these non–compulsory subjects for GCSE, which is likely to depress ratings of ability. For the sciences, the percentage thinking they were 'good' at each subject ranged from 38% in chemistry to 48% in biology.

In years 12–13, re–basing the survey data only on those studying a science subject at A level or an alternative post–16 qualification, the overall rate of perceived ability in each science subject was much higher at 92% for biology, 93% for physics and 87% for chemistry.

Figure 3.8: Percentages of young people in a) years 7–9 and b) years 10–13 who thought of themselves as 'good' at different subjects (2019 & 2023)



How good would you say you are at the following subjects? (Good1–Good9)

Bases (2023): All year 7–9s (3,077); all year 10–13s (4,179). Bases (2019): All year 7–9s (2,314); all year 10–13s (4,095)

* Design & Technology was added to the question in 2023

As shown in Figure 3.8, self–ratings of ability among students in years 7-9 fell between 2019 and 2023 for most subjects (except for history where ratings remained stable). These decreases were most prominent for science (56% in 2019 vs 49% in 2023) and computing (50% vs 43%). However, amongst those in years 10–13, ratings for all subjects have remained much more stable over time, although there has been a decrease between 2019 and 2023 in the percentage who perceived themselves to be good at computing.

The fall in self–perceptions over time amongst the younger year groups mirrors the findings in section 3.3 where degree of interest in science was found to be lower in 2023 than in 2019. One hypothesis, as already mooted, is that the pandemic affected the younger cohorts more than the older cohorts in terms of school science, as the younger cohort would have been in the late stages of primary school when their education was disrupted. This could have affected the extent to which these younger pupils felt prepared for secondary school science after they made the transition from primary school.

Another way of looking at changes over time and by school year is to compare the equivalent cohort over time. Although this is not a cohort survey that follows up the same participants over time, comparing students in a younger school year in 2019 (e.g. Year 7) with the year group four years later in 2023 (e.g. Year 11) provides an indication of changes within that individual school cohort.

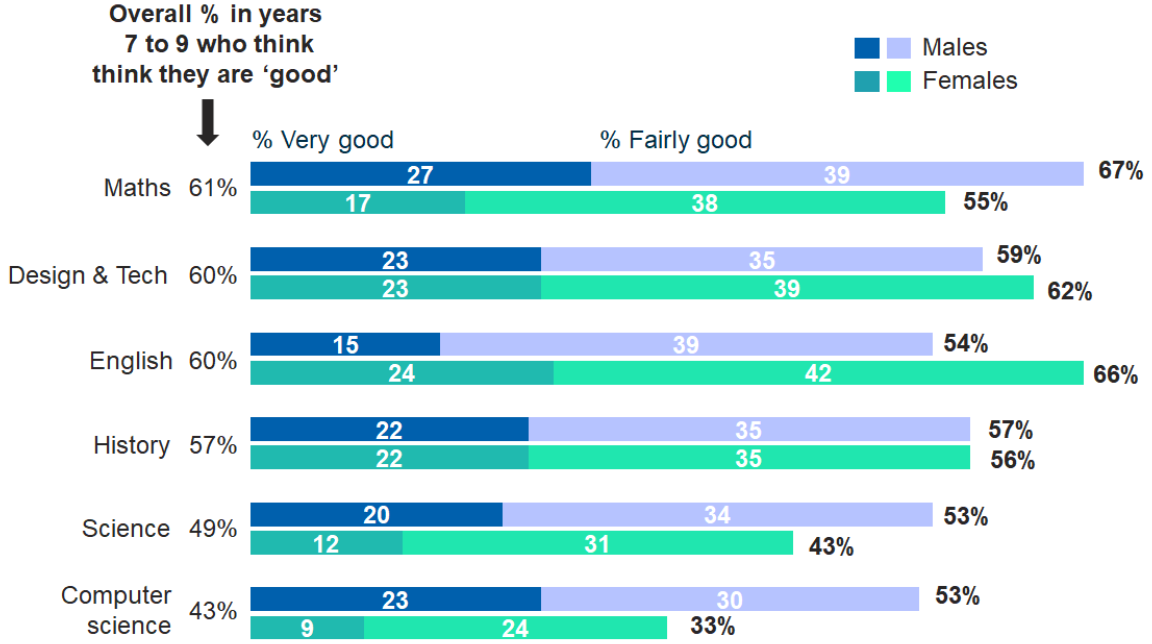
In relation to analysis of self-perception of ability in school subjects, this comparison is only possible for certain year groups and subjects. In 2019, 71% of year 7s thought that they were good at maths. The proportion who thought they were good at maths in the equivalent cohort in 2023 (Year 11) was 59% which indicates a declining rating of self-ability over time.

An equivalent change can be seen for English: 67% of Year 7s in 2019 compared with 57% of Year 11s in 2023.

Perceived ability in science and other subjects by gender

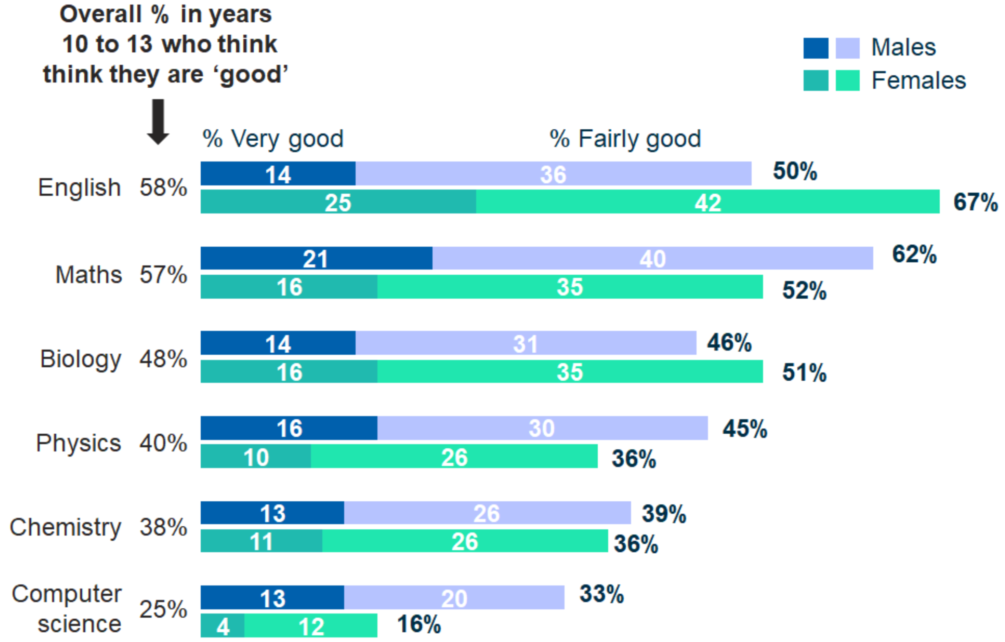
Figures 3.9 and 3.10 display the percentages who consider themselves to be 'very good' or 'good' at each subject by gender. The results are based on 2023 only – however, it is worth noting that the decreases over time highlighted above are reflected across both genders.

Figure 3.9: Percentage of year 7–9 students who thought of themselves as 'good' at different subjects by gender (2023)



How good would you say you are at…[subject]? (Good1–Good6)
Bases: All year 7–9 males/females (1,535/1,466)

Figure 3.10: Percentage of year 10–13 students who thought of themselves as 'good' at different subjects by gender (2023)



How good would you say you are at…[subject]? (Good1–Good9, excl.Good_3)
Bases: All year 10–13 males/females (1,893/2,135)

The data show that female students had considerably lower self–perceptions of their own ability than male students in most STEM subjects in years 7–9 (for maths, science and computing) and years 10–13 (for maths, physics, and computing), although self–ratings for design & technology in years 7–9 were more balanced by gender.

In contrast, the gender gap for English was reversed, with females more likely than males to think they were good at the subject at both school stages; females in years 10–13 were also slightly more likely to rate themselves as good at biology. At years 10–13, ratings are more balanced for chemistry.

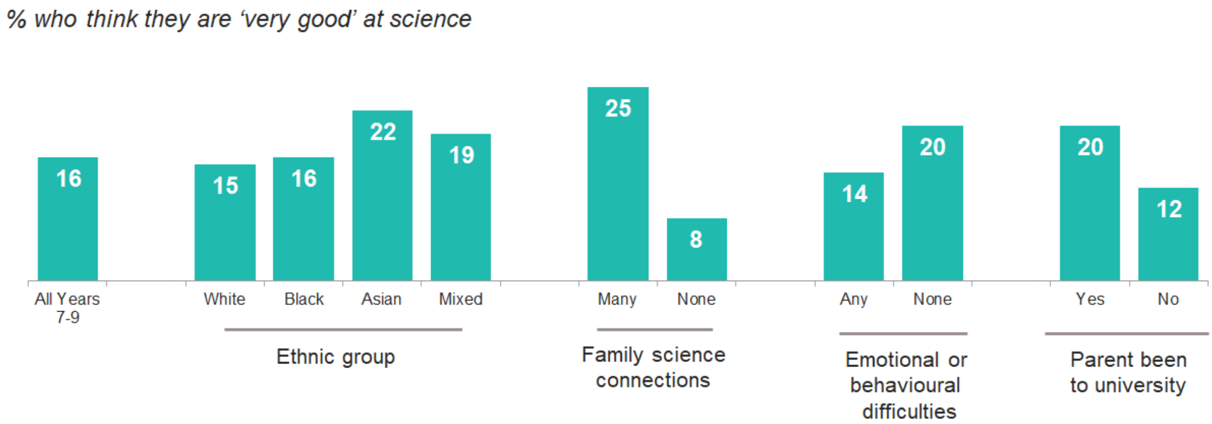
This wide gender imbalance in perceived ability in science reflects a considerable wider body of evidence reporting similar findings (see, for example, DfE, 2019; Hansen and Henderson, 2019; Richardson et al., 2020).

Which groups of students had the highest and lowest levels of perceived ability in science?

Aside from gender differences, perceived ability in science also varied by demographic subgroup. Figure 3.11 shows the percentage of young people in years 7–9 in different groups who considered themselves to be 'very good' at science. The following groups reported a higher self–belief in science (years 7–9):

- Asian students (compared with white students).
- Students with many family science connections (compared with those who had none).
- Students with a university–educated parent (compared with those without).
- Students who did not have any emotional, behavioural or concentration or social difficulties (compared to those who have).

Figure 3.11: Percentage of students in years 7–9 who felt that they were 'very good' at science by ethnic group, family science connections, emotional or behavioural difficulties and parental university attendance (2023)



How good would you say you are at science? (Good3)
Bases: All year 7–9s (3,077); white (2,175); Black (183); Asian (402); mixed (195); FSCI_science: many (657); none (579); Emotional or behavioural difficulties: any (1,598), none (1,320); Parent at university: yes(1,645), no (1,130)

For students in years 10–13 separate ratings of ability were collected for biology, chemistry and physics. Some common themes can be observed across all three subjects, with the following groups of students being more likely to rate themselves as ‘very good’ in each of these science subjects:

- Asian and Black students– for example in biology, 21% of Asian and 21% of Black students vs 13% of white students.
- Students with many family science connections – for example in physics, 22% of students with many connections vs 8% with none.
- Students with a university–educated parent – for example in biology, 20% of students with a degree–educated parent vs 12% of students without a degree-educated parent.
- Students who did not self–report emotional, concentration, behavioural or social problems – for example in biology, 13% who did not report this vs 18% who did.
- Students living in London – for example in chemistry,18% in London vs 12% overall.
- Students living in more affluent areas – for example in physics, 18% being in the least deprived quintile vs 10% being in the most deprived quintile.
- Students taking the triple science pathway – for example in chemistry, 22% taking triple science vs 7% taking double science.

4. Factors affecting motivation to learn science at school

This chapter explores the factors that motivate and discourage students to learn science at school in years 7–9, and to learn biology, chemistry and physics in years 10–13. Where relevant, findings have been compared with SET 2016 and SET 2019.

Key findings

Changes over time

Between 2019 and 2023, year 7–9 students cited more barriers to learning science with the largest shifts relating to quantity of practical work and subject interest. Between 2019 and 2023, there were decreases in the percentages of year 7–9 students motivated to study science because they found it interesting or relevant. Conversely, in 2023, greater percentages of year 7–9 students indicated they were put off learning science because of lack of interest in it and lack of practical work. In 2019, 21% said that that nothing had put them off learning science although this declined to 13% in 2023. It is not possible to examine similar changes for the older age cohorts due to changes in question presentation.

2023 findings

Doing practical science was a key incentive to learn science for students in years 7–9, with 52% choosing this as a motivating factor. Other encouragement factors included having a good teacher, finding science interesting, and relevance to real life. Students with no family science connections (27%) and students who did not rate themselves as good at the subject (38%) were much more likely than average (14%) to say that nothing had encouraged them to learn science at school.

Perceptions of difficulty, volume of work and lack of interest were the strongest disincentives for year 7–9 students learning science. Around two–fifths mentioned perceived difficulty and quantity of work, while around a third mentioned lack of interest. Further disincentives included lack of practical work, and classroom issues such as class behaviour and teacher-related issues.

Females in years 7–9 mentioned more barriers than males and were especially likely to say that they had been put off by factors related to difficulty and ability. Within this age group, females were considerably more likely to say that they had been put off because they found science difficult (50% vs 31% males), it involved a lot of work (44% vs 30% males), or was not sufficiently interesting (42% vs 26% males). Males were over twice as likely to say that nothing had put them off (19% compared with 7% of females). Females were more motivated by having a good teacher and because it is important to do well.

In years 10–13, factors that encouraged and discouraged students to learn science varied across the three science subjects. Compared with the other sciences, students were more likely to link biology to subject interest, a good teacher, relevance to real life, getting good marks, fitting with future plans and finding it easier than other subjects, while chemistry was more associated with enjoyment of practical work. On the other hand, chemistry and physics were linked to a wider range of barriers including subject difficulty, not getting good marks, and finding the maths difficult. As for year 7–9s, females were more likely than males to choose many of these discouragement factors across all three of these subjects.

4.1 Context

Inspiring young people to engage in science is important for several reasons. One of the major reasons is to motivate more young people to consider a science–based career. As well as providing young people with stimulating future career options, this will also help address the STEM skills gap, particularly in specific sectors such as engineering and technology. More generally, engaging young people in science is important for improving the scientific literacy of young people, to enable them to interact with scientific developments and debates in wider society. Department for Education initiatives to promote understanding of climate change is one such example of how young people can relate what they learn in school to real world issues that impact them directly.

In Chapter 2, we discussed the ways in which young people develop an understanding of how science affects their everyday life through activities outside of school. In this chapter, we cover the role of school in engaging young people in science. This chapter provides detail on the underlying reasons for this by highlighting the factors that most encourage young people and those that most discourage them to learn science.

In SET 2023, for the first time, we asked older students in years 10 and above about the factors encouraging students to learn each of the three science subjects (biology, chemistry, physics) separately, which provides a richer insight into the drivers and barriers to engagement within different parts of the science curriculum.

4.2 Factors affecting young people in years 7–9 to learn science

What encourages young people in years 7–9 to learn science?

In SET 2023, the single greatest incentive to learning science at school among students in years 7–9 was enjoyment of practical work (52%), while 36% of students were motivated by having a good teacher and 32% because they found it interesting or enjoyable (Figure 4.1[15]).

The remaining core motivations mainly centred on the utility of science: 26% were motivated by the importance of doing well in science, 25% by the relevance of science to real life, while 20% said it fitted with their study or career plans. A further 23% were encouraged by getting good marks.

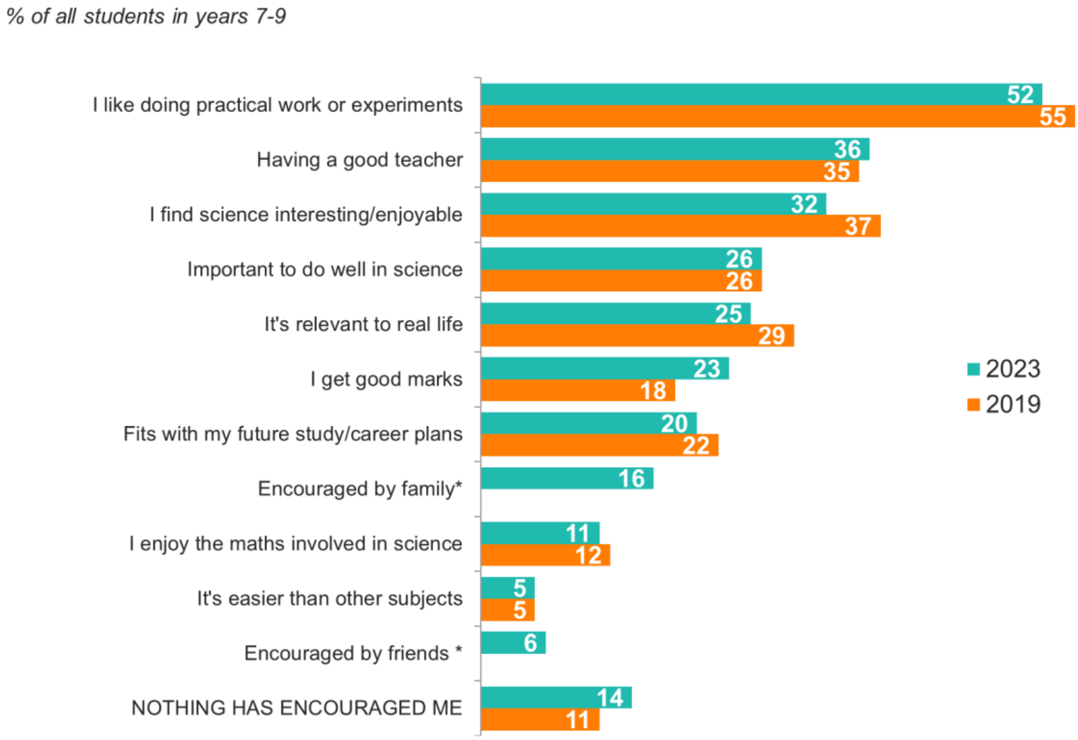
Encouragement by family members was a relatively less important factor (16%) although this was much higher than encouragement by friends (6%), suggesting that peer influence is largely irrelevant in terms of motivation to learn science at school. One in ten (14%) said that nothing had encouraged them to learn science.

Some differences between 2019 and 2023 were evident. Compared with 2019, smaller percentages of young people in years 7–9 were motivated by finding science interesting or enjoyable (37% in 2019 vs 32% in 2023) and by the relevance of science to real life (29% in 2019 vs 25% in 2023). On the other hand, the percentage of year 7–9 students in 2023 who were encouraged by getting good marks was higher than in 2019 (18% in 2019 vs 23% in 2023). There was also a higher percentage of those in years 7–9 who said that nothing had encouraged them to learn science (11% vs 14%).

The drop between 2019 and 2023 in the percentage of young people motivated by finding science interesting reflects the findings reported in Chapter 3 (section 3.3), which also shows a more general decline in the extent to which young people in this age group were interested in science. The overall pattern of results suggests that over this period young people have become more motivated by doing well in the subject rather than because they find the subject interesting and enjoyable, and relevant to real life.

[15] Respondents were presented with a list and could choose as many options as applied.

Figure 4.1: What has encouraged young people in years 7–9 to learn science at school (2019, 2023)



What has encouraged you to learn science? Choose all that apply (SciEnc)
Bases (2023/2019): All year 7–9s (3,077/2,314)

* The question changed between 2019 and 2023: In 2019 there was one option ‘Encouraged by family or friends’ but in 2023 this was split into ‘Encouraged by family’ and ‘Encouraged by friends’.

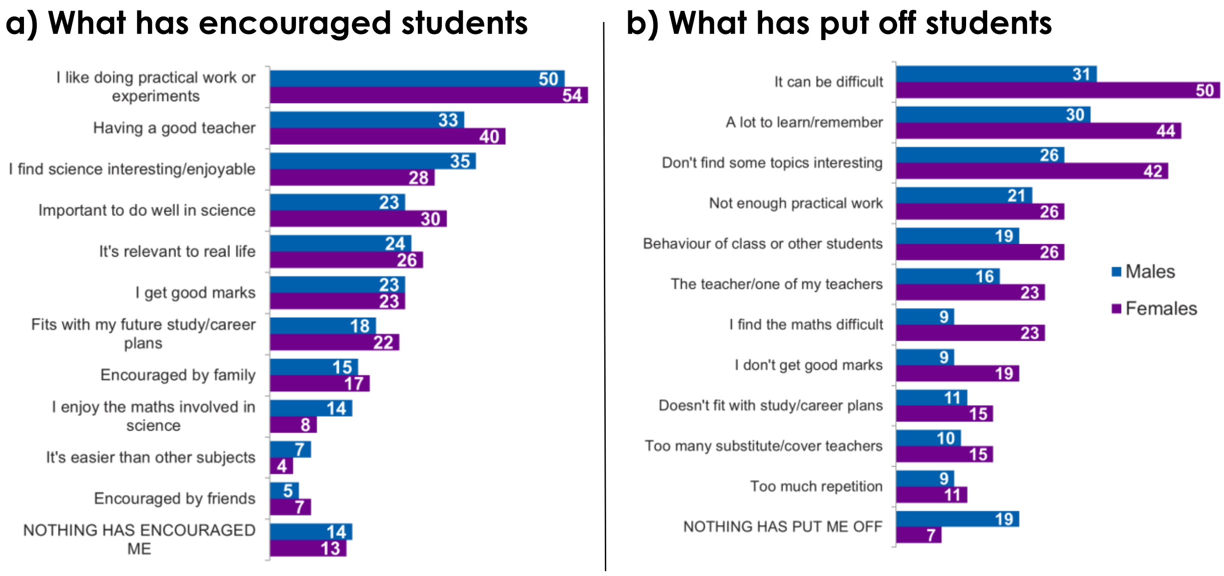
Demographic differences in encouragement factors

Factors which motivated students in years 7–9 to learn science at school varied considerably by gender, as shown in Figure 4.2, which also shows gender differences in factors that discourage students from learning science (discussed further below).

Figure 4.2 shows that male students in years 7–9 were more likely than female students to be motivated by factors relating to enjoyment, including finding science interesting or enjoyable (35% vs 28% of females) and enjoying the maths involved (14% vs 8%); males were also slightly more likely than females to find it easier than other subjects (7% vs 4%).

On the other hand, female students were more likely to be motivated by practical aspects of science learning including having a good teacher (40% vs 33% of males), the importance of doing well in the subject (30% vs 23% of males), and because it fits with future career or study plans (22% vs 18% of males). Female students were also slightly more motivated by doing practical work (54% vs 50% of males).

Figure 4.2: What has a) encouraged and b) put off young people in years 7–9 from learning science at school by gender (2023)



And what has [encouraged you to learn science] [put you off learning science]? Choose all that apply (SciEnc/SciDis)
Bases: All year 7–9s 2023 a)/b) (3,077): males (1,535); females (1,466)

The likelihood of students in years 7–9 feeling encouraged by different factors also varied by other subgroups, as summarised below.

By school year:

- Students in year 7 were most likely to be motivated by enjoying practical work (56% in year 7, 52% in year 8, 47% in year 9).
- There was an increase between year 7 and year 9 in the percentage citing factors related to wider relevance of the subject, indicating that these were more of an encouragement factor for students as they approached their GCSEs:
    - It's important to do well in science (21% in year 7, 29% in year 8, 30% in year 9).
    - It's relevant to real life (22% in year 7, 27% in year 8, 27% in year 9).
    - Fits with my future study or career plans (15% in year 7, 20% in year 8, 23% in year 9).

By ethnic background:

- Asian students were more likely than white students to be motivated by a range of factors, including finding science interesting or enjoyable (42% vs 30% of white students), the importance of doing well in science (35% vs 24%), future career or study plans (28% vs 17%), relevance to real life (32% vs 24%), encouragement by family (24% vs 13%), and enjoying the maths involved (17% vs 10%).

By family science connections:

- Students with many family science connections were more likely to have been motivated by almost all of the encouragement factors listed in Figure 4.1. For example, students with many family science connections were more likely than those with few science connections to be motivated by finding the subject interesting or enjoyable (44% vs 19%), the importance of doing well in science (35% vs 17%), its relevance to everyday life (39% vs 12%), and encouragement from family (27% vs 6%). Conversely students with no family science connections were far more likely to say that nothing has encouraged them (27% vs 7% of those with many connections).

By level of disadvantage (defined by IDACI) and other area–related factors:

- Students in the least deprived quintile were more likely than those in the most deprived quintile to be motivated to learn science on account of having a good teacher (41% vs 32%) thinking it important to do well in science (31% vs 23%) relevance to real life (29% vs 21%), and getting good marks (27% vs 19%).
- Students living in rural areas were more likely than those living in urban areas to cite having a good teacher as a motivation (41% vs 36%).

By emotional, concentration, behavioural or social difficulties:

- Students who self–declared any difficulties of this nature were less likely than students who reported no such difficulties to be motivated by most of the encouragement factors shown in Figure 4.1.

By self–rating of ability in science:

- Students who did not rate themselves as 'good' at the subject were less likely than those who thought they were 'good' to mention all barriers and were much more likely than average (38% compared with 14% overall) to say that nothing had encouraged them to learn science at school.

What discourages young people in years 7–9 from learning science?

In SET 2023, as in SET 2019, perceived difficulties of the subject and concerns about the volume of work were the most demotivating aspects of science lessons for students in years 7–9 (Figure 4.3[16]), which reflects the findings reported in Chapter 3, where it is shown that sciences were more likely than other school subjects to be associated with lower self–perceptions of ability (section 3.5). Amongst all year 7–9s, 40% were put off by finding the subject 'difficult' and 37% by finding there to be a lot to learn or remember.

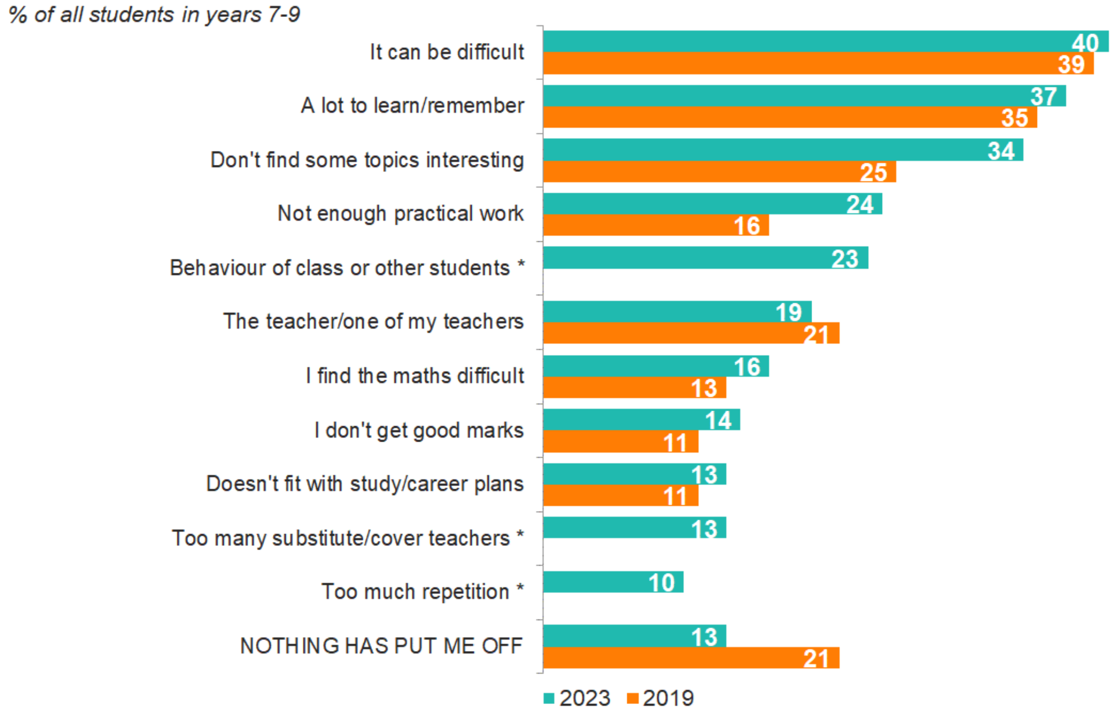
Other demotivating factors included a lack of interest or enjoyment (34%), too little practical work (24%), class behaviour issues (23%), issues related to the teacher (19%) and finding the maths difficult (16%).

There were some questionnaire changes in the list of barriers provided to respondents between 2019 and 2023. However, for those response options which remained the same, some trends are evident: year 7–9 students in 2023 were more likely to be put off by a lack of interest in some of the topics (34% compared with 25% in 2019), a lack of practical work (24% vs 16%), not getting good marks (14% vs 11%) and finding the maths difficult (16% vs 13%). A particularly striking finding is a marked change in the percentage of students in years 7–9 who said that nothing had put them off learning science (21% in 2019 vs 13% in 2023).

These trends over time reflect a more general pattern of findings presented in this report. The increase over time in being put off by lack of interest in the subject mirrors the findings observed in Figure 4.,1 which indicates a reduction in the percentage who were motivated by interest and enjoyment in the subject. In addition, the large increase between 2019 and 2023 in the percentage of students finding a lack of practical work demotivating mirrors the wider findings reported in chapter 6 showing that students in 2023 reported doing less hands–on practical work and an increased desire to do more of it.

[16] Respondents were presented with a list and could choose as many options as applied.

Figure 4.3: What has put off young people in years 7–9 from learning science at school (2019, 2023)



And what has [encouraged you to learn science] [put you off learning science]? Choose all that apply (SciEnc/SciDis)
Bases: All year 7–9s 2023 a)/b) (3,077)): males (1,535); females (1,466)

Demographic differences in discouragement factors

The barriers to learning science at school among students in years 7–9 varied considerably by gender, as shown in Figure 4.2 above, which also shows the gender differences in factors that encourage young people to learn science.

Males were more likely to say that nothing had put them off (19% vs 7% of females). On the other hand, female students were more likely to choose almost all barriers and were especially put off by factors related to difficulty and ability, including science being difficult, having a lot to learn, finding the maths difficult and not getting good marks. Females were also more likely to find some science topics less interesting. The barriers to learning sciences at school also varied by other subgroups, as summarised below:

By school year:

Students in year 9 were more likely to cite a range of discouragement factors than younger students in year 7, which were more related to the way in which the subject is taught, rather than future study/career choices.

- A feeling that science can be difficult (34% in year 7, 41% in year 8, 46% in year 9).
- Concern about there being a lot to learn (32% in year 7, 35% in year 8, 43% in year 9).

- Issues related to a teacher (16% in year 7, 19% in year 8, 22% in year 9).
- Lack of interest or enjoyment (29% in year 7, 35% in year 8, 37% in year 9).

By family science connections:

- Students with many family science connections were more likely to have been put off by teaching–related factors including class behaviour issues (27% vs 18% with no family science connections), the teacher (20% vs 14%), and too many substitute teachers (13% vs 9%).

By emotional, concentration, behavioural or social difficulties

- Students who self–declared any difficulties of this nature were more likely than students who reported no such difficulties to be put off by many of the discouragement factors listed in Figure 4.3, including perceptions of difficulty (45% of those who experience difficulties vs 35% who do not), finding the maths difficult (20% vs 11%), and not getting good marks (17% vs 9%).

By science identity

- Students who said that science is 'not for me' were considerably more likely to be put off by most of the discouragement factors listed in Figure 4.3.

4.3 Factors affecting young people in years 10–13 to learn science subjects

In SET 2016 and SET 2019, all students were asked about what encourages and discourages them to learn 'science'. In SET 2023, a similar approach was used for students in years 7–9 (see section 4.2 above).

However, in SET 2023 a different approach was applied for students in years 10–13. All students in these groups were asked about encouragement and discouragement factors for biology, chemistry, and physics separately. If students no longer studied these subjects beyond GCSE, they were asked to think back to when they did study them. Given the change in approach in SET 2023, it is not possible to compare results for these questions with SET 2019 or SET 2016.

As detailed below, the general finding was that biology was more likely than the other sciences to be associated with a range of encouragement factors (including having a good teacher), and less likely to be associated with a range of discouragement factors. This may be partly explained by the difficulty faced by schools in recruiting subject–specialist teachers for some science subjects. Ofsted (2021), based on an analysis of the 2019 school workforce census data, noted that biology was most likely to be taught by subject specialists: 7% of teaching hours in biology were taught by non–subject specialists compared with 17% and 27% for chemistry and physics, respectively.

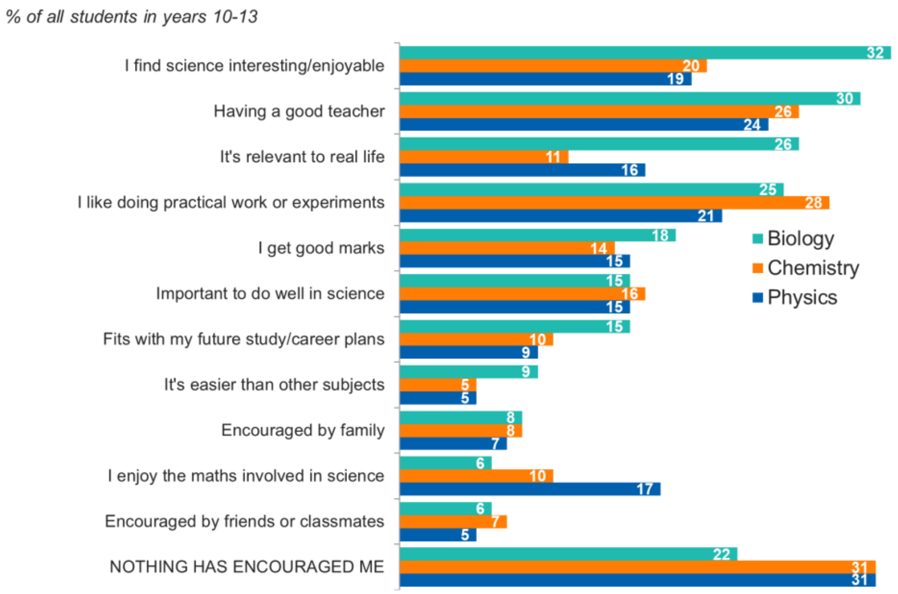
What encourages young people in years 10–13 to learn biology, chemistry and physics?

Figure 4.4 indicates clear differences in motivational factors for the three separate sciences in the GCSE years and beyond. When compared to the other sciences, biology was most likely to be associated with a range of motivational factors.

- Biology was most associated with interest and enjoyment, a good teacher, relevance to real life, getting good marks, fitting with future plans and finding it easier than other subjects.
- Chemistry was most associated with enjoyment of practical work.
- Physics was most associated with enjoyment of the maths involved in the subject.
- Higher percentages indicated that nothing had encouraged them to learn chemistry and physics (31% for each of these subjects) compared with biology (22%).

In general, females were more motivated than males to study biology for most of the reasons listed in Figure 4.4. The reverse was true for physics in that males were more likely to be encouraged by enjoyment of the subject, practical work, relevance to real life and enjoying the maths involved, while for chemistry there were relatively few differences by gender.

Figure 4.4: What has encouraged young people in years 10–13 to learn biology, chemistry and physics at school (2023)



What has **encouraged** you to learn [Biology][Chemistry][Phyiscs]? [IF IN YEARS 12–13] If you no longer study this subject, think back to when you were studying it. (SciEncB/SciEncC, SciEncP)
Bases: All year 10–13s (4,179)

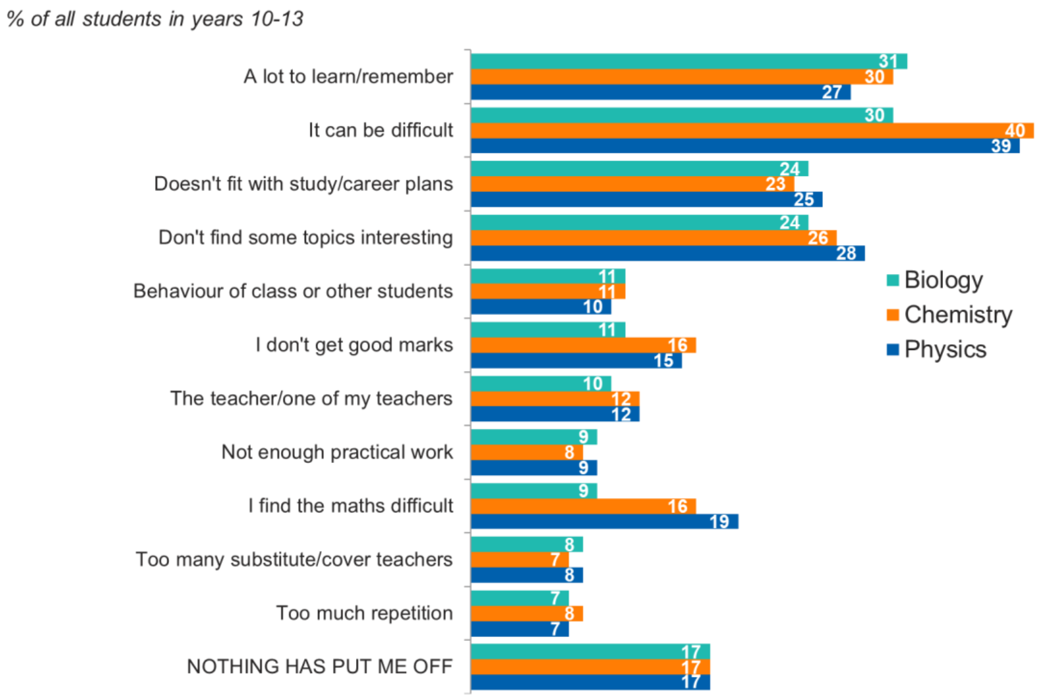
What discourages young people in years 10–13 to learn biology, chemistry and physics?

Figure 4.5 indicates clear differences in discouragement factors for the three separate sciences in the GCSE years and beyond. When compared to the other sciences, chemistry and physics tended to be associated with more negative attributes than biology.

- Chemistry and physics were more likely to be associated with subject difficulty, not getting good marks, and finding the maths difficult (this latter factor was especially likely to be associated with physics).
- Physics was most associated with lack of interest in the subject.
- Biology and chemistry were more likely to be associated with a feeling of there being a lot to learn or remember.

On the whole, females were more likely than males to choose many of these discouragement factors across all three of these subjects.

Figure 4.5: What has put off young people in years 10–13 learning biology, chemistry and physics at school (2023)



What has **put you off** learning [Biology][Chemistry][Phyiscs]? [IF IN YEARS 12–13] If you no longer study this subject, think back to when you were studying it. (SciDisB/SciDisC, SciDisP)
Bases: All year 10–13s (4,179)

5. Factors affecting motivation to learn computing at school

This chapter explores students' interest and perceived ability in computing, the motivations and barriers associated with studying computing at school, and level of uptake of computing as a subject at GCSE. Patterns of variation by demographics and other characteristics are also explored. Results are compared with SET 2019 where applicable.

Key findings

Changes over time

The level of interest in computing at school was lower among year 7–9 students in 2023 compared with 2019. This change was most marked among students in year 7 (where interest levels fell from 75% in 2019 to 68% in 2023). This reflects a similar pattern in relation to changes in interest in school science over time (see Chapter 3).

In 2023, young people within both years 7–9 and years 10–13 were less confident in their ability in computing compared with 2019. Overall, the percentage who rated themselves as 'good' at the subject fell from 50% to 43% among year 7–9s, and from 32% to 25% among year 10–13s (most of whom were reflecting back on their experience of studying this in earlier years). This pattern of change over time was reflected across both genders.

Between 2019 and 2023, there was a small increase in computing GCSE uptake among those in years 10-13 (from 20% in 2019 to 22% in 2023), a trend which reflects national statistics.

2023 findings

There was a wide gender gap in interest in learning computing at school with males twice as likely to be interested than females. The percentage who were either 'very' or 'fairly' interested in computing across all school years was 61% for males and 32% for females, and among students in year 7–9 who were currently studying the subject, the equivalent gender gap in interest in computing was 68% vs 42%.

Interest in learning computing fell sharply across students in years 7–9. By school year, interest in the subject fell steeply between year 7 (68%) and year 8 (53%), reaching 47% in year 9. The pattern of decreasing interest by school year was similar among both males and females.

Underlying this, between year 7 and year 8, students increasingly cited a range of barriers to computing ranging from finding the subject uninteresting, difficult or repetitive, to not fitting with their future plans. Students in year 8 were also less likely than students in year 7 to rate themselves as 'good' at the subject.

Computing was less popular than science. However, there was less variation in levels of interest by family related factors. Furthermore, interest in computing was higher among students from more deprived backgrounds and with a disability, patterns which were not observed in relation to interest in science. Among all year 7–9s, 71% were interested in science lessons and 56% in computing lessons. Unlike science, for computing there was no gap in level of interest between students with or without a university-educated parent and the interest gap between those with many and those with no family science connections was much smaller for computing compared with science. Furthermore, while there was no difference in science interest between levels of deprivation (IDACI quintiles) and disability, students living in more deprived areas and with a limiting disability were more interested in computing than their counterparts.

Motivations to study computing included creativity, interest, having a good teacher and relevance to real life, while barriers focused on lack of interest, difficulty, or lack of fit with future aspirations. Between 17% and 24% of students in years 7–13 mentioned each of these motivating factors, while around 20–30% mentioned each of these barriers. Males were more likely than females to be motivated by these factors, and were much less likely to cite each of these barriers.

Two in ten students (22%) in years 10–13 reported taking GCSE computing. In line with national statistics (JCQ, 2023a), this was much higher among male (33%) than female (10%) students. Uptake was also higher among Asian students compared with white students, and among students who participated in computing activities (such as creating a computer game, website or animation) outside school.

5.1 Context

Developments in computing and technology, and the demand for specialist technology skills, have continued to grow at pace. Computing was introduced as a core curriculum subject in 2014, which led to children being taught digital skills from age 5 upwards. This means that all students included in the SET 2023 survey will have started learning relevant content at primary school. However, computing stops being a compulsory subject after year 9 and encouraging higher uptake of computing at GCSE and beyond continues to represent a challenge. In SET 2023, creativity was highlighted as a key motivation for studying the subject, but lack of interest and subject difficulty were cited as key barriers.

There are indications that computing is becoming a more popular subject choice. Data for 2023 (DfE, 2023a) highlights computing as the subject with the largest percentage increase in GCSE entries between 2022 and 2023 (an increase of 11.9%), and the second largest percentage increase for A levels (14.5% increase). However, schools face considerable challenges in delivering computing education given the difficulties in recruiting and retaining subject specialist teachers, which have intensified since the pandemic. A report by McLean et al. (2023) documents the scale of the recruitment and retention challenge in schools at the time of the survey, and highlights computing as one of the top three subjects associated with under–recruitment, alongside physics and design & technology.

A further challenge is ensuring that computing is seen as an attractive option to young people from across the demographic spectrum, with the low level of uptake among females representing a particular challenge. The SET 2023 survey results continue to show striking gender imbalances in levels of interest, perceived ability and GCSE uptake.

5.2 Interest in computing

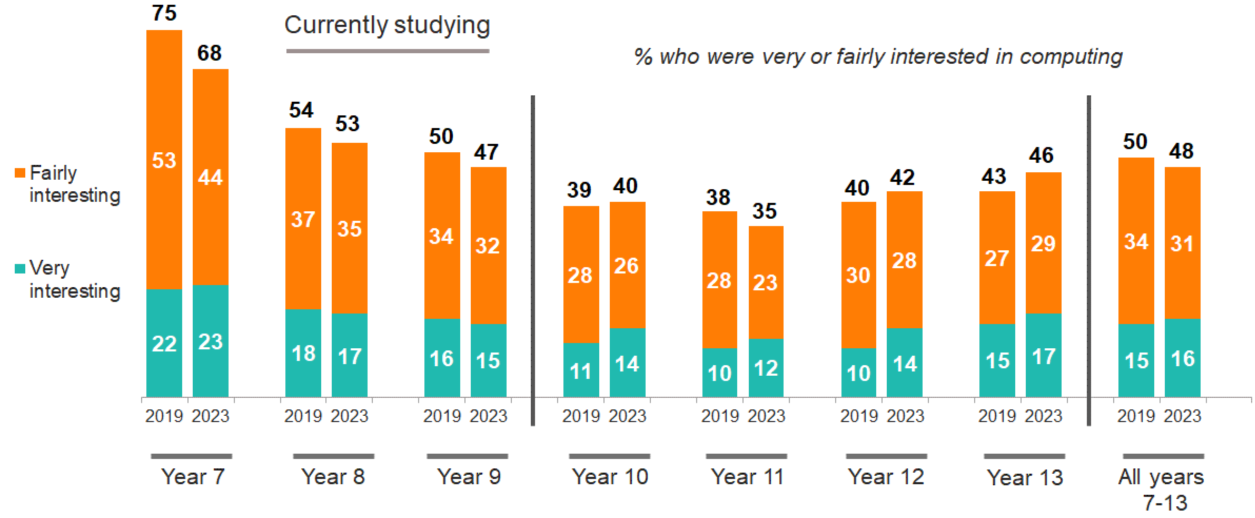
In the SET 2023 survey, young people were asked how interesting they found computing lessons at school. It is important to note that in English state schools computing is compulsory in years 7–9 and optional thereafter. This means that while year 7–9 students were reflecting on current or very recent experience of studying the subject, most students in years 10–13 were reflecting on when they studied it in years 7– 9 and their answers were therefore retrospective.

Focusing first on the 2023 results, as shown in Figure 5.1, almost half of students (48%) across all years 7–13 expressed an interest in computing lessons, with 16% being very interested and 31% fairly interested.

Comparing across the year groups, we can see that progressively smaller percentages of survey participants in years 7–11 indicated an interest in computing (from 68% in year 7 to 35% in year 11), with a particularly steep fall in interest between year 7 and year 8. Interestingly, from year 11 onwards, levels of interest rise again, which could be because most students are reflecting on when they studied this as a compulsory subject in years 7–9.

Figure 5.1 also demonstrates a decrease in level of interest in computing between 2019 and 2023 among students in years 7–9, and especially among students in year 7 where interest in the subject fell from 75% in 2019 to 68% in 2023. Interest among older students (most of whom would be reflecting back to when they had to study computing) remained more stable over time. The steeper fall in interest between 2019 and 2023 for year 7s reflects similar findings for science (see Chapter 3). As discussed further in section 3.3, this might be related to this younger cohort having experienced more disruption at primary school during the pandemic, which in turn may have affected their readiness for secondary school.

Figure 5.1: Extent to which young people in years 7–13 were either 'very interested' or 'fairly interested' in computing by year group (2019 vs 2023)



CSInt (2019) (half sample) SciIntB/OtherInt_5 (2023): How interesting do you find Computing/Computer Science lessons at school?
Bases (2019/2023): All (2,784/7,256); Year 7 (364/993), Year 8 (388/1032), Year 9 (356/1052), Year 10 (444/1057), Year 11 (424/1076), Year 12 (414/1040), Year 13 (394/1006)

As shown in Figure 5.2a, among those in years 10–13 interest levels increased among males and declined among females. This points to a wider overall gender gap in 2023 (61% males, 32% females) than in 2019 (61% males, 37% females). Again, this reflects similar patterns of time trends for science (see section 3.3).

Figure 5.2b provides a more detailed analysis of level of interest by gender within year group and indicates a wide gender divide in computing interest across all year groups. Males were notably more interested than females in computing throughout years 7–11, after which the gender gap widens even further when most students are basing their opinions on a reflective judgement.

Figure 5.2: Extent to which young people in years 7–13 were either 'very interested' or 'fairly interested' in computing a) by gender and year group and b) by gender within year group (2019 vs 2023)

Chart a)

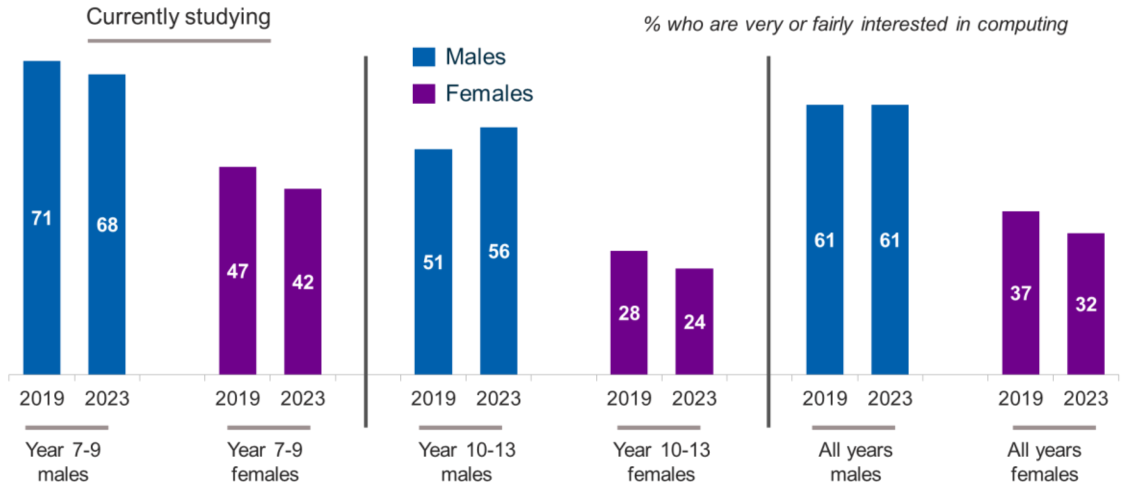
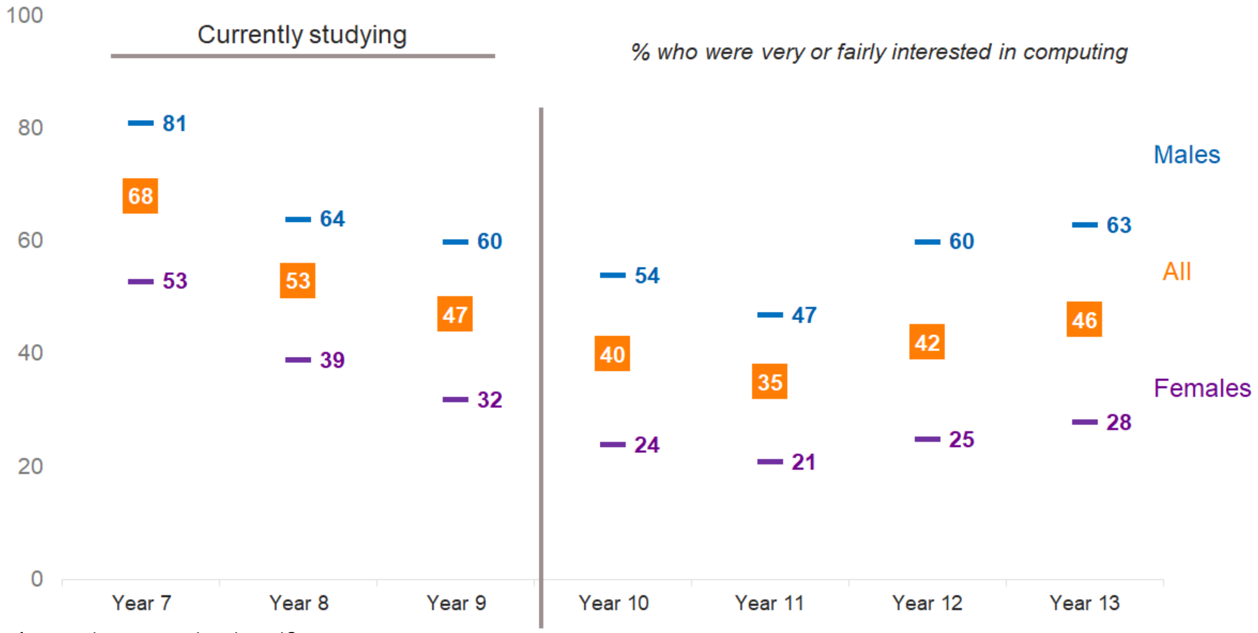


Chart b)



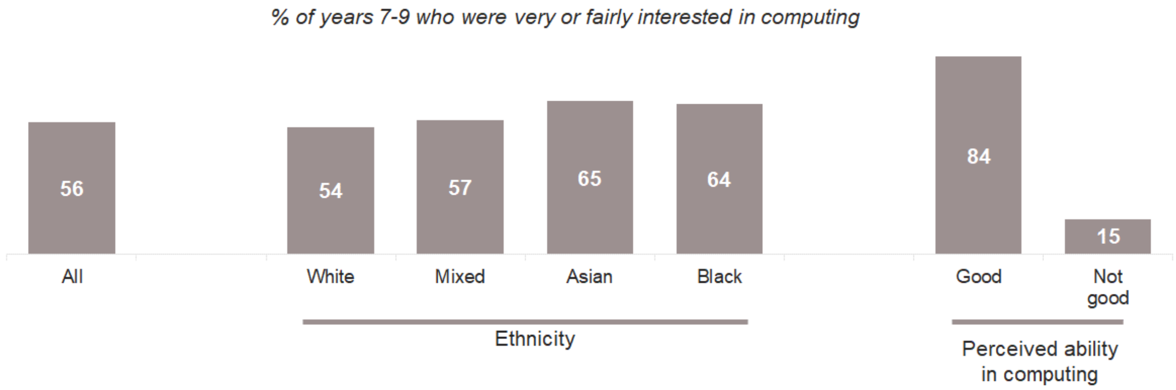
Science lessons at school?

Bases (2019/2023): All (2,784/7,256), All males (1,402/3,428), All females (1,352/3,601); All Year 7–9 (1,108/3,077), Male Year 7–9 (566/1,535), Female Year 7–9 (533/1,466); All Year 10–13 (1,676/4,179), Male Year 10–13 (836/1,893), Female Year 10–13 (818/2,135) Year 7 All (364/993); year 8 (388/1,032); year 9 (356/1,052); year 10 (444/1,057); year 11 (424/1,056); year 12 (414/1,040); year 13 (394/1,006). Year 7 males (188/494);Year 8 males (194/536);Year 9 males (184/505);Year 10 males (209/493);Year 11 males; (220/496)Year 12 males; (210/454)Year 13 males (197/450.). Year 7 females (172/475);Year 8 females (191/470);Year 9 females (170/521);Year 10 females (233/538);Year 11 females; (199/542)Year 12 females; (196/550)Year 13 females (191/505).

Patterns also emerge when comparing levels of interest in computing among year 7–9 students by other subgroups aside from gender (Figure 5.3). Year 7–9 students from Asian and Black backgrounds expressed more interest in computing compared with those from other ethnic backgrounds. Interest in computing among year 7–9s was also associated with students' self–perception of their computing ability, with those who perceived themselves to be 'good' at computing expressing a higher level of interest (84%) compared with those who reported that their ability is 'not good' (15%).

The variation in level of interest in computing by family- and area-based factors is discussed in section 5.3 below.

Figure 5.3: Extent to which young people in years 7–9 were either 'very interested' or 'fairly interested' in computing by ethnicity and self–perception of ability in computing (2023)



SciIntB: How interesting do you find the following lessons at school? Computer/Computing
Bases: All (3,231), White (2,175) Mixed (195) Asian (402) Black (183), Good (1,336) Not good (639)

5.3 Interest in computing vs interest in science

Focusing on years 7–9 only, there was a different pattern of engagement for students studying computing compared with those studying science (Figure 5.4).

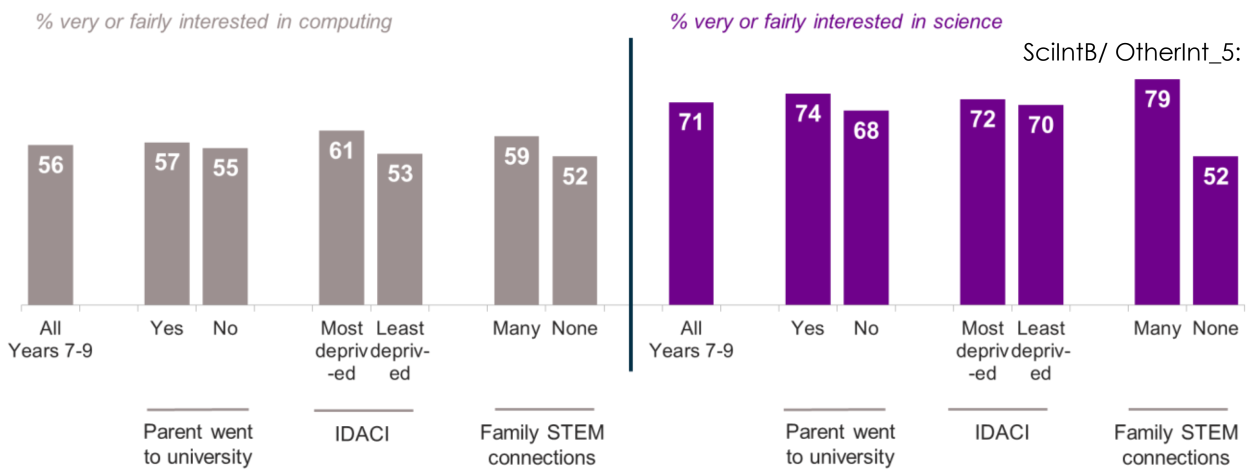
Students were more interested in science than computing. Among all year 7–9s, 71% were interested in science and 56% in computing. However, beyond level of interest at an overall level, there were also differences in demographic patterns of interest in the two subjects.

As discussed in section 3.3 (Figure 3.5), interest in science at school was associated with family background including access to family science/STEM connections and having a parent who had been to university, although there was no difference in interest in school science by measures of disadvantage.

However, these same patterns are not observed for computing where there is no relationship between university connections and interest in computing, and only a small difference by family STEM connections. Furthermore, students living in the most deprived areas were more interested in computing than those living in the least deprived areas. This contrasts with interest in science which shows no variation by type of area. A further finding (not shown in the chart) is that students with a self–reported limiting disability were more interested in computing than those with no disability (64% compared to 55%) with no equivalent difference for interest in science (72% and 71% respectively). This suggests that computing is, relative to science, less affected by parental connections and may be more appealing to groups of students who are typically less engaged in science.

Figure 5.4: Extent to which young people in years 7–9 were either 'very interested' or 'fairly interested' in school subjects a) computing and b) science; by gender, year group, parental university attendance, IDACI and Family STEM connections (2023)

Chart a) **Chart b)**



SciIntA: How interesting do you find the following lessons at school? Science

SciIntB: How interesting do you find the following lessons at school? Computer/Computing
Base: All (3,077); Parent attending university (1,645) not attending university (1,130); IDACI 1 – most deprived (711), IDACI 5 – least deprived (583); Many family STEM connections (954), no family STEM connections (324)

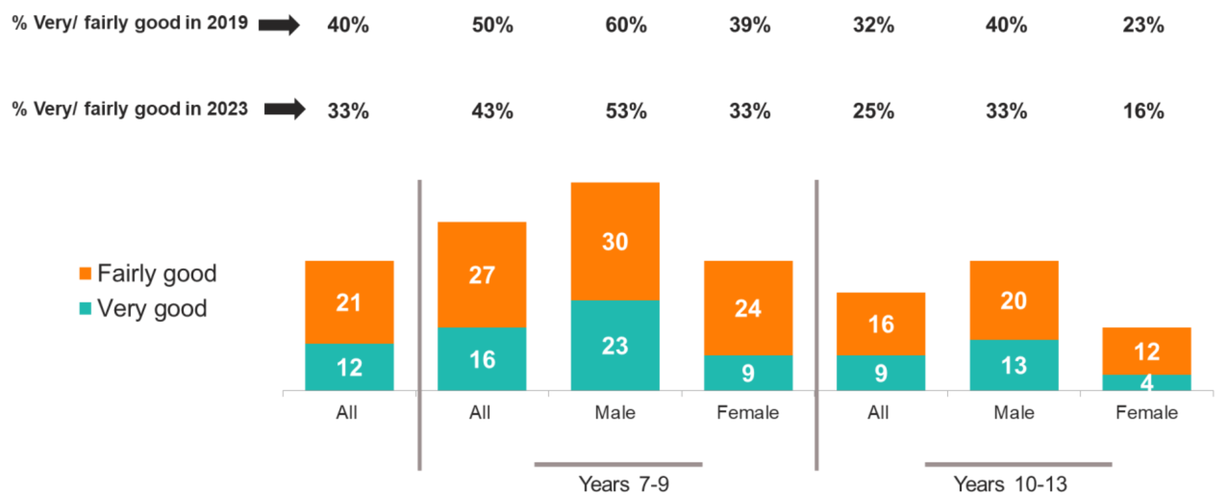
5.4 Self–belief in ability in computing

Students were asked to rate their ability in various subjects, including computing. Chapter 3, section 3.5, covers a wider discussion on this relating to school subjects in general, while this section focuses in on self–rated ability in computing.

As with interest in computing, students beyond year 9 who were no longer studying the subject were asked to reflect on when they were learning it. Overall in 2023, a third of young people (33%) considered themselves to be 'good' at computing, higher among those in years 7–9 (43%) and lower among those in years 10–13 (25%). There were wider gender gaps observed across both school stages, with males being considerably more confident in their abilities in the subject than females (Figure 5.5).

Figure 5.5 also shows that perceived ability in computing was lower in 2023 compared with 2019, this being observable across both the year 7–9 and year 10–13 cohorts, and across both genders. As shown in section 3.5 lower perceptions of ability recorded in 2023 compared with 2019 among students in years 7–9 point to a wider pattern in terms of declining confidence in abilities across most school subjects within these younger age cohorts.

Figure 5.5: Perceived ability in computing among year 7–13 students by school stage and gender (2019, 2023)



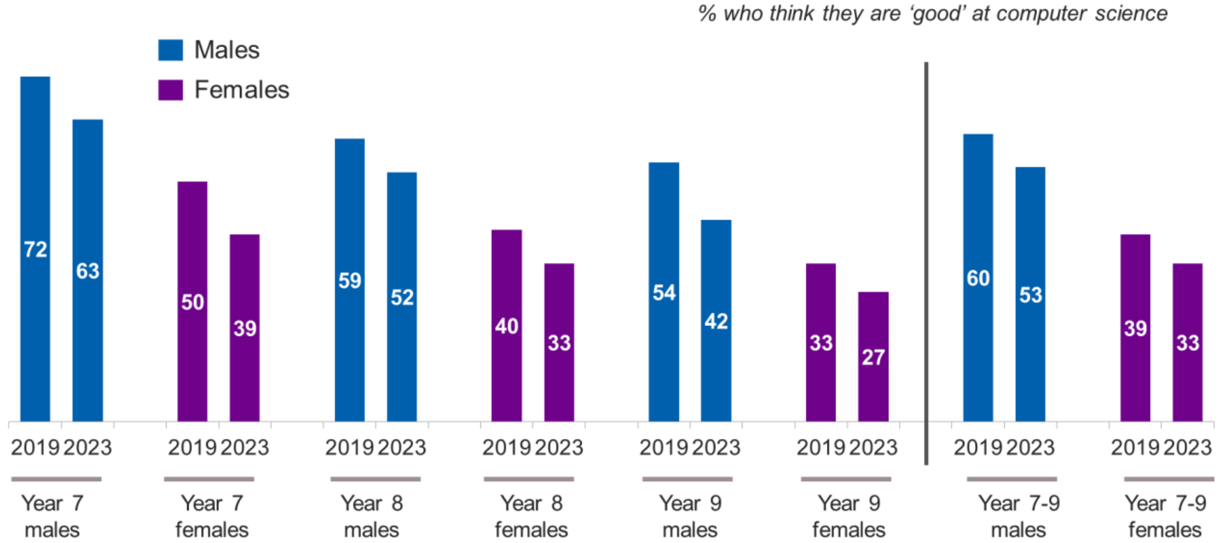
GoodComp (2019): Good_5 (2023): How good would you say you are/were at the following subjects – Computer Science/Computing
Bases (2019/2023): All (5,619/7,255); All Year 7–9 (2,314/3,077); Year 7–9 males (1,170/1,535), Year 7–9 females (1,122/1,466); All Year 10–13 (4,095/4,179); Year 10–13 males (1,943/1,893), Year 10–13 females (2,106/2,315);

Looking in more detail at patterns by year group within the year 7–9 cohort in 2023, perceived ability in computing dropped between year 7 and year 9 among both males and females. The percentages of students rating themselves as 'good' at computing decreased across years 7–9 from 63% to 42% for males and from 39% to 27% for females. Within each year group in 2023, female students had lower levels of self–belief in their ability in computing compared with males (Figure 5.6).

The findings by school year could be interpreted in two ways. It is possible that students become less interested in computing (see Figure 5.1) and less confident in their own ability as they move through the school years. However, it is also possible that younger cohorts come into secondary school with more understanding, skills and confidence in computing given enhanced computing teaching in primary schools over time and this might be creating the differences by school year (in other words, it is possible that this is a cohort effect rather than a school progression effect). More general access to and familiarity with digital media in the wider world may also be helping to boost confidence among younger cohorts.

Figure 5.6 also shows how the decline between 2019 and 2023 in perceived ability in computing among year 7–9s is evident within all gender/year groups.

Figure 5.6: Extent to which young people in years 7–9 believed they were 'good' at computing by gender and year group (2019 vs 2023)



GoodComp (2019): Good_5 (2023): How good would you say you are/were at the following subjects – Computer Science/Computing
Bases (2019/2023): Male Year 7–9 (566/1,535), Female Year 7–9 (533/1,466); Year 7 males (403/494);Year 8 males (396/536);Year 9 males (333/505); Year 7 females (348/475);Year 8 females (387/470);Year 9 females (338/521);

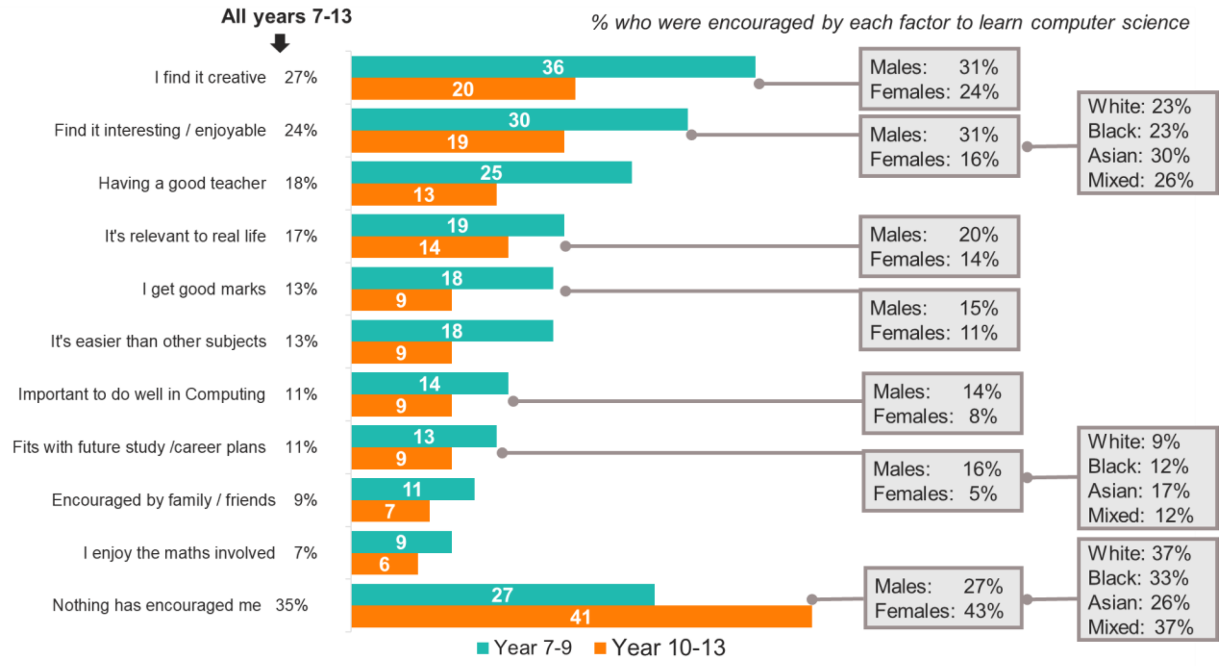
5.5 Factors encouraging young people to learn computing

At an overall level in 2023, the key factors cited by young people in years 7–13 as motivation for learning computing were finding it creative (27%), interesting (24%), having a good teacher (18%) and relevance to real life (17%). About one in ten students were motivated by each of thinking it important to do well in computing and because the subject is a good fit with their future study or career plans. Overall, just over a third (35%) of students who had ever studied computing stated that nothing had encouraged them (Figure 5.7).

The pattern of factors encouraging young people to study computing differs by younger (year 7–9) and older (year 10–13) age groups. The findings for younger students in years 7–9 are based on students who had been studying computing in the past academic year, and these students were far more likely than older students (most of whom were reflecting on previous years of study) to mention a range of factors that encouraged them to learn computing. Conversely, they were much less likely than older students to say that nothing had encouraged them (27% of year 7–9s vs 41% of year 10–13s).

There were no changes in the pattern of findings at an overall level between 2019 and 2023.

Figure 5.7: Factors encouraging young people in years 7–13 to learn computing (2023)



CompEnc – What has/had encouraged you to learn Computer Science/Computing?
Base (2023): All Year 7–9 (3,077); All year 10–13 (4,179); Males (3,428); Females (3,601);White (5,115) Mixed (450) Asian (935) Black (487)

Looking at motivational factors by subgroups, Figure 5.8 also illustrates clear differences by gender and ethnicity. In general, male students and those with Asian ethnicity were especially likely to cite encouragement factors for computing.

By gender:

- Female students were much more likely to say that nothing had encouraged them (43% of female students vs 27% of male students).
- Conversely, male students were more likely to have been encouraged by a range of factors, particularly the creativity involved (31% vs 24% females), interest and enjoyment (31% vs16% females), the relevance of computing to real life (20% vs14% females), fitting well with their future plans (16% vs 5% females) and because it is important to do well in this subject (14% vs 8% females).

By ethnic background:

- Asian students were more likely to have been motivated by finding the subject interesting (30% vs 23% of white students) and because computing fits with their future study and career aspirations (17% vs 9% of white students). Asian students were also less likely to feel that nothing had encouraged them (26% vs 37% of white students).

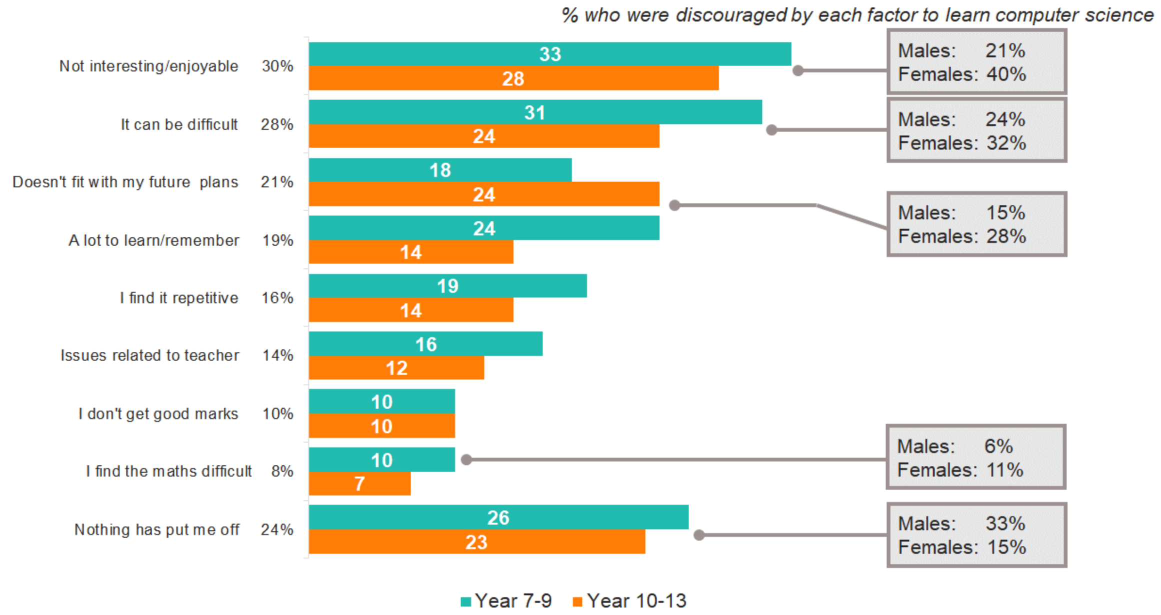
5.6 Factors discouraging young people to learn computing

The main barriers to learning computing among young people in years 7–13 were lack of interest or enjoyment (30%), perceived difficulty of the subject (28%), not fitting with future study or career plans (21%) and the volume of work (19%). Almost a quarter of students overall said that nothing had put them off learning computing.

Figure 5.8 shows the results broken down by school stage. The findings for students in years 7–9 are based on students who had been studying computing in the past academic year and who therefore tended to cite more barriers than older students. However, younger students were less likely than older students (most of whom were reflecting on previous years of study) to find computing off–putting due to it not fitting with their future plans, probably because they have not yet formed future plans. Those in years 7–9 were also more likely to say that nothing had put them off.

There were no changes in the pattern of findings at an overall level between 2019 and 2023.

Figure 5.8: Factors discouraging young people in years 7–13 to learn computing (2023)



CompDis – What has/had put you off learning Computer Science/Computing?
Base (2023): All Year 7–9 (3,077); All year 10–13 (4,179); Males (3,428); Females (3,601);White (5,115) Mixed (450) Asian (935) Black (487)

As with encouragement factors, barriers to learning computing varied by gender. Female students were much less likely to say that nothing had put them off (15% of female students vs 33% of male students), and mentioned a much wider range of barriers and were more likely to have been discouraged by lack of interest, difficulty, not fitting well with future plans, volume of work, not getting good marks and finding the maths difficult.

5.7 Patterns of discouragement factors by school year

Figure 5.2b shows a steep decline in overall level of interest in computing by school year from 68% in year 7 to 47% in year 9 and that this fall was observed for both females (53% of year 7s vs 32% of year 8s) and males (81% vs 60%).

To uncover the underlying reasons for this change over time, Figure 5.9 shows how discouragement factors vary by school year between years 7 and 9. These figures show that increased negative reactions to computing tend to happen mostly between year 7 and year 8, which reflects the steeper drops in interest in the subject recorded between these two school years (see Figures 5.1, 5.2):

- Between year 7 and year 9, there was a rise in the percentage of both genders who felt that the subject was difficult.
- Between years 7 and 8 there was a steep rise in the percentage who found the subject uninteresting; again this is reflected across both genders.
- Between year 7 and year 8 there was a steep rise in the percentage saying they were discouraged because the subject doesn’t fit with future pathways, and this increase was steeper for females than for males.
- Between year 7 and year 8 there was an increase in the percentage who found the subject repetitive, and this rise was steeper for males compared with females.

Alongside these changes in prevalence of barriers to computing by school year, there was also a steep decline in perceived ability in computing over this time period. The percentage who rated themselves as ‘good’ at the subject dropped from 52% in year 7 to 43% in year 8 to 35% in year 9.

As discussed in section 5.4, it is not possible to say whether the differences by school year represent a cohort effect (with younger students more engaged due to greater familiarity) or a school progression effect, with interest in computing declining with age or as the school curriculum changes.

Figure 5.9: Barriers to learning computing by gender and school year: % of young people across years 7–9 who cite each of these factors as putting them off learning computing

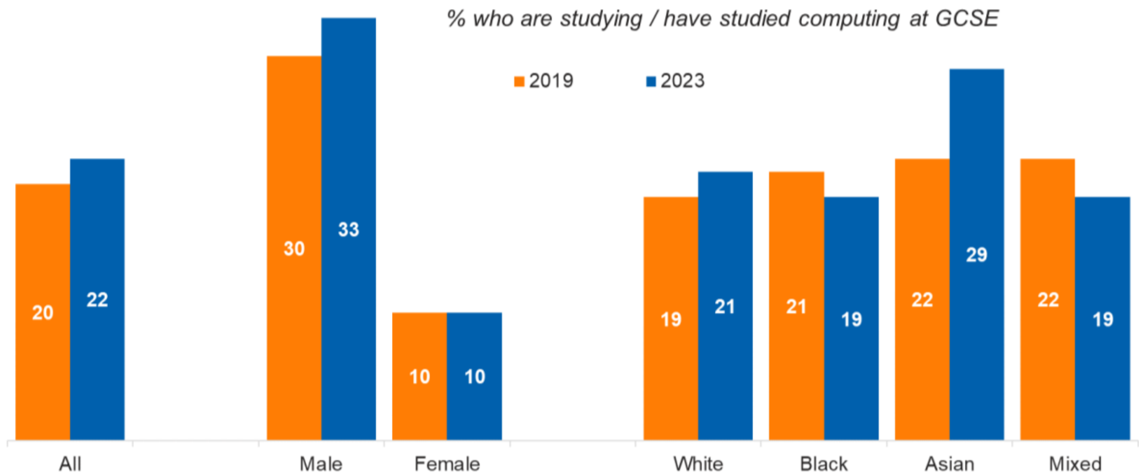
And what has put you off learning Computer Science? Choose all that apply (CompDis)
Bases: Year 7 All/male/female (993/494/475); Year 8 All/male/female (1,031/536/470); Year 9 All/male/female (1,052/505/521)

5.8 Uptake of computing at GCSE

In 2023, 22% of students in years 10–13 reported studying computing at GCSE, which is slightly higher than in 2019 when 20% of students said that were taking or had taken this. This increase reflects external data on GCSE entries showing that the uptake of computing has been increasing over time, with 11.9% more young people taking a computing GCSE in 2023 compared with 2022 (DfE, 2023a).

As illustrated by Figure 5.10, based on survey data in 2023, males were much more likely than females to study computing at GCSE (33% compared with 10%). This gender disparity again broadly reflects external data, which show that in 2023 males were 3.5 times as likely to study the subject as females (JCQ, 2023a). By ethnicity, Asian students were more likely to choose computing as a GCSE subject compared with those from other backgrounds (29% Asian, 21% white vs 19% Black or mixed ethnicity). The SET 2023 results suggest that over time the gender gap in GCSE computing uptake has widened, and that an increasing percentage of Asian students is now choosing this as a subject.

Figure 5.10: Percentage of young people in years 10–13 who were studying/ studied computing at GCSE by gender and ethnicity (2019, 2023)



CompGCSE – Are you studying / did you study Computer Science/Computing at GCSE?
Base (2019/2023): All Year 10–13 (4.095/4,179); Males (1,943/1,893); Females (2,106/2,135);White (3,015/2,940); Mixed (214/255) Asian (535/533) Black (241/304).

There was a relationship between undertaking computer–based activities outside school (such as creating a computer game, blog, website or animation) and opting to study computing/computer science at GCSE. Just under half (45%) of those who had undertaken computer–based activities outside school at least once a month in the past year were taking or had taken computing GCSE, compared with only 17% of those who had not participated in any such activities in the past year.

6. Practical science

This chapter explores young people's experience of practical work in science lessons, whether they feel they get enough exposure to practical science, and which students are most motivated by this aspect of science lessons. Where possible, findings have been compared with data from SET 2016 and SET 2019.

Key findings

Changes over time

While the overall frequency of practical work in schools has remained similar, there were notable shifts between 2019 and 2023 in the type of practical work students were doing. Across all school years, there was a decline in the percentage of students doing either hands–on or teacher–demonstrated practicals (the Gatsby definition of good–quality practical work), and this decline is especially apparent in year 10.

Over the longer–term, between 2016 and 2023, there was a marked shift away from more interactive forms of practical work with videos increasingly being used as a replacement. The percentage of GCSE students doing hands–on practical work at least fortnightly dropped from 44% in 2016 to 37% in 2019 and 26% in 2023, with a similar pattern of decline in watching teacher demonstrations at least fortnightly (47%, 38%, 32%). Conversely the percentage watching a video of a practical at least fortnightly increased over time (39%, 41%, 46%). Similar shifts over time between 2019 and 2023 are observed for students in years 7–9 (data for the younger group was not collected in 2016).

Reduced frequency of hands–on practical work over time was associated with rising levels of unmet demand for this. The percentage of year 10–11 students who wanted to do more practical work was 58% in 2016, 57% in 2019 and 68% in 2023.

Compared with between 2016 and 2019, all of the above changes were more accentuated between 2019 and 2023, which covered the period of COVID–19 school lockdowns. While it is possible that these changes are symptomatic of a longer–term shift towards using digital technology as a replacement for hands–on work, it is likely that the pandemic has accelerated any such shifts and could mean that digital teaching practices introduced during lockdowns have now become more embedded.

2023 findings

Among all students in years 7–11, the most common form of exposure to practical science was via video: 49% reported watching a video of a practical at least once a fortnight, compared with 44% watching a teacher demonstration, and 38% doing hands–on practical work.

Triple science students reported more timetabled science hours and more hands–on practical work than double science students. 29% of triple science students compared with 22% of double science students did hands–on practical work at least once a fortnight, while double science students watched more videos of practicals (51% experiencing this at least fortnightly compared with 42% of triple science students).

The frequency of hands–on practical work declined by school year. In year 7, 65% reported doing more direct forms of practical work (teacher demonstrations or hands–on) at least fortnightly. However, this percentage fell steadily by school year such that only 39% of year 11s reported this.

Access to hands–on practical science among years 7–9 was lower in London compared with all other regions. Whilst an average of 41% of years 7–9 reported hands–on practical work at least once a fortnight, the rate in London were 34%.

Enjoying practical work was the top motivation among years 7–9 for feeling encouraged to learn science. The students most motivated in science by practical work tended to be those who were also most engaged in science more generally, for example students with strong family science connections and those with a strong science identity.

Seven in ten students in years 7–11 wanted to do more practical work, with rising levels of demand among those who do this least frequently: 61% who did hands–on practical work at least fortnightly wanted to do more compared with 79% who do practicals less often.

The appetite for more practical work was higher among groups with lower levels of engagement in science. Students who were not interested in science or who do not see science as 'for me' were associated with higher levels of feeling that they wanted to do more.

Year 7–11 students were more likely to do practical work in groups or pairs than independently, and relatively few undertook fieldwork–style activities. 81% cited group work, 38% said they had carried out practical work independently and 29% had taken part in fieldwork. While follow–up work involving analysing results and writing up conclusions of practical work was common (74% and 73% respectively), a lower percentage (57%) said they engaged in class discussion about practical work.

Most year 7–11 students were unable to relate practical tasks in school to real life contexts. While most students (66%) said that they understood the aim of the practical tasks rather than just following instructions, only 34% said that the teacher always or usually explained the relevance of the practical work to everyday life. Males, students from Asian, Black and other minority ethnic backgrounds, and students studying triple science were more likely to rate the practical work they did highly across a range of quality metrics.

6.1 Context

It is widely acknowledged that good quality practical work promotes the engagement and interest of students in science as well as developing a range of skills, science knowledge and conceptual understanding (SCORE, 2008; Gatsby 2017).

The nature of practical work in school science can vary. SCORE (2013) defines practical work as 'learning activities in which students observe, investigate and develop an understanding of the world around them, through direct, often hands–on, experience of phenomena or manipulating real objects and materials' whereas Gatsby (2017) and Ofsted (2023) adopt a slightly broader definition that includes teacher demonstrations as well as hands–on activities.

It is clear from SET 2023 (see section 4.2) that students enjoy practical science. However, it is important to focus not only on the quantity but also the quality of practical work. Gatsby (2017) has set out ten benchmarks for best–practice practical work, and these recommendations are discussed at relevant points within this chapter. Ofsted (2023) also sets out some of the features of high–quality practical work: pupils have the necessary curriculum–based knowledge before undertaking the task; the purpose of the practical is clear; pupils undertake practical work as part of a wider sequence of learning; and they encounter the phenomena they are studying through both laboratory and fieldwork.

However, there have been critiques of the way in which practical work is conducted in schools, which can involve a focus on simply following 'recipe–like' instructions rather than engaging students in discussion that helps them link the activities to underlying science concepts (e.g. Abrahams, 2019; Abrahams and Reiss, 2012, 2017; Millar and Abrahams, 2009; Wellcome, 2017).

Beyond these challenges, the SET 2023 results also need to be considered against the backdrop of the lingering impact of COVID–19. The pandemic clearly had a substantial impact on science learning in the UK, and during the period of school closures and disruption (from March 2020 to March 2021) many pupils were deprived of opportunities to take part in practical science activities. Furthermore, when schools did reopen, COVID–19 safety measures such as social distancing continued to impact on the provision of practical work, while the need to help students catch up on missed learning often meant that teachers needed to prioritise core subject content over practical activities. In addition, GCSE and A level exams taking place in 2021 and 2022 were modified to remove the practical component.

As a result, there was an increased focus on the theoretical elements of science, with increased use of teacher demonstrations in place of hands–on work (Ofsted 2020). To compound these issues, the Royal Society of Chemistry (2021) noted how teacher training between 2019 and 2021 was significantly disrupted, in particular the lack of opportunities to hone skills like teaching practical science which may also affect the ability and willingness of more recent recruits to do this going forwards.

As discussed in Chapter 4 of this report, practical work is the factor most frequently provided by students as encouraging them to learn science. This finding continues to underline the importance of students experiencing frequent and good–quality practical work. However, amid the continuing after–effects of COVID–19, coupled with budget pressures for many schools and difficulty recruiting and retaining science teachers with the relevant subject specialisms, there are heightened concerns that practical science in schools is being squeezed.

This chapter describes the frequency and nature of practical work experienced by students, how this has changed over time, and examines how the experience of practical work varies by school year and across different subgroups of the population.

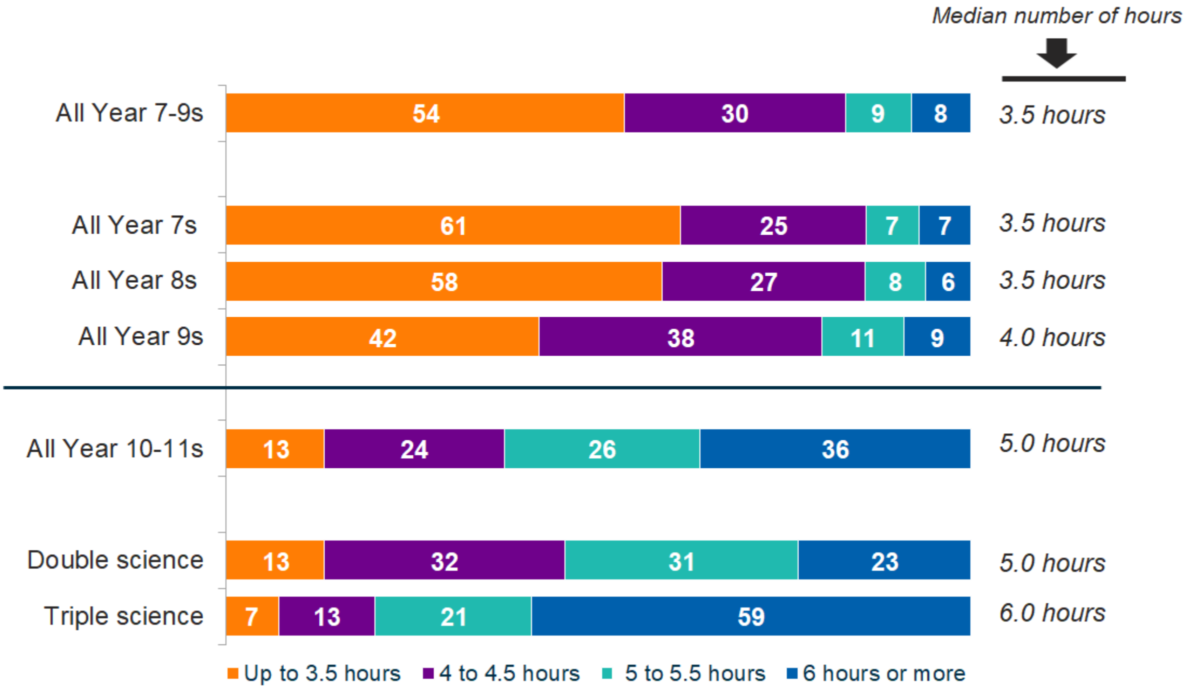
6.2 Number of hours of science education

Figure 6.1 displays the number of hours students in years 7–11 said they spent learning science per week. In years 7–8, most students (61% in year 7, 58% in year 8) reported learning science for up to 3.5 hours a week. However, this increased over the school years: the median number of hours increased from 3.5 hours in years 7–8 to 4 hours in year 9 and 5 hours in years 10–11.

Broadly, these findings remain unchanged compared with both 2016 and 2019, and the median number of hours per year group has remained consistent over time[17]. However, despite this, there is evidence of a decrease in the number of science hours among students in year 9: 28% of year 9 students were studying science for 5 or more hours a week in 2019 compared with 20% in 2023.

As in 2019, triple science students reported more timetabled science hours than double science students: 59% of triple science students reported 6 or more hours per week compared with 23% of double science students[18].

Figure 6.1: Number of hours spent studying science by students in years 7–11; and by type of course for students in years 10–11 (2023)



Over the last school year, how many hours of science lessons (Biology, Chemistry, Physics) did you have each week on average? (Sciles)
Bases: All year 7–11s 2023 (5,210): year 7 (993); year 8 (1,032); year 9 (1,052); years 10–11 (2,133); double science (1,111); triple science (772)

[17] For SET 2016, comparisons can only be made with years 10–11 as younger groups were not included in the 2016 survey.
[18] As discussed in section 7.2, students' self–reported classification of whether they study double or triple science is not wholly reliable due to student confusion associated with the terminology. Therefore, any findings associated with course type should be treated with a degree of caution.

6.3 Frequency of practical work at school

Overall frequency in 2023

Students were asked about the frequency and type of practical work they were exposed to. Two of the ten Gatsby benchmarks (Gatsby, 2017) – as referenced in section 6.1 above – are relevant in the context of this survey:

Gatsby benchmark 4 : Students should experience a practical activity in at least half of their science lessons. On average, across the year and across all the sciences, at least half of lessons should involve direct practical activities, whether hands–on or teacher demonstration.

Gatsby benchmark 7 : Teachers should use digital technologies to support and enhance practical experience, but not to replace it. Virtual environments and simulated experiments have a positive role to play in science education but should not be used to replace a good quality, hands–on practical.

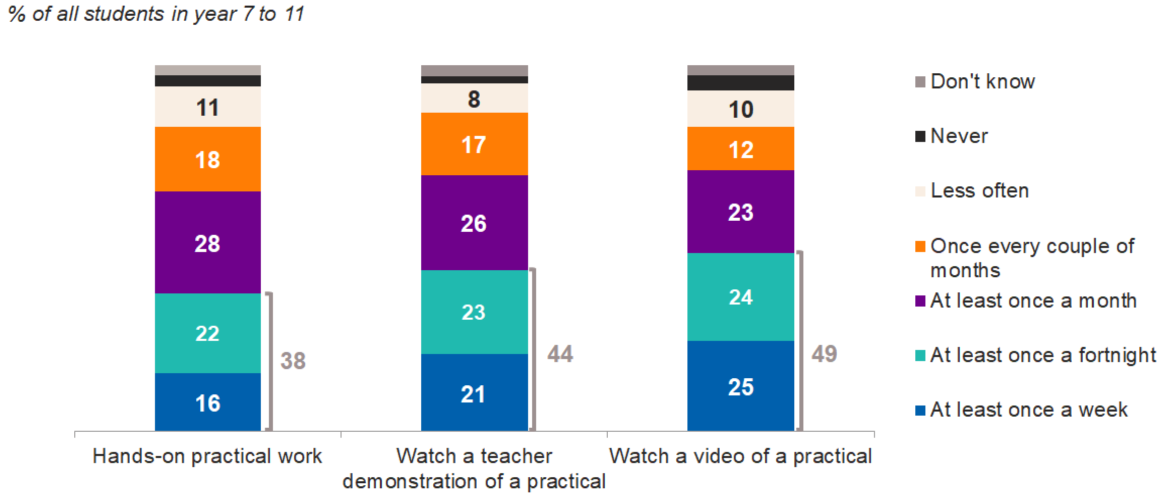
Gatsby (2017) conducted a survey among science teaching leads in English secondary schools in 2017 and concluded that most schools in England were falling short of benchmark 4, with around two–fifths of science lessons in English schools involving practical activities at that time. Gatsby also found that this varied widely by age and science subject, with greater frequency among younger age groups, and in physics and chemistry compared with biology. According to the Gatsby survey, in 2017 there was no widespread evidence of digital technologies replacing more hands–on practical work (benchmark 7): Gatsby found that 58% of schools used computers to replace practical sessions 'little of the time' and 33% did so 'some of the time'.

However, the SET 2023 findings indicate a significant shift over the period since the Gatsby research was published towards video technologies as a replacement for more direct practical experience. In SET 2023, among all students in years 7–11, the most common form of exposure to practical science was via video: 49% reported watching a video of a practical at least once a fortnight, compared with 44% watching a teacher demonstration, and 38% doing hands–on practical work at least once a fortnight (Figure 6.2).

In years 10–11, triple science students were doing more hands–on practical work at least once a fortnight compared with double science students (29% compared with 22%), while double science students were more likely to watch videos of practical work at least once a fortnight (51% compared with 42%). The percentage who observed teacher demonstrations of practical work was similar for both groups (33% of triple science and 31% of double science students).

The finding noted above might be related to the reduced number of teaching hours for double science compared with triple science (see Figure 6.1). This may also be related to a reduced level of specialist teaching for double science. Lauchlan (2018) found that while most secondary schools were offering teaching from teachers without subject–specific expertise, this was especially high among schools which only offered a double (combined) science route. This report also showed that GCSE combined science was most commonly under–resourced: 38% of schools reported that fewer than 3 teachers were allocated to a typical combined science class compared with 13% for separate science classes[19].

Figure 6.2: Frequency of different types of practical work among students in years 7–11 (2023)



Still thinking about this last school year, about how often did you generally do the following in science lessons? (Pracquan)
Bases: Year 7–11s (4,160): all year 7–9s (3077); half sample A year 10–11s (1,083)

Overall frequency: trends over time

Figure 6.3 displays trends in exposure to practical work in school science over time. For years 10–11, the SET 2023 results can be compared with SET 2016 and SET 2019. However, for years 7–9, these results can only be compared with 2019 as the 2016 survey did not cover this age group.

The time trend analysis provides evidence of a sharp decline in the more interactive forms of practical sessions across cohorts between 2016 and 2023. The percentage of GCSE–level students (years 10–11) doing hands–on practical work at least once a fortnight dropped from 44% in 2016 to 37% in 2019, and then more steeply to only 26% in 2023. There was a similarly sharp fall in the percentage watching a teacher demonstration at least fortnightly from 47% in 2016 to 38% in 2019 to 32% in 2023. Conversely the percentage watching a video of a practical at least fortnightly increased over time, and especially between 2019 (41%) and 2023 (46%).

Overall, in 2023, students in years 7–9 did more interactive practical work at least once a fortnight than students in years 10–11: 41% did hands–on practical work (compared with 26% of those in years 10–11) and 48% watched a teacher demonstration (compared with 32% in years 10–11). The percentage who watched videos of practicals at least once a fortnight was similar across both age groups.

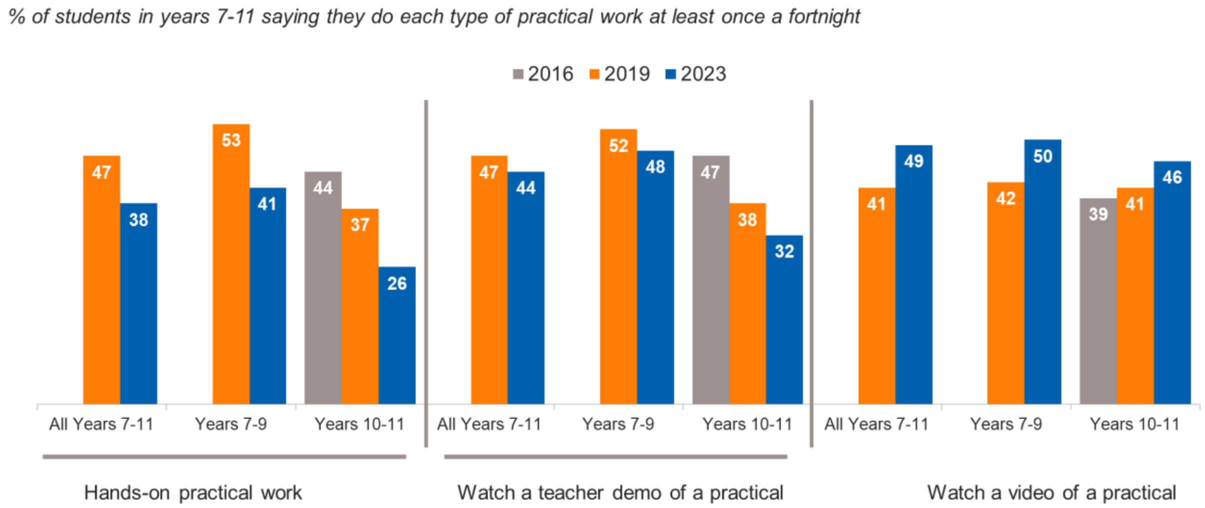
[19] Some of the data presented in this sentence was obtained via personal correspondence with the Institute of Physics rather than from the published report.

However, although students in years 7–9 did more practical work than GCSE–level students, the same shift over time from more direct exposure to video delivery of practicals is also evident in the younger age group. For example, the percentage of students in years 7–9 who did fortnightly hands-on practicals was lower in 2023 compared to 2019 (53% in 2019 vs 41% in 2023), while the percentage of year 7–9 students who viewed videos of practical work fortnightly was higher in 2023 compared with 2019 (42% in 2019 vs 50% in 2023).

Changes between 2016 and 2019 were thought to be at least partly attributable to changes in the GCSE specification over this period, which included changes in the way that practical skills were assessed. However, differences in findings between 2019 and 2023 could well be associated with school disruption during COVID–19, which caused schools to switch to more digital forms of science teaching, along with removal of practical assessments from exams.

It is possible that the changes over time between 2016 and 2023 are symptomatic of a longer–term shift towards using digital technology in place of hands–on practical work, even without COVID–19. However, even if this were to be the case, it is likely that the COVID–19 pandemic has accelerated any such changes and could mean that digital teaching practices introduced during lockdowns have now become more embedded. Also, as mentioned in section 6.1, a reduced opportunity for trainee teachers to learn practical teaching skills during the pandemic may have affected their ability and willingness to teach practical work hands-on even after COVID–19 restrictions were lifted.

Figure 6.3: Frequency of different types of practical work done by students in years 7–11 (2016, 2019, 2023)



Still thinking about this last school year, about how often did you generally do the following in science lessons? (Pracquan)

Bases (2023): All year 7–11s (4,160): all year 7–9s (3077); half sample A year 10–11s (1083)

Bases (2019): All year 7–11s half sample (2,193): all year 7–9s (1,153); year 10–11s (1,040)
Bases (2016): All year 10–11s (2,072)

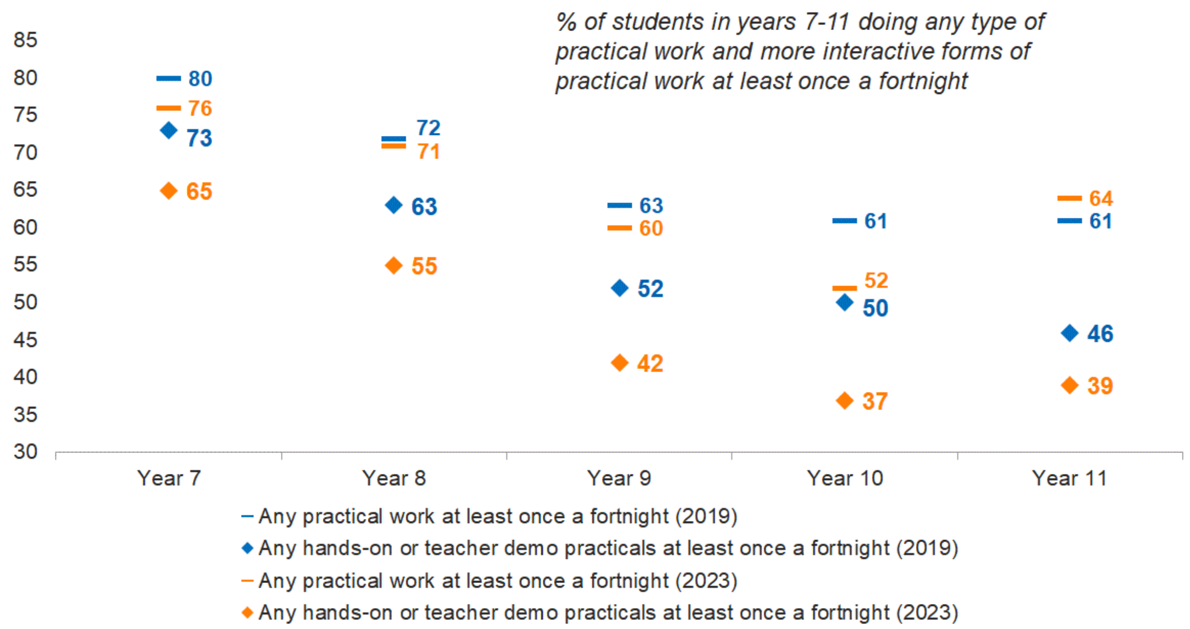
Figure 6.4 focuses on two summary measures for 2019 and 2023 which further underline these trends, but at the more detailed school year level: i) the percentage of students in years 7–11 who reported doing **any** of the three types of practical work at least once a fortnight; and ii) the percentage of students in years 7–11 who reported doing either hands–on practical work or teacher demonstrations (which is how Gatsby defines good–quality practical work).

This indicates that, broadly, the amount of practical work of any type that students are being exposed to overall may not have changed greatly between 2019 and 2023, although year 10 students in 2023 reported doing less practical work than year 10 students in 2019. As also observed in 2019, in 2023 there was again a clear pattern of decline in access to any form of practical work by school year: while three in four year 7 students (76%) reported having at least fortnightly exposure to any form of practical work, only 52% of year 10 students reported doing so. However, there was an uptick to exposure to any form of practical work in year 11, which was largely explained by an increase in watching videos of practicals from year 10 to year 11 (39% of year 10 students and 55% of year 11 students). This pattern was also evident in 2019 and could be linked to reduced frequency of more interactive practicals in the lead–up to GCSE exams as well as a propensity for schools to use videos as a revision aid.

Another way of looking at changes over time and by school year is to compare the equivalent cohort over time. Although this is not a cohort survey that follows up the same participants over time, comparing students in a younger school year in 2019 (e.g. Year 7) with the same year group four years later in 2023 (e.g. Year 11) provides an indication of changes within that individual school cohort. When looked at from this perspective, 80% of year 7s in 2019 and 64% of year 11s in 2023 undertook any form practical work at least fortnightly, which reflects the findings noted above.

However, while levels of exposure to practical work of any type appear to have remained broadly consistent between 2019 and 2023, there appears to have been a decline in the volume of students undertaking more direct forms of practical work. Across all school years, the percentage of students being exposed to either hands–on or teacher–demonstrated practicals was lower in 2023 compared with 2019, a drop that is especially apparent in year 10, where this percentage has dropped from 50% to 37%. As we have seen in Figures 6.2 and 6.3 above, it is clear that watching videos of practicals has increasingly replaced these more interactive forms of practical work.

Figure 6.4: Frequency of different types of practical work done by students in years 7–11 (2016, 2019, 2023)



Still thinking about this last school year, about how often did you generally do the following in science lessons? (Pracquan)

Bases (2023): All year 7/8/9 (993/1,032/1052); half sample year 10 (544) half sample year 11 (539)
Bases (2019): All year 7–11s Half sample (2,193); all year 7/8/9/10/11 half sample (372/402/379/508/532)

Variation in frequency of practical work by region and area deprivation

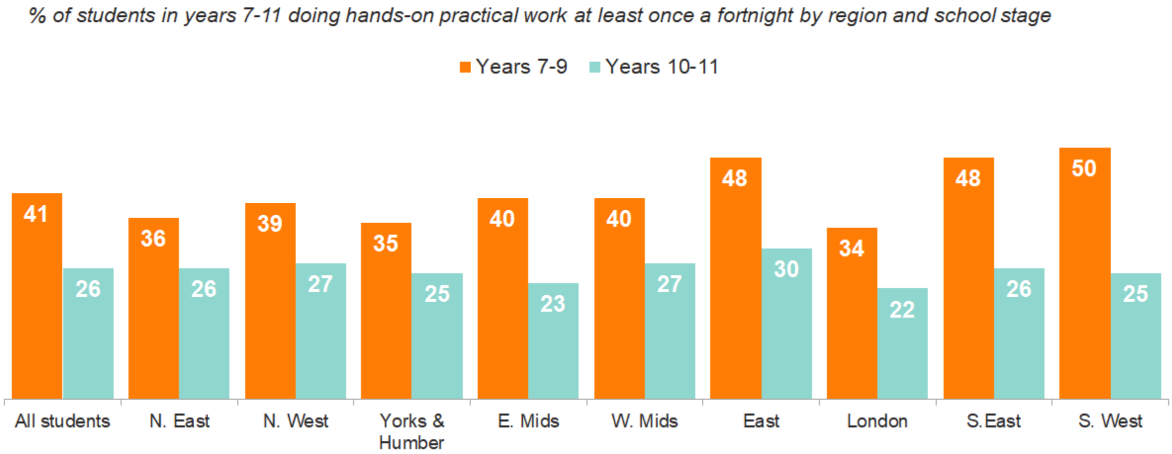
As shown in Figure 6.5, there were some variations in the experience of practical work by region. It was notable that access to hands–on practical work was lower in London compared with other regions, and this was the case among students in both years 7–9 and years 10–11.

The participation rate of year 7–9 students doing hands–on practical work at least once a fortnight was in the 35%–40% range across most regions but it was higher in the South East, South West and East (48–50%) and lower in London (34%). The participation rate of year 10–13 students doing hands–on practical work at least once a fortnight was higher than average in the East (30%) and lowest in London (22%)[20].

There were no clear differences by IDACI quintile.

[20] While this latter finding is indicative of the wider trend the difference is not significant given smaller base sizes.

Figure 6.5: Percentage of years 7–11 who took part in hands–on science practical sessions at least once a fortnight by region and school stage (2023)



Still thinking about this last school year, about how often did you generally do the following in science lessons? (Pracquan)

Bases: All year 7–9s (3,077), half sample A year 10–11s (1,083): North East year 7–9/10–11 (131/55*); North West year 7–9/10–11 (385/138); Yorkshire and the Humber year 7–9/10–11 (334/93); East Midlands year 7–9/10–11 (281/102); West Midlands year 7–9/10–11 (328/130); East of England year 7–9/10–11 (350/119); London year 7–9/10–11 (436/168); South East year 7–9/10–11 (516/178); South West year 7–9/10–11 (310/100)
*Note small base size

6.4 Whether students feel they do sufficient practical work

On balance, students in all school years 7–11 wanted to do more practical work (Figure 6.6). Overall in 2023, 22% thought they did enough practical work and 71% would have liked to do more; only a negligible percentage (3%) wanted to do less.

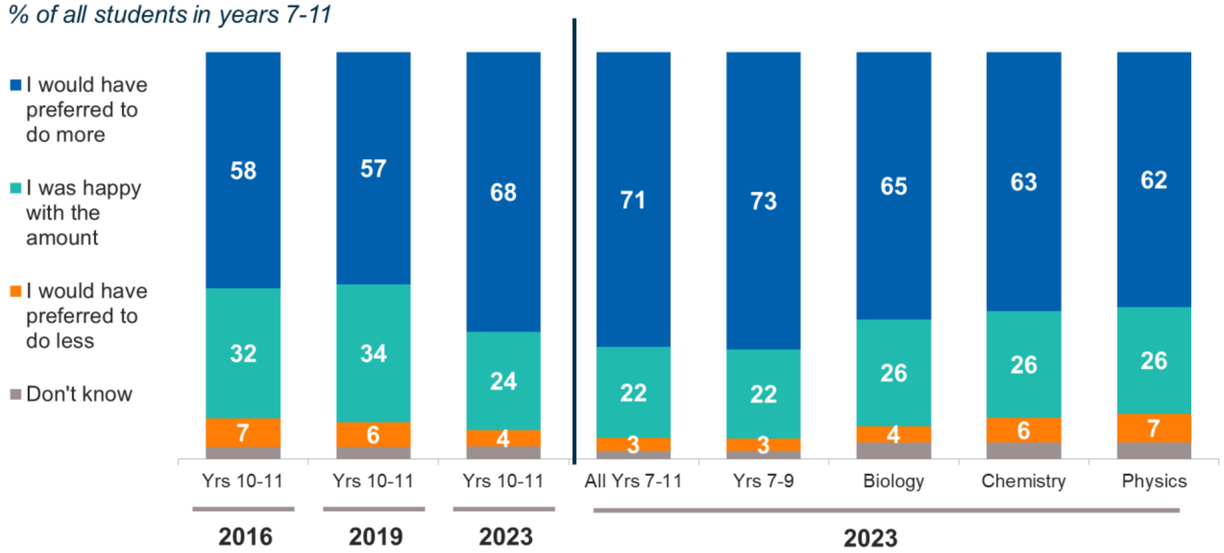
For clarity, students who wanted to do more practical work were asked which type of practical work they wanted to do more of. Almost universally, 94% said they wanted to do more hands–on practical work, while there was much less appetite among this group for more teacher demonstrations (12%) or more videos of practicals (5%).

Year 7–9 students were more likely to be dissatisfied with the amount of practical work they do compared with year 10–11 students (73% compared with 68%).

For students in years 10–11, findings can be tracked since 2016. These indicate that in 2023 there is considerably more unmet demand for practical work compared with previous years. The percentage of year 10–11 students who wanted to do more practical work was 58% in 2016, 57% in 2019 and 68% in 2023.

In 2023, students in years 10–11 were asked about their preference for the volume of practical work individually within each science subject. This indicates that levels of unmet demand are broadly consistent across all three sciences (from 62% in physics to 65% in biology).

Figure 6.6: Preference to do more practical work in years 7–11 (2016, 2019 and 2023)



Which of these best applies to you? (Pracres)

Bases (2023): Years 7–11 (4,160); years 7–9 (3,077); half sample A years 10–11)1,083)

Bases (2019): Years 7–11 half sample (2,193); years 7–9 (1,153); years 10–11 (1,040)

Bases (2016): Years 10–11 (1,061)

There were some clear trends in terms of the types of students who would have liked to do more practical work:

- Students who said they did hands–on practical work less than once a fortnight (79% compared with 61% who did hands–on practical work more frequently).
- Year 7–9 students who were not interested in science (78% compared with 60% who were very interested in science).
- Year 10–11 students on the double science pathway (73% compared with 64% of year 10–11 students on the triple science pathway).
- Students who see science as 'not for me' (76% compared with 65% who say they actively seek out science news and events).

It is interesting to note that the appetite for more practical work was higher among students taking the double science route and among those with lower levels of interest and engagement in science. Given that these groups were less likely to want to study science or enter a career in science (see chapters 8, 9 and 11), increasing the exposure to practical science among these traditionally less–motivated groups (for example, those in lower–ability groups or those who take double science) may be one way to help even out imbalances in science outcomes across the population.

As in SET 2016 and SET 2019, SET 2023 also shows a connection between a teacher being seen as 'good' and the amount of practical work students experience. Among year 7–9s, 30% of students citing a 'good teacher' as one of their reasons for enjoying science thought they did enough practical work, compared with only 17% of students who did not cite having a good teacher as a motivation for learning science.

For older students in years 10–11, a similar pattern can be found for those citing a 'good' teacher as one of their reasons for enjoying biology, chemistry and physics. For example, 37% of those who were encouraged by having a good teacher in chemistry thought they did enough practical work compared with 19% of students who did not cite having a good teacher as a motivation for learning chemistry.

6.5 Which groups of students were most likely to be motivated by practical work?

As discussed in Chapter 4, enjoying practical work was the top reason for feeling encouraged to learn science: overall, 52% of students in years 7–9 selected this as a motivating factor, while between 21% and 28% of students in years 10–13 cited this as a motivating factor individually for biology, chemistry and physics (see section 4.3). As seen in Figure 6.4 above, access to practical work declines in older year groups, which helps explain the reason for this drop – it follows that as students receive less exposure to practical work that it will become less of a motivating factor.

The following groups of students in years 7–9 were the most likely to feel motivated by doing practical work in science:

- Students in the early years of secondary school: 56% of students in years 7 vs 52% of year 8 and 47% of year 9 students.
- Students with many family science connections: 59% of those with a high FSCI–Science score vs 42% with a low FSCI score.
- Students with a high self–belief in science ability (60% who saw themselves as 'very good' or 'good' at science compared with 32% who see themselves at 'not very good' or 'not good at all' at science).
- Students who have a strong science identity (58% of those who are actively engaged in science compared with 37% of those who see science as 'not for me').

6.6 Nature of practical work done at school

Gatsby (2017) advocates within their benchmarks several markers of high–quality practical provision. These include the opportunity for students to undertake practical work individually, in pairs, and in groups; that practical work should be varied and balanced in type, including outdoor fieldwork activities; and that practical activities should be followed up by discussing the outcomes with the class, individually or collectively.

A question designed to explore the more detailed nature of practical work undertaken by students in years 7–11 was asked for the first time in 2023 (see Figure 6.7).

In SET 2023, when carrying out an experiment, students in years 7–11 were most likely to undertake this as part of a group task: 81% said that they carried out an experiment with others while 38% said that they carried out an experiment independently.

Most students had done some follow–up work following an experiment: 74% analysed the results, 73% wrote up conclusions although a lower percentage (57%) said they took part in a class discussion.

An activity involving fieldwork was undertaken by 29% of students while 14% said that they had carried out an experiment using a virtual laboratory, defined in the survey as 'a simulated experiment rather than in real life, using a website or special computer software'[21].

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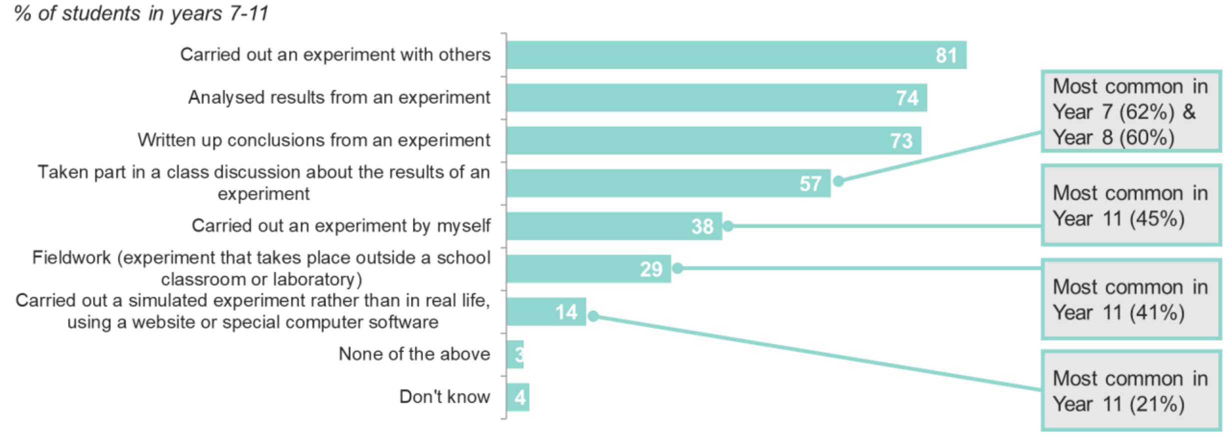
[21] It was found in cognitive pre–testing that young people were not familiar with the term 'virtual laboratory'.

There were some differences by school year. Class discussions were more common in year 7 (62%) and year 8 (60%) compared with years 9–11 (53%). However, some types of practical work were much more common in year 11 than all other years: 45% of year 11s had carried out a solo practical experiment, 41% had conducted fieldwork, and 21% had done work involving computer simulation.

Figure 6.7: How students experienced practical work in years 7–11 (2023)



Thinking about the whole of this last school year, have you done any of these kinds of work in science lessons? (Pracqual)
Bases: Years 7–11 (4,159); all year 7/8/9 (993/1031/1052); half sample A year 10/11 (544/539)

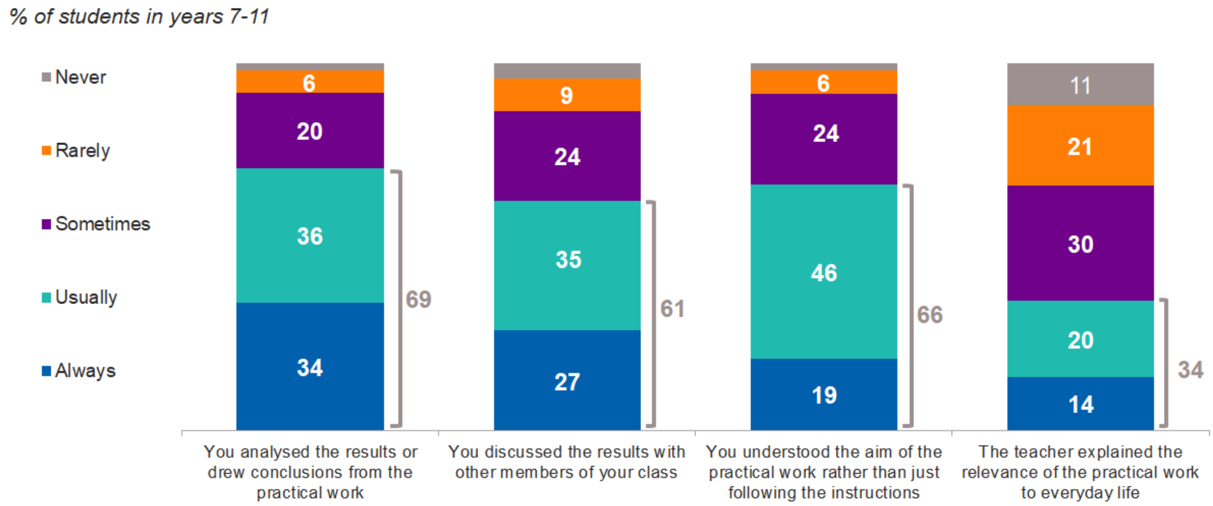
6.7 Quality of practical work done at school

Some further questions were added to the 2023 survey for the first time in the survey series to help assess the level of quality of practical work undertaken by students.

Most year 7–11 students said that they always or usually had a chance to discuss the results of the practical with other class members (61%) and to analyse results or draw conclusions from the practical task (69%), while 66% said that they understood the aim of the practical rather than just following instructions (Figure 6.8).

However, less positively, only a third of students (34%) said that the teacher always or usually explained the relevance of the practical work to everyday life. This is an important finding as one of the criticisms levelled at practical work (see discussion in section 6.1) is that students simply follow a 'recipe' when doing a practical, and fail to learn the relevant scientific concepts underpinning it. In support of this observation, Cramman et al. (2019) found that the breadth of practical work undertaken by 11–14 year olds in England and Scotland was limited, with most experiments requiring the student to "follow prepared instructions", with fewer opportunities for more open–ended exploration.

Figure 6.8: Extent to which students in years 7–11 experienced good quality practical work (2023)



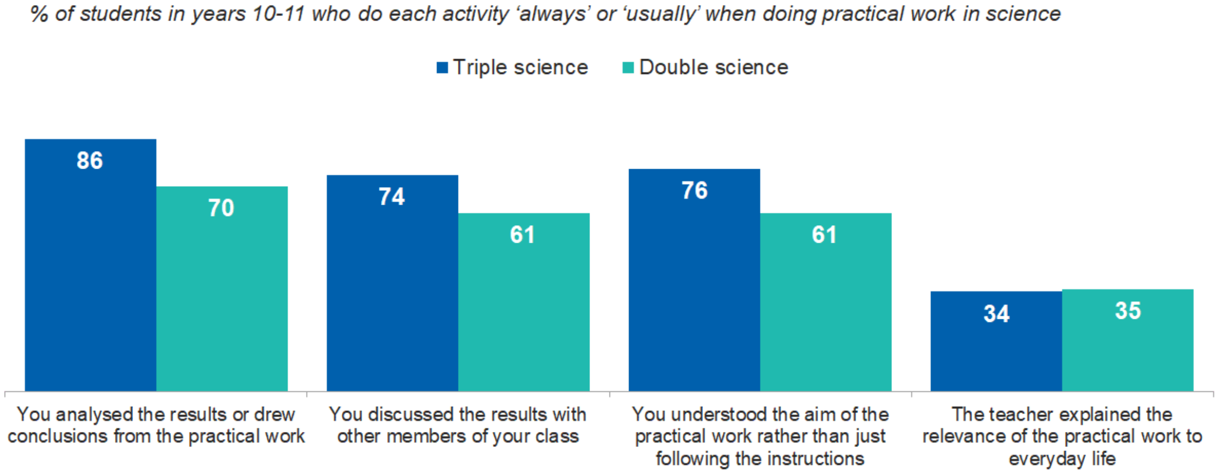
Thinking about the whole of this last school year, when doing practical work, how often would you say that… (PracOft)
Bases: 2023 Years 7–11 – all years 7–9, half sample years 10–11 (4,160)

Male students (72%) were more likely than female students (59%) to say that they 'always' or 'usually' understood the aim of the practical work rather than just following the instructions.

Students from minority ethnic groups were more likely to feel that they experienced good quality practical work. For example, these students were more likely than white students to say that that they always or usually had a chance to discuss the results with other classmates (Asian 72%; Mixed/multiple: 66%; Black 70%; white 59%) and that the teacher explained the relevance of the task (Asian 40%; Mixed/multiple: 38%; white 32%).

For three of the four items covered in Figure 6.8, students on a triple science pathway were more likely to say that they experienced features of high–quality practical work (Figure 6.9). Students on the triple science pathway were more likely than those on the double science pathway to report that they always or usually understood the aim of the practical task (76% vs 61%), and that they always or usually analysed results or drew conclusions (86% vs 70%) or took part in a class discussion following the practical (74% vs 61%). However, there was no difference in the percentage who said that the teacher had explained the relevance of the practical task: one in three students on both science pathways said this happened on a frequent basis.

Figure 6.9: Extent to which students in years 7–11 experienced good quality practical work by type of science course at GCSE (2023)



Thinking about the whole of this last school year, when doing practical work, how often would you say that… (PracOft)
Bases: Years 7–11 – all years 7–9, half sample years 10–11 (4,160); double science (568); triple science (383)

7. Science pathways at GCSE

This chapter explores science pathways taken by students in years 10–11, the profile of students who take triple and combined (double) science, and barriers to the uptake of triple science. The chapter also covers the experience of private tuition or other help received when studying for science GSCEs. Findings have been compared with SET 2016 and SET 2019 where relevant.

Key findings

Changes over time

The percentage of students who said they had access to triple science increased over time between SET 2016 and SET 2023. Nine in ten students in 2023 (89%) said they were offered the opportunity to take triple science, a small increase since 2019 (87%) and a larger increase since 2016 (81%). Of those who did not take triple science, only 3% said that the school not offering triple science had been the reason for this, down from 10% in 2019 and 23% in 2016.

2023 findings

A third (32%) of year 10–13 students said they had taken triple science. However, there is evidence that some young people misclassified double science as triple science; official DfE figures suggest that the survey–derived measure is likely to be an over–estimate.

Triple science take–up among year 10–13s was higher among students from more advantaged backgrounds and with stronger family science connections. Take–up was higher among students who were Asian, living in the least deprived quintile, with many family science connections, with a university–educated parent, living in the South East, with a strong science identity, and who felt they were ‘good’ at biology, chemistry or physics.

One in five year 10–13 students would have liked to study triple science but were not able to. While most students taking a non–triple science route were content with this, 19% of non–triple science students would have liked to study triple science had the option been available to them.

Nine in ten year 10–13 students said they attended schools which offered triple science. The most common barriers to studying triple science related to lack of interest, perceptions of difficulty and volume of work. Among those who didn’t study it, only 3% said that their school had not offered it. Instead, most students (69%) cited a personal barrier such as lack of confidence or interest, or concerns about the volume of work; 38% cited a school–selection barrier such as not achieving the grade required. Females were more likely than males to choose not to study triple science because they lacked confidence (38% vs 23%) or because they thought it would involve too much pressure (34% vs 27%).

One in three students had received some help from family or a private tutor when studying for their science GCSEs: 22% had received informal help from a sibling or other family member, and 12% had received private tuition. Receipt of private tuition was raised among students from a Black or Asian background, with a university–educated parent, with many family science connections, and among students living in London.

7.1 Context

'Triple science' is the study of three separate science GCSEs, whereas students taking 'double science' (or combined science) study all three sciences for two GCSE awards. These pathways have been in place since the GCSE reforms in 2018 that involved a change in the grading from A*–G to 9–1, although a similar specification was in place before these reforms.

All GCSE options provide students with teaching across the sciences to ensure coverage of the three core subjects (biology, chemistry, physics). Triple science is usually regarded as the 'gold standard' of science education at GCSE as it provides the opportunity to study a wider range of science content. It is also linked to more positive attitudes and confidence in science, higher rates of post–16 science uptake and raised aspirations to study STEM subjects (this report, chapters 3, 8, 9; Archer et al., 2020).

Recent data suggest that the majority of state schools – over 90% – now offer triple science as an option (Teacher Tapp, 2022). However, there have been several publications citing regional, demographic and attainment imbalance in the entitlement to triple science. For example, STEM Learning (2022), based on an analysis of 2019 NPD data, found that among schools which entered no students for GCSE triple science, on average 38% of students were from disadvantaged backgrounds compared to 12% of students at schools that entered most of their students for triple science. On a similar theme, Archer et al. (2020) noted that students from socially disadvantaged and lower–attainment groups were much less likely to study triple science, patterns which are repeated in the SET 2023 data (section 7.3). Archer et al. (2020) further noted that triple science is overwhelmingly seen as the route for those who are 'clever' and 'science–y' and suggest that the triple science route could actually be perpetuating social inequalities among pupils who are studying science and aspiring to work in a science career.

Against this backdrop, this chapter explores the profile of students in terms of the science course they have taken and barriers to uptake, including a detailed analysis of both school–based and personal barriers.

7.2 Science pathway taken in years 10 and 11

The Science Education Tracker asked students to report their current (if year 10/11) or previous (if year 12/13) GCSE science course.

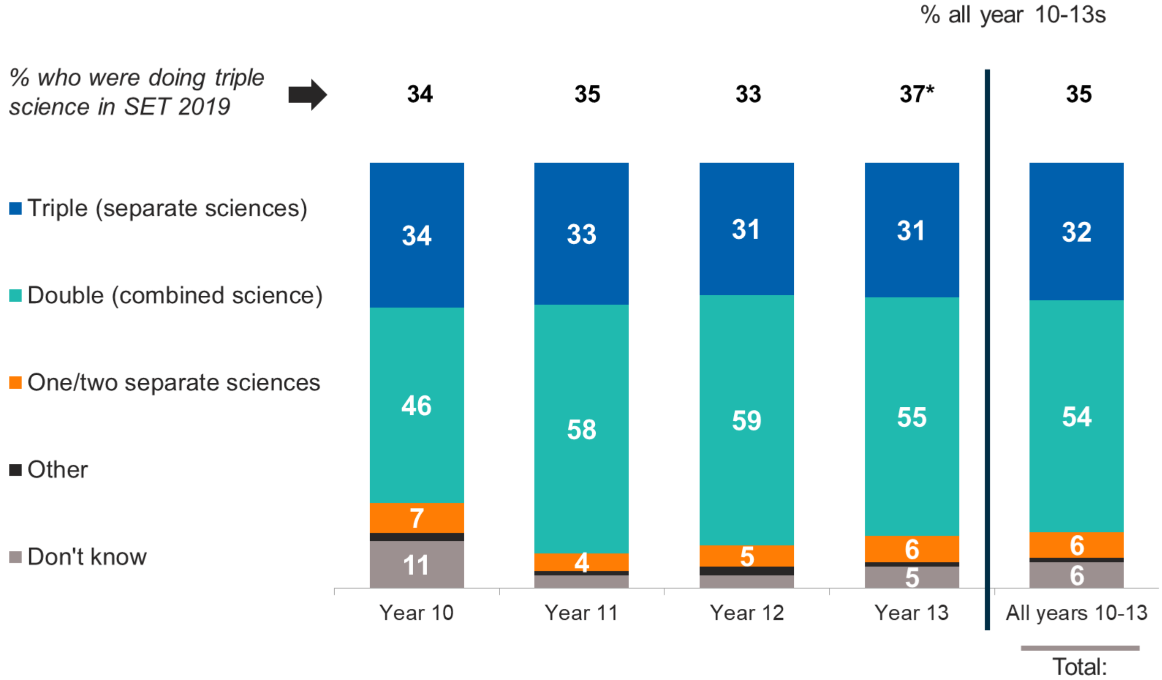
According to SET 2023 survey data, 32% of students across years 10–13 were taking or had taken triple science GCSE, while 54% were taking or had taken the combined (double) science pathway, with only minimal percentages opting for separate sciences (6%) or an alternative non–GCSE pathway (1%) (Figure 7.1).

The survey data suggest a ratio of triple to double science of 37:63. However, it is important to note that these figures are based on student self–reported data, and there is clear evidence that the survey rate of triple science uptake was overestimated due to student confusion around what counts as 'triple' and 'double' science[22]. Similar confusion was also noted in SET 2019 and SET 2016.

Official data for GCSEs taken in 2021, 2022, 2023 (when respectively the year 13, 12 and 11 cohorts would have taken their GCSES)[23] suggests that the ratio of triple to combined science is about 28:72 which reinforces the indication that the survey figures overestimate triple science take–up. However, as the questions were asked in the same way across all surveys in the SET series, changes over time detected by the survey are likely to reflect genuine changes in the uptake of different pathways.

Across the individual cohorts of years 10, 11, and 12, triple science GCSE take-up has remained broadly comparable over time. While there has been an apparent large drop among the year 13 cohort, it should be noted that the year 13 cohort in 2019 took a different GCSE and therefore the measures are not directly comparable across cohorts.[24]

Figure 7.1: Science pathway taken at GCSE: survey–reported data among years 10–13 (2019, 2023)



* Not directly comparable across the two surveys as the Year 13 cohort in SET 2019 took unreformed GCSEs graded A*-G instead of 9-1

Which science course [did you take/are you taking] in year 10 and 11? GCSESciA
Bases (2023): All year 10–13s (4,179): Year 10 (1,057); year 11 (1,076); year 12 (1,040); year 13 (1,006)

[22] In cognitive testing it was found that students studying all three sciences as part of a double or combined science curriculum sometimes thought they were studying triple science, as they still took exams in all three science subjects. It tended to depend on how the science course options were communicated to students and parents by the school.
[23] See for example https://www.gov.uk/government/statistics/provisional–entries–for–gcse–as–and–a–level–summer–2023–exam–series/provisional–entries–for–gcse–as–and–a–level–summer–2023–exam–series
[24] The 2019 year 13 cohort would have taken their science GCSEs in 2017 when the grading was still A*–G as opposed to the reformed 9–1 specification.

7.3 Patterns of triple science uptake by population subgroups

The discussion in section 7.2 above has demonstrated that prevalence estimates based on science pathways taken should be interpreted with a degree of caution. However, it is still possible to investigate overall patterns associated with triple science uptake.

Based on the survey classification, and compared with the overall survey rate in SET 2023 (32%), triple science take–up among years 10–13 was higher in the following groups:

- Asian students (37% overall: 36% of Asian males and 38% of Asian females).
- More advantaged students living in the least deprived IDACI quintile (42%).
- Students with a strong science identity (58% who took an active interest in science news and other activities).
- Students with strong family science connections (48% of those with a high FSCI score).
- Students who feel that they are 'very good' or 'fairly good' at biology, chemistry, physics (44%, 47%, 47% respectively).
- Students with a parent who had been to university (41%).
- Students living in the South East (39%).

Conversely, uptake of triple science, when compared with the overall rate of 32%, was lower in the following groups:

- Black students (29% overall: 31% of Black males and 28% of Black females).
- Students living in the most deprived IDACI quintile (25%).
- Students with a weak science identity (16% who considered that 'science is not for me').
- Students with no family science connections (22% of those with a low FSCI score).
- Students who feel that they are 'not very good' or 'not good at all' at biology, chemistry, physics (15%, 20% 19%, respectively).
- Students without a university–educated parent (26%).
- Students living in the North West and Yorkshire and the Humber (both 26%).

The relationship found in SET 2023 between triple science uptake and disadvantage is consistent with findings reported elsewhere (Archer et al., 2020, STEM learning, 2022). For example, the ASPIRES 2 survey noted that the most socially disadvantaged students were almost two and a half times less likely to study triple science compared to the most advantaged. Together, these findings underline the importance of income and family science connections, as well as identity and confidence in ability, in explaining science–related choices and outcomes for young people.

7.4 Barriers to taking triple science

As in previous SET surveys, the reasons for not taking up triple science were classified into three categories:

- **School–access barriers:** where schools do not enter any students for triple science;
- **School–selection barriers:** triple science is available, but schools are selective in who is given the opportunity or encouragement to study it;
- **Personal barriers:** triple science is available, but students choose not to take it due to a lack of interest or confidence.

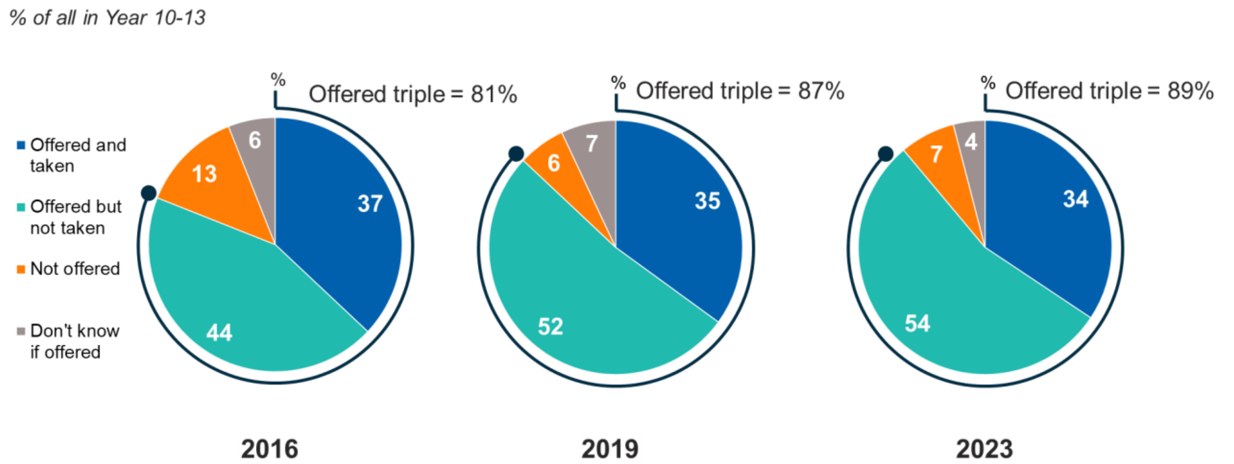
We explore these barriers separately in the sections below.

School access barriers

Figure 7.2 shows the percentages of students in the three SET surveys who believed that their school entered at least some students for triple science. Overall, according to SET survey data, access to triple science has increased between the survey time points with a particularly steep increase between SET 2016 and SET 2019, though we are clearly unable to conclude if this increase has been consistently maintained throughout the period 2016–23.

The rate has increased from 81% of students saying that their school had offered it in 2016 to 87% in 2019 and then further to 89% in 2023. The result for 2023 is broadly consistent with other external data; for example the Teacher Tapp survey in December 2022 (Teacher Tapp, 2022) reported 93% of schools in England offering access to triple science.

Figure 7.2: Whether triple science was offered to at least some students at their school: 2016, 2019, 2023 (students in years 10–13)



Which science course [did you take/are you taking] in year 10 and 11? (GCSESciA/GCSESciB)

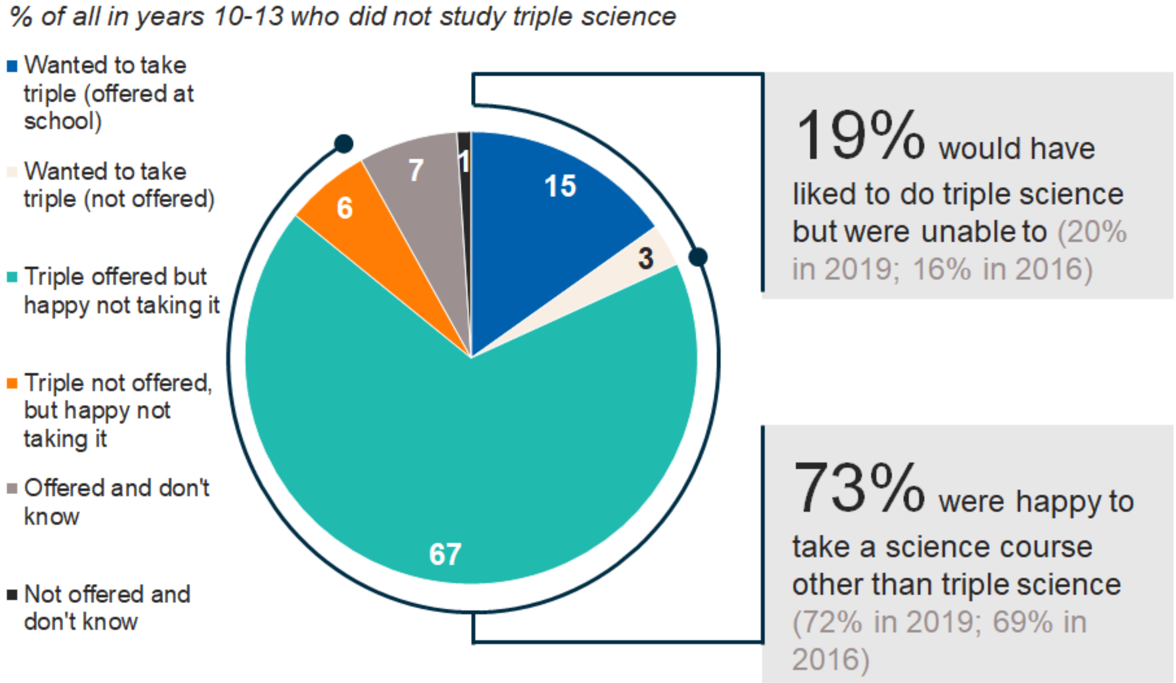
When you were choosing your GCSE options, did your school offer Triple Science to any students? (TripSciSch)

Bases: All year 10–13s: 2016 (4,070), 2019 (4,095), 2023 (4,179)

Consistent with other published reports which highlight the more limited availability of triple science within more socially disadvantaged areas (Archer et al., 2020; Teacher Tapp, 2022), SET 2023 also found a link between access to triple science and socioeconomic status. Overall, in 2023, 11% of students said either that their school didn't offer triple science or that they didn't know if it did. However, this rate was higher for those living in more deprived IDACI quintiles (15% in the most deprived quintile reducing to 5% in the least deprived quintile).

Students who did not take triple science were asked whether this was their preference. Figure 7.3 shows that a large majority of students (73%) were happy with the science route they took, while 19% felt that they had been denied access to triple science by their school, either because it was not offered (3%) or because it was selectively not offered to them (15%). There are no changes on these measures compared with 2019 (Figure 7.3).

Figure 7.3: If you did not study triple science, was this the preferred route? Students in years 10–13 (2016, 2019, 2023)



(If triple science not offered by school) Would you have wanted to study Triple Science if your school had offered it? (TripSciNo) (If triple science offered school) At the time, did you want to study [Double Science / this science course] or would you have preferred to take Triple Science? (TripSci)
Bases: All year 10–13s who did not study triple science (excluding DK if offered): 2023 (2,301), 2019 (2,321), 2016 (2,202)

Some groups of students were somewhat more likely than others to feel that they had been denied access to triple science (that is, they had wanted to study it but their school either didn't offer it at all or didn't offer it to them):

- Asian students (23% vs 17% of white students),
- Students with many family science connections (27% vs 14% with no family science connections).
- Students living in the North East and West Midlands (24% and 23%, respectively, compared with 18% across all other regions).

School selection and personal barriers

Why didn't students take up triple science?

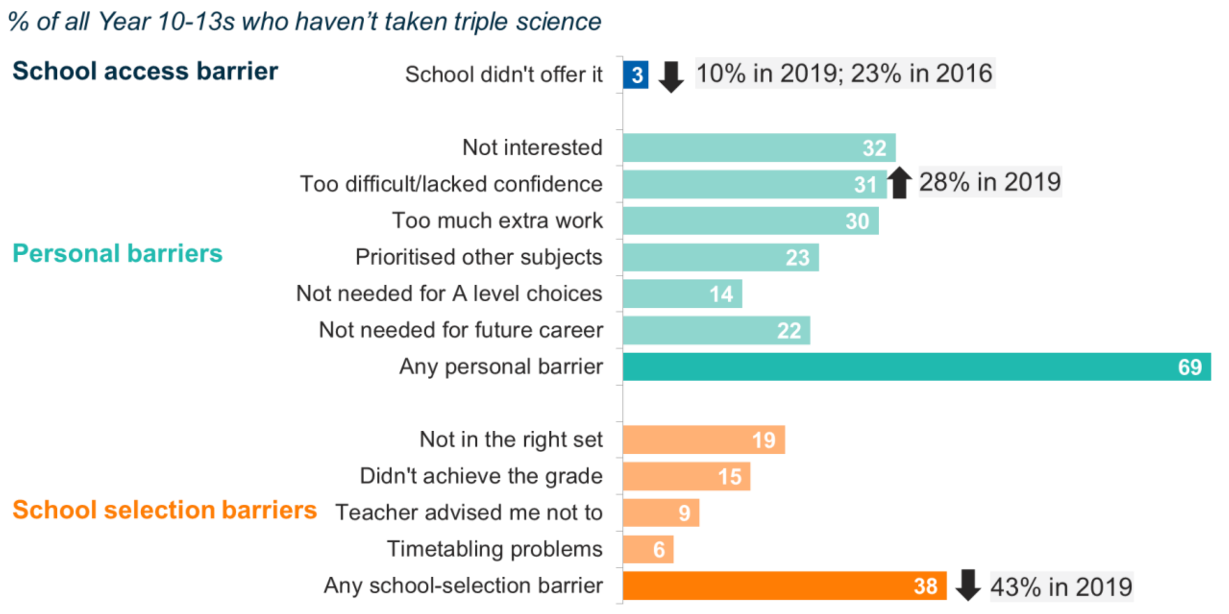
Analysis in this section is based on all students who did not take triple science. Figure 7.4 displays the key barriers to participation reported in 2023, with significant changes compared with previous surveys indicated.

Building on the findings discussed above, Figure 7.4 confirms that school access was a less important barrier in 2023 than in 2019: of those who didn't take triple science, only 3% said this was a barrier in 2023 compared with 10% in 2019 (and 23% in 2016).

As in 2019, personal barriers were more important than school–selection barriers in explaining why students do not take up triple science: 69% cited at least one personal barrier and 38% (down from 43% in 2019) at least one school–selection barrier. Personal barriers included lack of interest (32%), lack of confidence (31%, up from 28% in 2019), concern about the volume of work (30%), wanting to prioritise other subjects (23%), and not needing triple science for A level choices (14%) or future career plans (22%).

School–based barriers were mainly focused on not being in the right set (19%), not achieving the right grades (15%) and being dissuaded by teachers (9%).

Figure 7.4: Barriers to the uptake of triple science among those in years 10–13 who haven't studied it (2023)



Why didn't you (want to) study triple science? (TripSciWhy);
Base: All year 10–13s who did not study triple science (excluding DK if offered) 2023 (2,312) 2019 (2,321)

Variation in barriers by demographic subgroups

Among those who did not study triple science, there was some variation in the types of barriers cited by different groups of the student population by gender, ethnicity, and social disadvantage (IDACI quintiles):

- Females were more likely than males to say they were put off studying triple science due to lack of confidence (38% vs 23%), which reiterates the gender divide in students' confidence in their own ability more generally (section 3.5). Females were also more likely to be to feel that triple science was associated with too much extra work or pressure (34% vs 27%).
- Asian students were less likely than white students to be put off because they wanted to prioritise other subjects (17% vs 24%).
- Students from more advantaged backgrounds (IDACI quintiles) were more likely to say that they had prioritised other subjects (30% in the least deprived quintile vs 19% in the most deprived quintile), and that triple science was not needed for their future plans (26% vs 18%).

7.5 Private tuition and other external help with GCSE science

Overall, 34% of students in years 10–13 had received some help when studying GGSE science: 12% had received paid tuition outside of school (either in person or online), and 22% had received help from a sibling or other family member.

The propensity to receive help from a private tutor was raised among the following subgroups:

- Black and Asian students (22% and 21%, respectively compared with 9% of white students).
- When with a parent who had been to university (15% compared with 8% of students without a university–educated parent).
- Students with many family science connections (21% compared with 6% who had no such connections).
- Students living in London (21% compared with 12% overall).

There were no clear differences by level of area deprivation (IDACI quintiles).

It is also interesting that students who rated their abilities in science subjects as 'good' were somewhat more likely than those who rated their abilities as 'not good' to receive private paid tuition. For example, 15% who rated their ability in chemistry as 'good' received private tuition compared with 10% who rated their ability as 'not good', with similar findings for the other two science subjects.

The propensity to receive help from a sibling or other family member was higher among students with many family science connections (29% compared with 15% of those with no such connections).

8. Science pathways in years 12–13

This chapter explores the subject choices and intentions of students in years 12–13, once science becomes a non–compulsory subject. The chapter covers early post–16 science aspirations for years 7–9, post–16 subject choices among those in years 11–13, and variation in aspirations and choices by demographic subgroups. Finally, this chapter covers students' reflections on post–16 choices, and whether they had experienced any constraints when making these choices. Findings have been compared with 2019 where applicable.

Key findings

Changes over time

Compared with 2019, fewer year 7–9 students in 2023 intend to learn science after GCSE. The percentage of year 7s who think they will continue with science once it is no longer compulsory has fallen from 70% to 64%, with no change among year 8s and a small increase in post–GCSE science intentions among year 9s (from 55% to 59%). Among year 7s, a third (32%) say that science after GCSE is definitely not for them, up from 26% in 2019.

2023 findings

Six in ten year 7–9 students were open to following a science pathway when older: 62% said they would definitely or possibly choose to study science after GCSE, with 18% saying this was definite. Early aspirations to follow a science pathway were strongly related to ethnicity, interest, perceived ability, and family connections.

Self–perception of ability in STEM subjects was related to post–16 choices. Students in years 10–11 who felt they were 'good' at science subjects and maths were more likely to plan an academic route, while those who did not rate their abilities in these subjects were more likely to choose a vocational route.

A half of year 11–13s were taking (or planned to take) A levels. This pathway choice was over–represented among females, Asian students, triple science students, and those from the most affluent IDACI quintile.

About a third of year 11–13s were taking (or planned to take) a vocational pathway. This pathway choice was over–represented among double science students. When asked about subject area, the top three vocational pathways fell into the areas of health and social care, engineering, and administration and business management.

When making A level choices, students were more likely to opt for a non–STEM than a STEM pathway. Of all year 11–13 students who were either already studying for A levels or who had made their A level choices, 84% had chosen non–STEM subjects and 56% had chosen STEM subjects (many students had chosen a mixture – see paragraph below). In order, the most popular STEM A level choices were maths, biology, chemistry, physics and computing.

Among students taking STEM A levels, most took STEM subjects as part of a mixed STEM/non–STEM pathway: 43% of year 11–13 students who had made post–16 A level choices chose only non–STEM subjects, while 42% chose a mixed pathway and 14% only studied STEM subjects.

There was a strong association between self–ratings of ability in STEM subjects and intentions to study STEM at A level. Among year 11s who had planned but not yet embarked on A level courses, those who did not rate themselves as good at STEM subjects were highly likely to reject a STEM pathway altogether: between 56% and 62% who did not rate their abilities in STEM subjects as 'good' had rejected STEM altogether, compared with an overall rejection rate of 42%.

There were strongly gendered differences in both STEM and non–STEM A level choices. Males were more likely to choose maths, physics, and computing, while females were more likely to choose biology and chemistry. Females were more likely to choose many arts and social sciences subjects, including English, psychology and sociology.

Most students in years 11–13 were happy with post–16 choices at the time they made them: While 72% were happy, 20% said they would have preferred to take a different number or combination of subjects or courses. The main barriers to choosing subjects were the school or college not offering the course or a failure to meet minimum grade requirements. Unhappiness with post–16 subject choices was raised among those who self–reported difficulties relating to concentration, emotions, or behaviour.

When year 12–13 students were asked to reflect on their post–16 choices, 38% indicated that they would have liked to have chosen different subjects when originally selecting them or in hindsight. Reasons given for this focused on wanting to make different choices or a preference for more flexibility, for example taking a wider range of subjects.

8.1 Context

Once students reach the end of year 11, their pathways narrow as they make their post–16 choices. However, Archer et al. (2013) suggest that science aspirations might be formed much earlier; the period between ages 10–14 (years 7–9) is a critical time for the development of young people's attitudes to science, because by the age of 14, attitudes to science start to become increasingly fixed.

From year 11, students are required to make choices about post–16 pathways. However, the post–16 educational landscape in England is complex and students may experience difficulties making choices, for example about academic versus vocational routes, or which are flexible enough to enable future pathways which may not yet be fixed. At the time of writing, a potential qualification called the Advanced British Standard[25] has been proposed by the Government and is under consultation. As well as ensuring every student would study some form of maths and English to age

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[25] https://educationhub.blog.gov.uk/2023/12/14/the-advanced-british-standard-everything-you-need-to-know/

18, this would seek to offer students a broader curriculum closer to the baccalaureate system found in many international contexts, widening the level of post–16 choices compared to the choices currently available.

Against this policy background, this chapter explores the factors associated with post–16 choices in SET 2023, from the early aspirations of students in years 7–9 to the more confirmed pathways of those in years 10–13, looking at the factors that appear to influence pathways in years 12–13, and whether students are content with the choices they were able to make at this critical transition stage.

8.2 Future intentions among year 7–9s

Although students in the early years of secondary school may not yet have a precise idea of a future career pathway, it is interesting to look at early aspirations in relation to science.

Students in years 7, 8 and 9 were asked whether they thought they would carry on learning science after GCSEs, once this becomes an optional pathway.

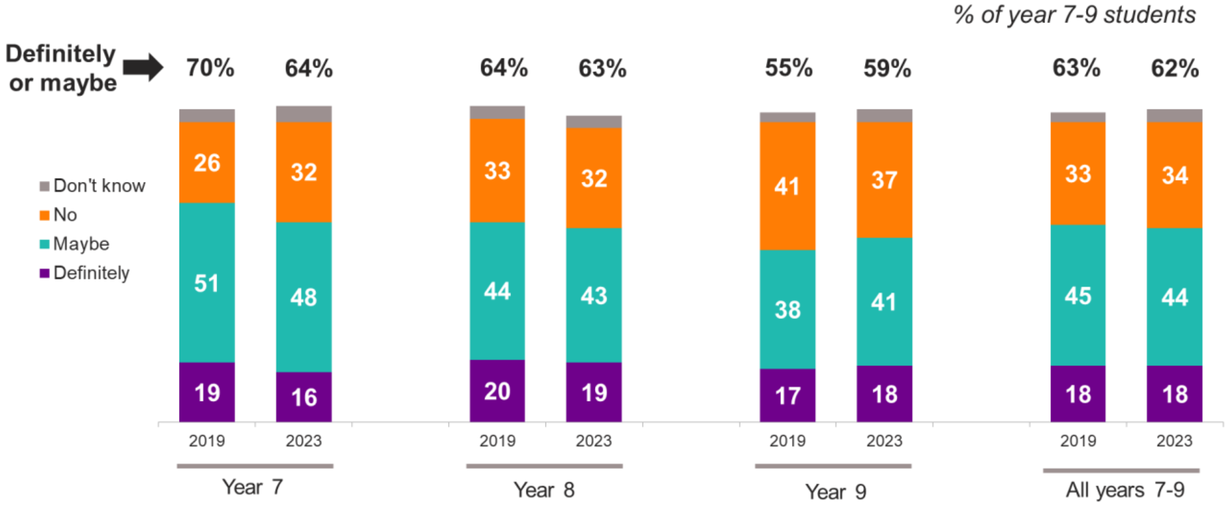
As shown in Figure 8.1, in 2023 around three in five students across years 7–9 were open to following a science pathway when they are older, with 62% saying they would definitely or possibly choose to study science after GCSE. The pattern of responses at an overall level remains unchanged from 2019. However, there has been a fall over time in post–GCSE science intentions among the year 7 group (from 70% in 2019 to 64% in 2023), with no change among years 8s and a small increase in such intentions among the year 9 group (from 55% in 2019 to 59% in 2023).

Among year 7s, a third (32%) said that science after GCSE is definitely not for them, up from 26% in 2019. The pattern of results over time – with a steeper decline in interest among the youngest cohorts compared with other year groups – mirrors similar changes in relation to the level of interest in school science shown in Chapter 3 (see section 3.3 for more discussion on this).

Given these changes over time, a different pattern by year group is now observed compared with 2019. In SET 2019, there was a fairly steep fall in future science intentions over the first three years of secondary school. However, in SET 2023, science intentions remained more stable over these school years, which is mainly explained by lower levels of enthusiasm for science among those in year 7.

It is also interesting to note that the percentage of students in SET 2023 who said they ‘definitely’ want to continue with science remained at around one in five over these school years. Although we do not (yet) have longitudinal data to affirm this, it would appear that the ‘maybe’ group is most vulnerable to being lost in the science pipeline.

Figure 8.1: Whether students in years 7–9 thought they would continue to learn science after it stops being a compulsory subject, by year group (2019 and 2023)

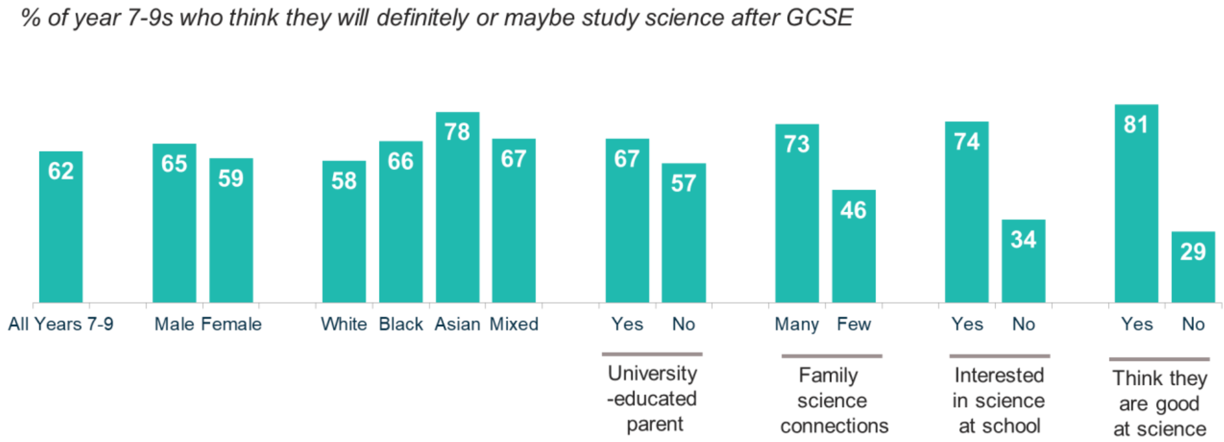


Everyone has to study sciences at GCSE. After that, students can choose what they want to study, for example at A levels. Which of the following best describes your view? (SciGCSELik)
Bases: (2023/2019): All years 7–9 (3,077/2,314); year 7 (993/775); year 8 (1,032/814); year 9 (1,052/725).

There were some clear demographic patterns in the types of young people who aspired to science pathways at this early stage. Figure 8.2 indicates only a relatively small gender difference in future aspirations to study science post–16, but there were wider differences by ethnic group: compared with white students (58%), Black (66%) and Asian students (78%) were much more likely to consider that they will definitely study science after GCSEs. Figure 8.2 also shows that early science aspirations were strongly related to interest, perceived ability and family connections.

Many of these patterns confirm similar findings noted in the ASPIRES study (Archer et al., 2020) and continue to underline the importance of family background in explaining STEM choices made by young people.

Figure 8.2: Whether students in years 7–9 thought they would continue to learn science after it stops being a compulsory subject by gender, ethnicity, family connections, interest and perceived ability in science (2023)



Everyone has to study sciences at GCSE. After that, students can choose what they want to study, for example at A levels. Which of the following best describes your view? (SciGCSELik)
Bases: All years 7–9 (3,077); Male/female (1,535/1,466); white (2,175); Black (183); Asian (402); mixed (195); Family science connections many/few (657/579); Interested in science yes/no (2,187/867); Good at science yes/no (1,531/486); University-educated parent yes/no (1,645/1,130)

8.3 Post–16 educational pathways

Year 10 and 11 students were asked about their intended pathways after GCSEs once they reach year 12, while those already in years 12–13 were asked about their current pathway (Figure 8.3). Students were able to choose more than one route so these pathways are not mutually exclusive.

Years 10–11

Amongst those in years 10–11, a half (50%) planned to study A levels in years 12–13 while 34% planned a vocational route, and 9% planned to start a paid job (Figure 8.3). Other options that were planned by very small percentages of students (under 5%) included intentions to study for an International Baccalaureate (IB), an Extended Project Qualification (EPQ), or a Core Maths qualification.

Compared with an overall average of 50%, students in years 10–11 who felt they were ‘good’ at subjects were more likely to plan to follow the A level route: 57% of those who thought they were good at maths; and, respectively, 63%, 62%, 61% and 56% who thought this about biology, chemistry, physics, and English.

On the other hand, compared with an overall average of 34%, students in years 10–11 who rated themselves as ‘not good’ at maths and science subjects were more likely to opt for a vocational route: 40% of those who felt they were not good at maths; 41% who thought this about biology; and 40% who thought this about chemistry. In contrast, those who thought they were good or not good at English were just as likely to consider a vocational pathway (33% and 34%, respectively).

These results suggest that confidence in abilities in STEM subjects is more of a driver for choosing between an academic and vocational pathway compared with English, which is the only other compulsory subject studied up to year 11.

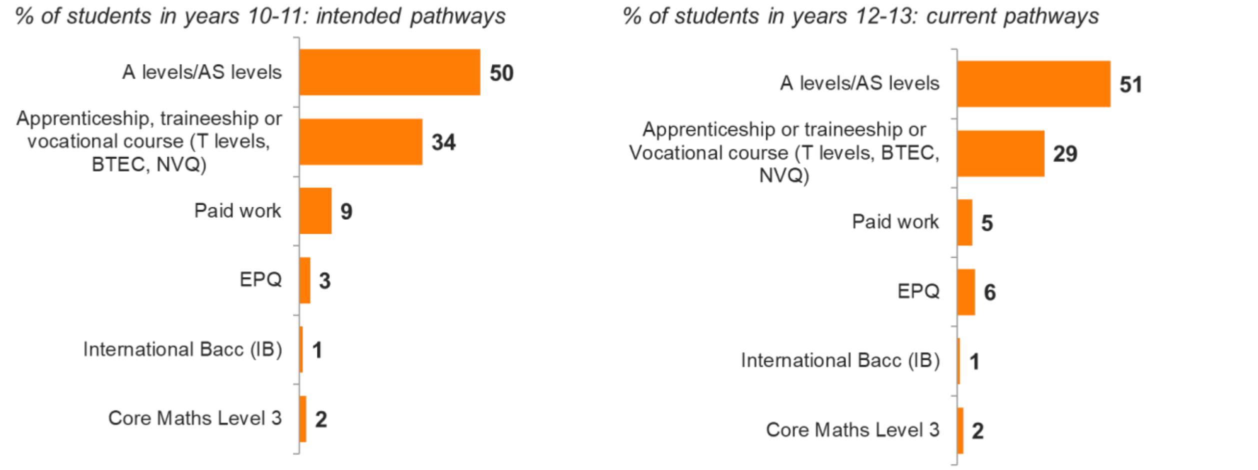
Years 12–13

The profile of pathways for those in years 12–13 was very similar to the intended pathways for those in years 10–11 (Figure 8.3). Focusing on this age group only, the choice of an academic or vocational pathway was strongly associated with a range of demographic characteristics.

Compared with the average of 51% taking A levels at years 12–13, females (58%), Asian students (64%), triple science students (70%), and students from the most affluent IDACI quintile (62%) were more likely to take this route.

Compared with the average of 29% taking vocational qualifications, double science students (35%) were more likely to opt for this pathway.

Figure 8.3: Intended year 12 and 13 pathways for those in years 10–11 and actual pathways among those in years 12–13 (2023)



Derived from a combination of: Which of these best describes what you have been doing during this academic year (September 2022 to July 2023)? (YPEconac); In the next academic year, are you planning to do any of the following types of further study or training in any subject? (FutL3plans); What else do you think you might do after Year 11? (FutL3Other); Have you been studying towards any of these qualifications in Year 12 or 13? (L3Qual)
Bases: All years 10–11 (2,133); All years 12–13 (2,046)

8.4 Post–16 subject choices

The analysis in this section is based on the following groups of young people in the survey:

- All year 12 and 13 students who were *already* studying for post–16 qualifications in a school, sixth form or FE setting.
- All year 11 students who *planned* to study for post–16 qualifications and had already made their post–16 choices about what they wanted to study.

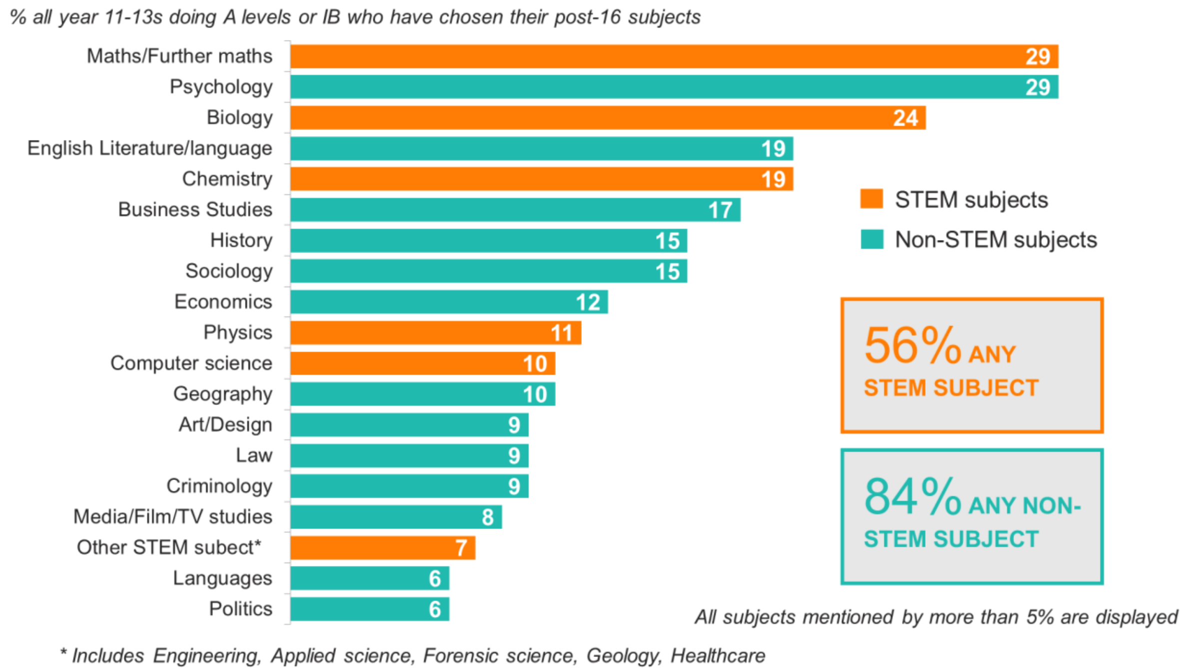
Intended and actual subject choices have been combined. In SET 2023, a different approach was applied to examine post–16 choices compared to previous SET studies. In 2023, we asked separate questions on subject choices for those studying A levels/International Baccalaureate (academic route) and for those choosing an apprenticeship, traineeship, T Levels, NVQ or BTEC qualifications (vocational route). This means that results cannot be compared with previous SET surveys.

Post–16 academic subject choices

Figure 8.4 displays the subject choices of year 11–13 students who were studying or intending to study for post–16 academic qualifications (mainly A levels). Maths and psychology were by far the most popular post–16 qualification choices (29% of this group were studying or planning to study each of these), then biology (24%), English (19%) and chemistry (19%). Focusing on other core STEM subjects, 11% of this group had chosen physics and 10% computing. The relative ranking of subject choices is aligned with 2023 DfE statistics on A level entries among young people (DfE, 2023a).

When combining the choices across all subjects, students in this group were considerably more likely to study or plan to study at least one non–STEM subject (84%) than at least one STEM subject (56%).

Figure 8.4: Post–16 subject choices among students choosing an academic route: based on year 11–13 students who had either already started their courses (years 12–13) or who had made their choices for the next year (year 11) (2023)



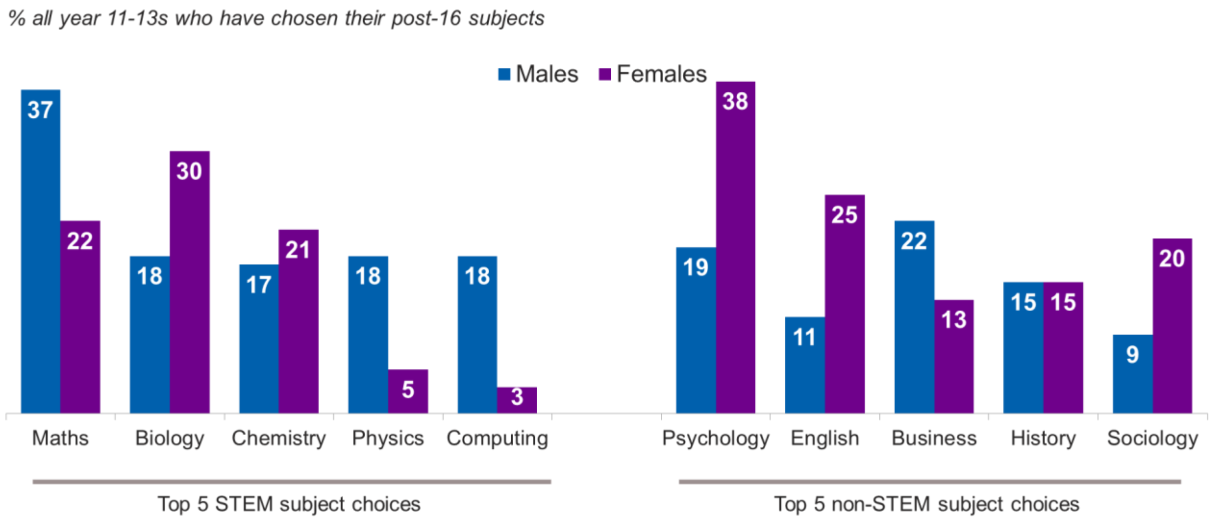
(Year 11 students who have chosen their subjects for Year 12) Are you intending to study any of the following subjects in Year 12? (Y12SubL3); (Year 12–13 students studying in a school, sixth form or FE college) Which subjects have you been studying in Year 12 or 13? (CurSubL3)
Bases: All year 11–13s who have chosen their post–16 subjects (1,845)

Figure 8.5 shows the gender differences for the five most popular academic STEM subjects and the five most popular non–STEM subjects, and this shows that subject choices were strongly patterned by gender. Males were more likely than females to choose many STEM subjects, including maths, physics and computing; although females were more likely to choose biology and slightly more likely to choose chemistry.

Females were more likely to choose many humanities and social sciences in the top 5, including psychology, English and sociology. History was more balanced by gender while business studies was more popular among males than females.

These patterns mirror very similar findings based on official statistics on A level entries (JCQ, 2023b).

Figure 8.5: Top 5 STEM and non–STEM post–16 subject choices among students choosing an academic route: based on year 11–13 students who had either already started their courses (years 12–13) or who had made their choices for the next year (year 11) by gender (2023)



(Year 11 students who have chosen their subjects for Year 12) Are you intending to study any of the following subjects in Year 12? (Y12SubL3) (Year 12–13 students studying in a school, sixth form or FE college) Which subjects have you been studying in Year 12 or 13? (CurSubL3)
Bases: All year 11–13s who have chosen their post–16 subjects: males (761), females (1,017)

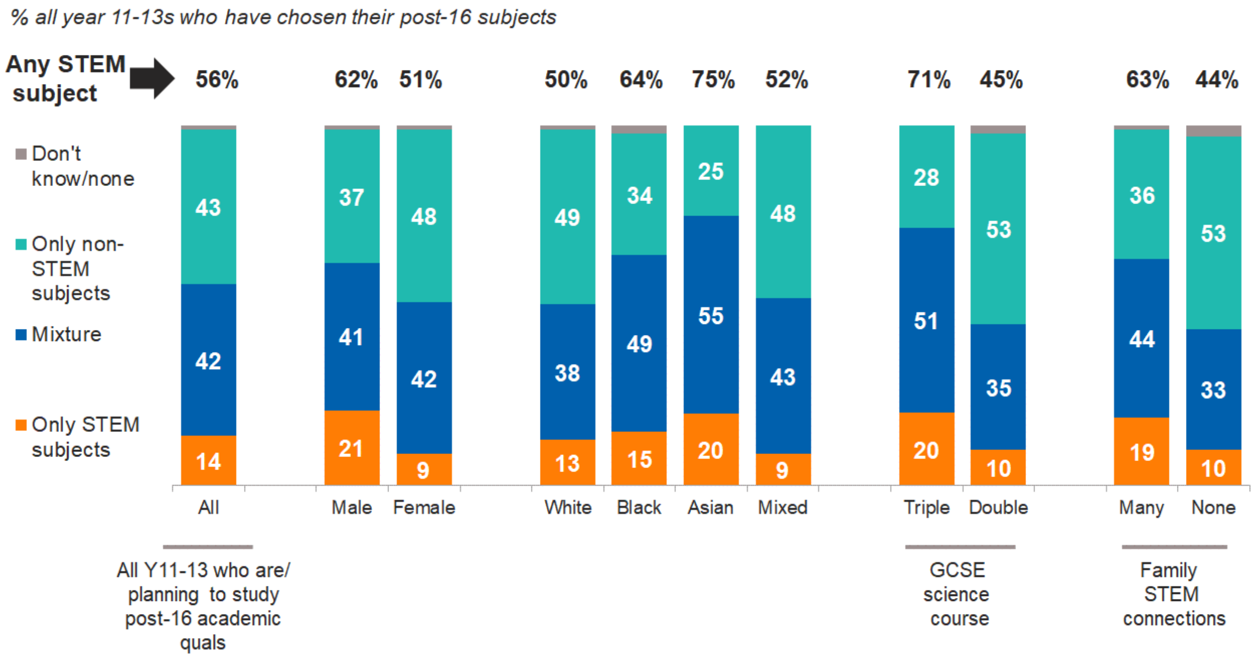
Figure 8.6 displays those groups that had chosen STEM–based academic subjects, based on all students who were either already studying or planning to study post–16 academic qualifications. Figure 8.6 also shows whether these students planned to exclusively study STEM subjects, exclusively study non–STEM subjects, or study a mixture of the two.

Focusing first on the overall rate of STEM participation among students studying or planning post–16 qualifications, the overall rate of STEM participation was 56%. However, this STEM participation rate was higher among the following groups:

- Males (62% vs 51% of females).
- Asian students (75% vs 50% of white students).
- Students who had studied triple science (71% vs 45% who had studied double science).

- Students with many family STEM connections (63% of those with many connections vs 44% with no connections).

Figure 8.6: Post–16 subject choices among students choosing an academic route based on year 11–13 students who had either already started their courses (years 12–13) or who had made their choices for the next year (year 11); percentage who had chosen STEM, non–STEM or a mixture of subjects (2023)



(Year 11 students who have chosen their subjects for Year 12) Are you intending to study any of the following subjects in Year 12? (Y12SubL3) (Year 12–13 students studying in a school, sixth form or FE college) Which subjects have you been studying in Year 12 or 13? (CurSubL3)
Bases: All year 11–13s who have chosen their post–16 subjects (1,845); males (761); females (1,017); white (1,219), Black (162), Asian (294), mixed (110); triple science (847), double science (955); 2 good science GCSEs: yes/no (315/300); family STEM connections: many/none (525/229)

Figure 8.6 also shows whether students chose post–16 subjects which were exclusively STEM, exclusively non–STEM or a mixture of the two. Overall, only 14% chose exclusively STEM options, 43% chose exclusively non–STEM subjects and 42% chose a mixture. This indicates that most students (58%) decided at the age of 16 to focus either on STEM subjects or on non–STEM (arts/social sciences/humanities) subjects. However, the latter was far more common; it was rare for students to focus exclusively on STEM subjects when making their choices, with STEM subjects much more likely to be taken in combination with non–STEM subjects.

As indicated in Figure 8.6, the percentage of students who chose only STEM subjects post–16 was higher among males, Asian students, students studying triple science, and students with many family STEM connections. In all of these groups around one in five focused their post–16 choices exclusively on STEM subjects.

Post–16 academic subject choices by ratings of interest and ability

The extent to which students rated themselves as 'good' at a subject is explored in detail in Chapter 3 (section 3.5). The SET 2023 results display a strong association between self–ratings of ability in STEM subjects, and intentions to study STEM after GCSEs.

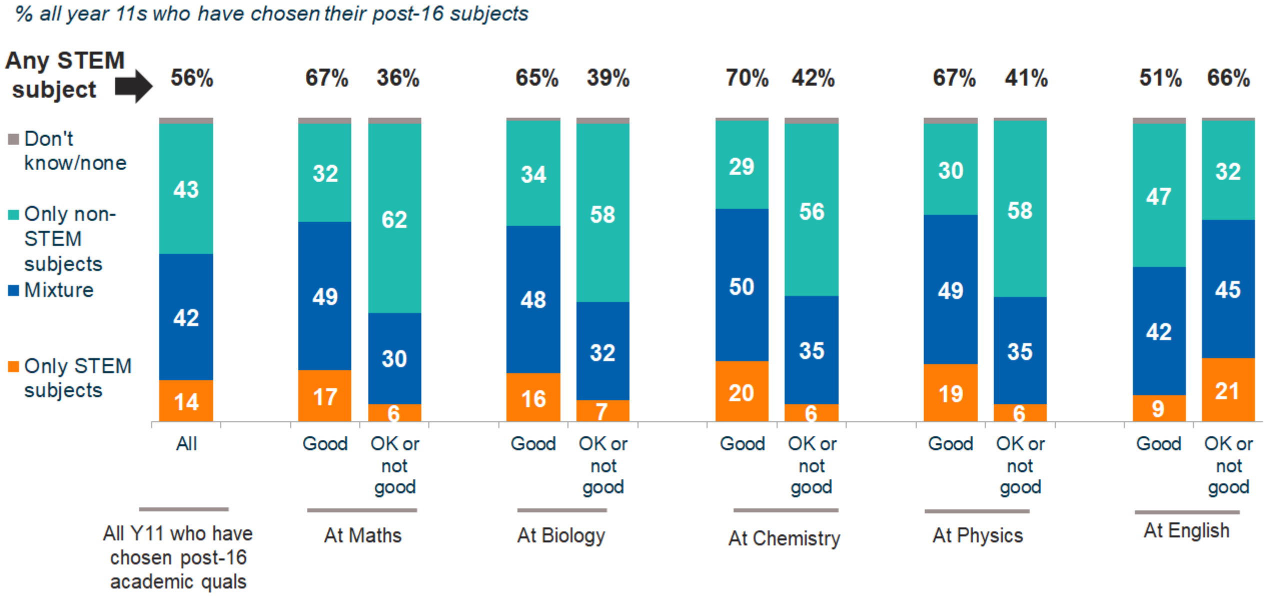
The analysis in this section is based only on year 11 students who have made choices about sixth form options but not yet started on these. This is because students in years 12–13 who have already started their courses may be more likely to rate themselves less good at a subject purely because they are no longer studying it.

Figure 8.7 displays the sixth form pathway choices of students in year 11 opting for an academic pathway by how good they felt they were at different subjects. Broadly speaking, year 11 students who thought they were 'good' at STEM subjects were much more likely to consider a STEM–only pathway, and this was particularly the case for those with high levels of self–belief in maths, physics and chemistry (a slightly smaller difference was observed in terms of how people rate themselves in biology). Students who rated themselves as good at STEM subjects were also much more likely to consider a mixed STEM/non–STEM pathway. On the other hand, those who did not think of themselves as good at each STEM subject were around twice as likely as those who felt they were 'good' at the subject to opt for a non–STEM-only pathway.

In contrast, those who rated themselves as 'good' at English (the only other compulsory subject studied in year 11) were less likely to choose a STEM–only pathway, but were as likely as those who felt they were not good at English to choose a mixed pathway.

Taken together, these findings suggest that those who did not rate themselves as good at STEM subjects are highly likely to reject a STEM pathway altogether: between 56% and 62% who did not rate their abilities in STEM subjects as 'good' have rejected STEM altogether. However, those who do not rate themselves as good at English are less likely to completely reject a non–STEM pathway: only 21% of this group have completely rejected non–STEM. This might suggest that confidence in abilities in STEM subjects is more predictive of future choices than confidence in abilities in non–STEM choices.

Figure 8.7: Post–16 subject choices among students choosing an academic route based on year 11 students who had made their choices for the next year; percentages who had chosen STEM, non–STEM or a mixture of both by self–ratings in subject ability (2023)



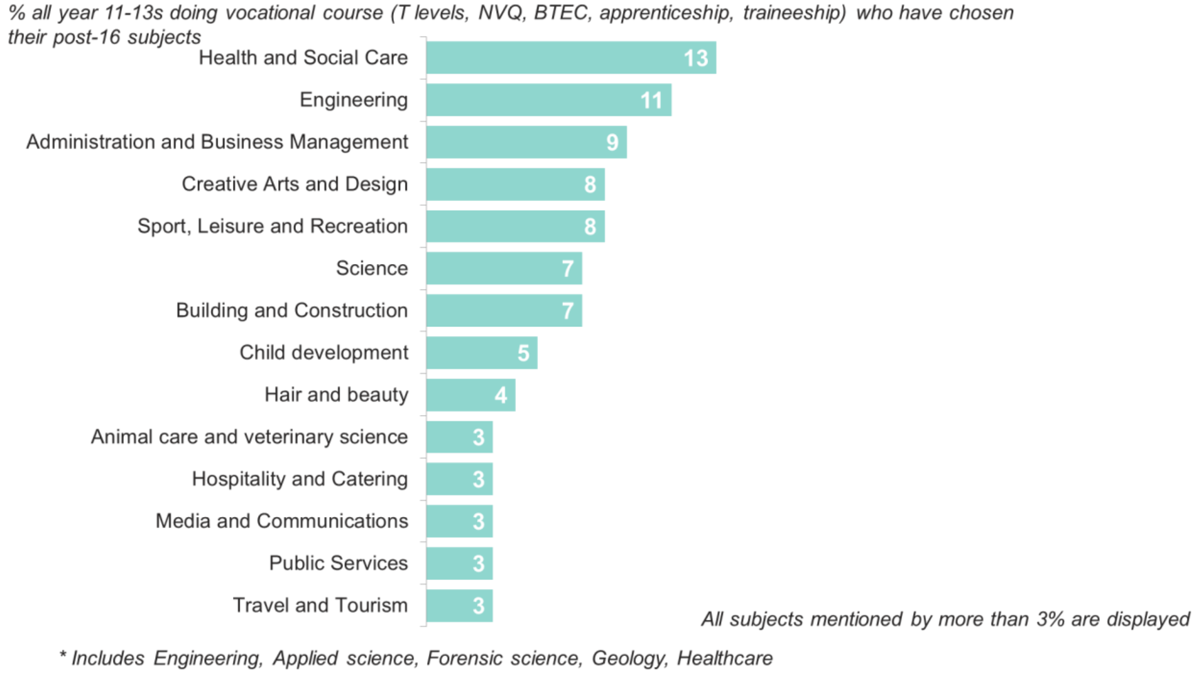
(Year 11 students who have chosen their subjects for Year 12) Are you intending to study any of the following subjects in Year 12? (Y12SubL3) (Year 12–13 students studying in a school, sixth form or FE college) Which subjects have you been studying in Year 12 or 13? (CurSubL3)
Bases: All year 11s who have chosen their post–16 subjects (650); Good/OK or not good at maths (444/205); biology (446/203); chemistry (336/312); physics (371/277); English (420/229).

Post–16 vocational subject choices

Figure 8.8 shows the areas of study for those opting for a vocational pathway. Given the number and diversity of vocational courses on offer in England, it would not have been possible to list them all in a survey question, and therefore the survey only captures the general area of study.

The top three pathways fall into the areas of health and social care, engineering, and administration and business management. It is more difficult to separate out these subject areas into STEM vs non–STEM given the wider–ranging nature of vocational courses, and the lower level of specificity of the categories included in the question.

Figure 8.8: Post–16 subject choices among students choosing a vocational route based on year 11–13 students who had either already started their courses (years 12–13) or who had made their choices for the next year (year 11) (2023)



(Year 11 students who have chosen their vocational subjects for Year 12) Are you intending to study any of the following subjects in Year 12 (Y12SubVoc); (Year 12–13 students studying in a school, sixth form or FE college) Which subjects have you been studying in Year 12 or 13? (CurSubVoc)
Bases: All year 11–13s who have chosen their post–16 vocational subjects (906)

8.5 Reflections on post–16 choices

Whether year 11–13 students felt they made the right choices at the time these choices were made

In SET 2023, a new series of questions was asked relating to whether students felt happy with their post–16 choices, or whether they would have preferred to study different subjects, or a different number or combination of subjects.

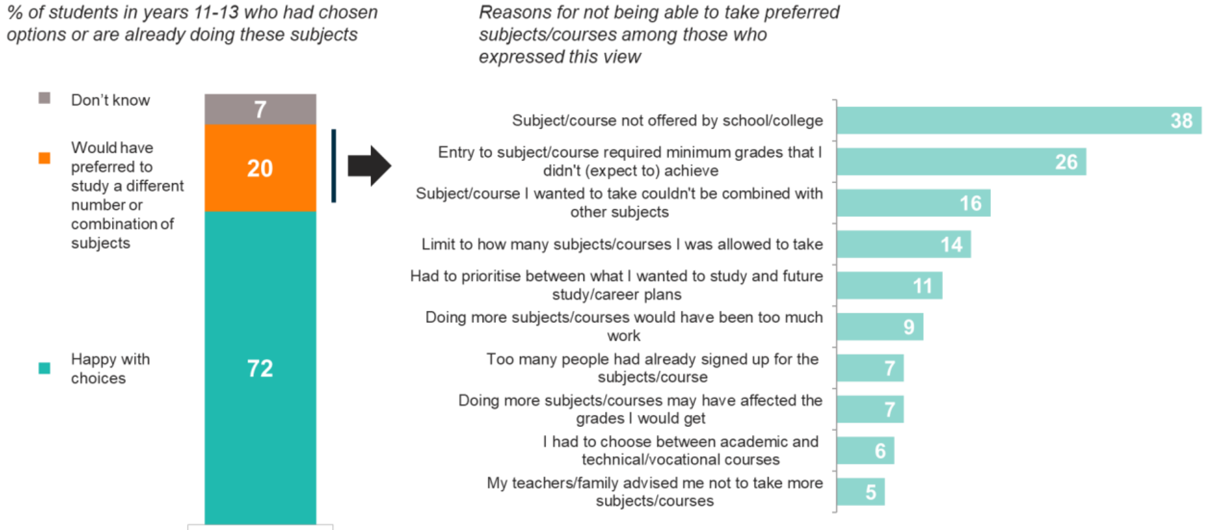
All students in years 11–13 who had either chosen their sixth form options (year 11) or who had already embarked on their sixth form courses (years 12–13) were asked if they had been able to take all of the subjects they had wanted to at the time they made their choices. Most (72%) were happy with their choices at the time, with 20% saying they would have preferred to take a different number or combination of subjects or courses, and 7% who were not sure (Figure 8.9, left hand side).

While there was relatively little variation on this measure by demographic subgroup, it is interesting to note that the percentage who felt unhappy with choices made was higher among those who self–reported any cognitive, emotional, social or behavioural difficulties (23%) and especially among those who self–reported severe problems of this nature (33%). The percentage who felt unhappy with choices made at the time was also raised among students from Black and mixed ethnic backgrounds (24% and 26% respectively). This backs up the findings of Hughes (2017) who found that young people with SEN and from certain minority ethnic backgrounds were more likely to find post–16 decision–making difficult.

As noted, 20% of students in years 11–13 who had made post–16 choices said they would have preferred to take a different range or number or subjects. When asked what had prevented them from making the choices they would have ideally liked[26], the main obstacle cited by 38% was that their school or college had not offered these, while 26% said that they had not met minimum grade requirements. Other students cited logistical obstacles such as lack of flexibility in combining subjects (16%) and a limit on the number of choices allowed (14%), while 11% said they needed to prioritise based on their future study plans (Figure 8.9, right hand side).

[26] Respondents were presented with options from a list and could choose as many options as applied.

Figure 8.9: Whether students in years 11–13 were happy with their post–16 choices and reasons for not being able to take the subjects/courses they had ideally wanted to (2023)



At the time you made your choices for Year 12 or 13 or the equivalent years at college, were you able to take all of the subjects you wanted to? (AllSub); What were the main reasons you were not able to take all the subjects or courses you wanted? (AllSubWhy)
Bases: Left: All year 11–13s who have chosen their post–16 subjects (2,975). Right: All of the preceding subgroup not able to take subjects they wanted to at time of choosing (583)

Whether years 12–13 students felt they made the right choices at the time or in hindsight

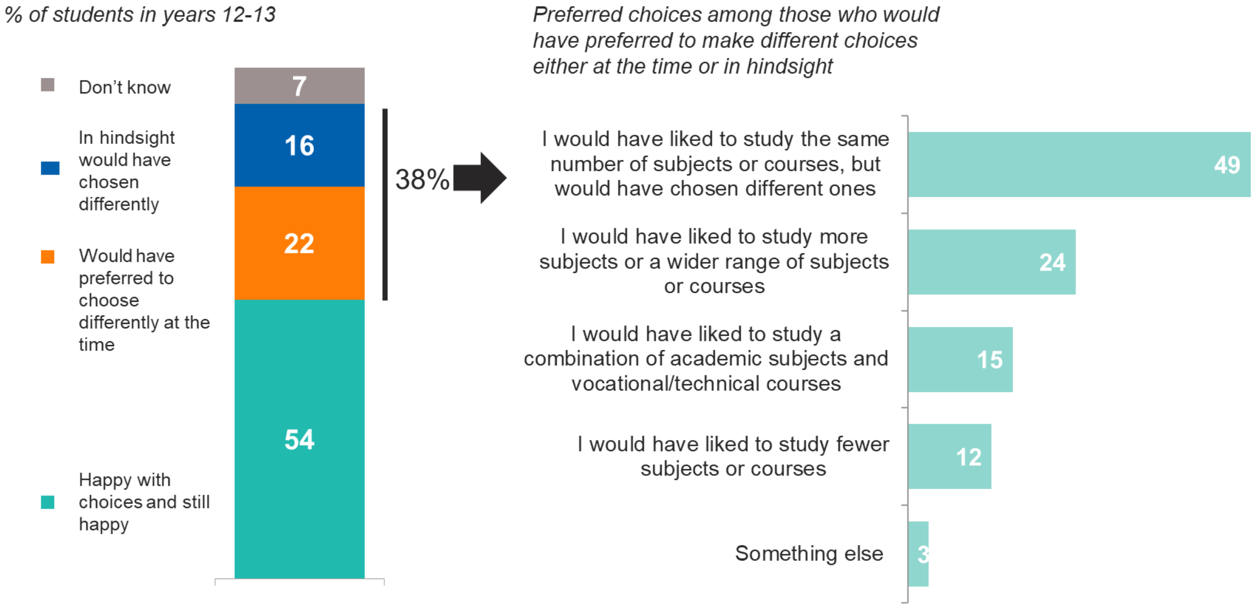
Students in years 12–13 who had made their post–16 choices, and were happy with their choices at the time, were asked whether they would have chosen differently in hindsight: 22% of this subgroup said that on reflection, if they were choosing now, they would choose differently. Combining responses across both questions, this means that overall 54% of students in years 12–13 were happy with their choices at the time and remained happy, while 38% would have chosen differently at the time or would have done so in hindsight (Figure 8.10, left hand side).

Those who said that they would choose differently, either because they were not able to choose the subjects they wanted to at the time, or because they regretted their choices in hindsight, were asked what they would have preferred to choose instead[27] (Figure 8.10, right hand side).

Reasons given focused on wanting to make different choices and/or a preference for more flexibility. A half (49%) of this subgroup were happy with the number of subjects or courses chosen but would have chosen different ones, while 24% would have preferred to take a wider range of subjects or courses, 15% would have liked to study a combination of academic and vocational courses, and 12% would have preferred to take fewer subjects.

[27] Respondents were presented with options from a list and could choose as many options as applied.

Figure 8.10: Whether students in years 12–13 were happy with their post–16 choices at the time and in hindsight; and if they would have preferred a different pathway, what would they have preferred? (2023)



At the time you made your choices for Year 12 or 13 or the equivalent years at college, were you able to take all of the subjects you wanted to? (AllSub); And how do you currently feel about the subjects you have chosen to study in Years 12–13? (AllSubNow); What were the main reasons you were not able to take all the subjects or courses you wanted? (AllSubWhy)
Bases: Left: All year 12–13s (2,046). Right: All who would have preferred to choose differently when making choices or in hindsight (937)

9. Higher education aspirations

This chapter explores young people's plans for higher education, including aspirations to study STEM and non–STEM subjects. Findings have been compared with SET 2019 where possible.

Key findings

Changes over time

Between SET 2019 and SET 2023, there was a decline in intentions to go to university among year 7–9s. Females continued to be more likely to consider university but this gender gap has widened over time. The percentage of year 7–9s intending to go to university was lower in 2023 (70%) compared with 2019 (76%), with the percentage definitely considering university decreasing from 40% to 31%. This decline was more accentuated among year 7–9 males (73% in 2019 vs 65% in 2023) than year 7–9 females (79% in 2019 vs 76% in 2023) resulting in a widened female–male gender gap since 2019. Although the findings for the 10–13 year group are not directly comparable, there was also an indication of a similar widened gender gap in university intentions among older students.

2023 findings

At all ages, most young people were at least considering university/higher education (HE); females were much more likely to be considering this. 70% of years 7–9 and 86% of years 10–13 were considering HE, while 31% and 44% of these groups respectively were more confirmed in their intentions. Females were more likely to express definite university intentions: among years 7–9 the female–male gender gap was 36% vs 26% while among year 10–13s it was 53% vs 36%.

One in eight year 10–13 students were definitely considering a degree apprenticeship, and this was higher among males. Among years 10–13, 44% were definitely considering university, 12% were definitely considering a degree apprenticeship, 30% were undecided and 13% had rejected a higher education pathway altogether. Males were more likely than females to be considering a degree apprenticeship (16% vs 9%).

At all age groups, HE intentions were strongly related to family university and science connections, Black and Asian ethnicity, and living in London. HE intentions were lower among more disadvantaged families as measured by IDACI quintiles, although these differences only became apparent from year 10, which is likely to be driven by an increased awareness of the financial pressures associated with HE among older students.

Consistent with post–16 choices (Chapter 8), year 10–13 students were more likely to consider non–STEM than STEM subjects. STEM aspirations dropped between year 10 and year 13. Of all year 10–13s considering university, 49% considered studying a non–STEM subject and 39% a STEM subject. The percentage who wanted to study STEM was highest among younger cohorts in year 10 (43%), dropping over time to 38% of year 13s. By year 13, non–STEM became an increasingly attractive choice among those aspiring to university (from 46% in year 10 to 56% in year 13).

In terms of HE STEM subject intentions, engineering and computing were more popular among male students, while healthcare and medicine were more popular among female students. Focusing on gender within ethnic groups, Asian females were particularly likely to want to study medicine (18% vs 7% of all year 10–13s considering university), Black females to study healthcare (19% vs 8%), and Asian males to study engineering (18% vs 5%).

9.1 Context

Recent publications (Shao, 2023, Sutton Trust, 2023) have documented how the percentage of young people who aspire to go to university has risen substantially over the longer–term. While the increase in student numbers has helped many more from groups traditionally underrepresented in higher education (HE) to attend, there remains substantial socio–demographic variation with young people from more disadvantaged backgrounds less likely to have university intentions. Other demographic differences highlighted by the Sutton Trust (2023) include HE participation among young people living in London, students from Black and Asian backgrounds, and females. In 2022, just over half of women applied to HE, compared to only 38% of men. All of these demographic differences are reflected in the SET 2023 data.

Research for the Sutton Trust (2019) found that disincentives to higher education included not enjoying studying, being put off by others, financial considerations, and students' doubts about their own academic ability. More recent research (Shao, 2023) highlights that financial barriers are likely to be even more prominent in the 2023 context, given prevailing cost of living difficulties.

The Sutton Trust (2019) also found that social constraints, including parents not having gone to university, were an important factor. The SET 2023 data also show the importance of parental experience of university, and of family science and STEM connections, in helping to explain the comparative popularity of higher education pathways.

Aside from university aspirations, there has also been a growth in higher (degree) level apprenticeships. The Sutton Trust (2022) highlights how the composition of apprenticeships has shifted from mainly low and intermediate level apprenticeships to one where higher and degree apprenticeships constitute a significant share (26% share in 2020). However, more generally EngineeringUK (2023) notes a concerning decline in STEM-related apprenticeship starts seen over recent years in the UK, with engineering-related apprenticeship starts in England being 9% lower than in 2014/15, and a 34% decline in apprenticeships linked more specifically to engineering and manufacturing technologies.

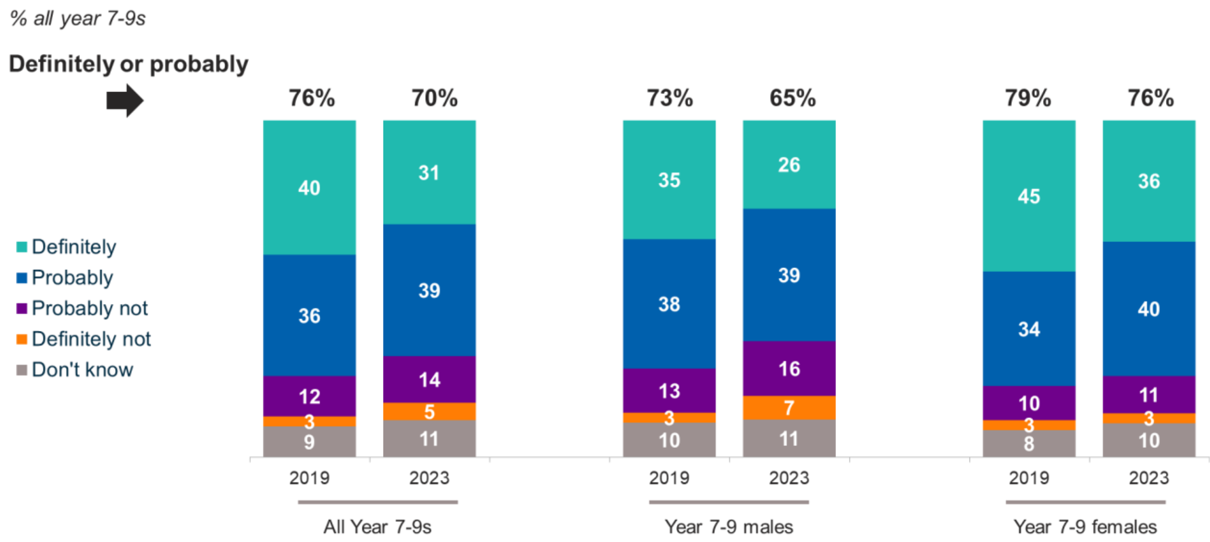
Beyond intentions for higher education more generally, there are many incentives and barriers to going on to study STEM specifically in higher education, and these have their basis in motivations to study science at school, particularly at the post–16 stage, as discussed in Chapter 8. HESA (2023) data show that fewer undergraduate students in 2021/2022 enrolled for STEM (45%) than for non–STEM subjects (55%), and that subject choices remain heavily gendered. While women make up 57% of all students, they are less likely to choose a STEM subject at university (43% vs 49% of men). However, there are signs of a small shift towards females choosing STEM subjects over recent years (from 41% in 2019/20 to 43% in 2021/22) while for males this rate has remained stable. And while males make up 43% of students overall, engineering and technology and computing had the highest percentage of male enrolments at 79% and 77% respectively.

9.2 Intended pathways beyond year 13 among year 7–9s

In SET 2023, year 7–9 students were asked if they had any plans to go to university. As shown in Figure 9.1, seven in ten year 7–9s (70%) said that they were likely to go to university after they finished school, with 31% saying they definitely wanted to do this. Among these younger age cohorts, females were more likely than males to intend to go to university (76% compared with 65%), which represents a widened age gap compared with 2019. Females were also more likely to have definite plans for university (36% compared with 26%).

This suggests a decline since 2019 in university intentions among this younger age group, when 76% expressed a desire to go to university (40% definitely). While the percentage who wanted to go to university was lower in SET 2023 than in SET 2019 among both genders, this was more accentuated among males than females: the percentage of young people in years 7–9 who definitely or probably wanted to go to university fell from 73% to 65% among males, and from 79% to 76% among females.

Figure 9.1: Percentage of year 7–9s who wanted to go to university by gender (2019 & 2023)



How much do you want to go to university after you finish school? (UniWant)
Bases: All year 7–9s 2019/2023 (2,314/3,077) ; All/male/female year 7–9s 2019 (2,314/1,170/1,122); All/male/female year7–9s 2019 (3,077/1,535/1,466);

There was considerable variation in plans to go to university by other demographic subgroups. A definite intention to go to university (31% among all students in years 7–9) was higher among the following subgroups:

- Students from a Black or Asian background (54% and 53%, respectively vs 24% white and 33% mixed).
- If at least one parent had been to university (40% vs 21% with a non–university educated parent).
- Those with many family STEM connections (43% vs 18% with none).
- Students living in London (43% vs 31% overall).

- Students who rated themselves as ‘good’ at science (40% vs 17% who rated themselves as ‘not good’).
- Students with a strong science identity (59% vs 17% who said that science is ‘not for me’).

On the other hand, definite intentions to go to university were lower among students with a disability that limited daily activities (27%) and who self–reported definite or severe problems related to emotions, concentration, behaviour or social skills (21%).

9.3 Intended pathways beyond year 13 among year 10–13s

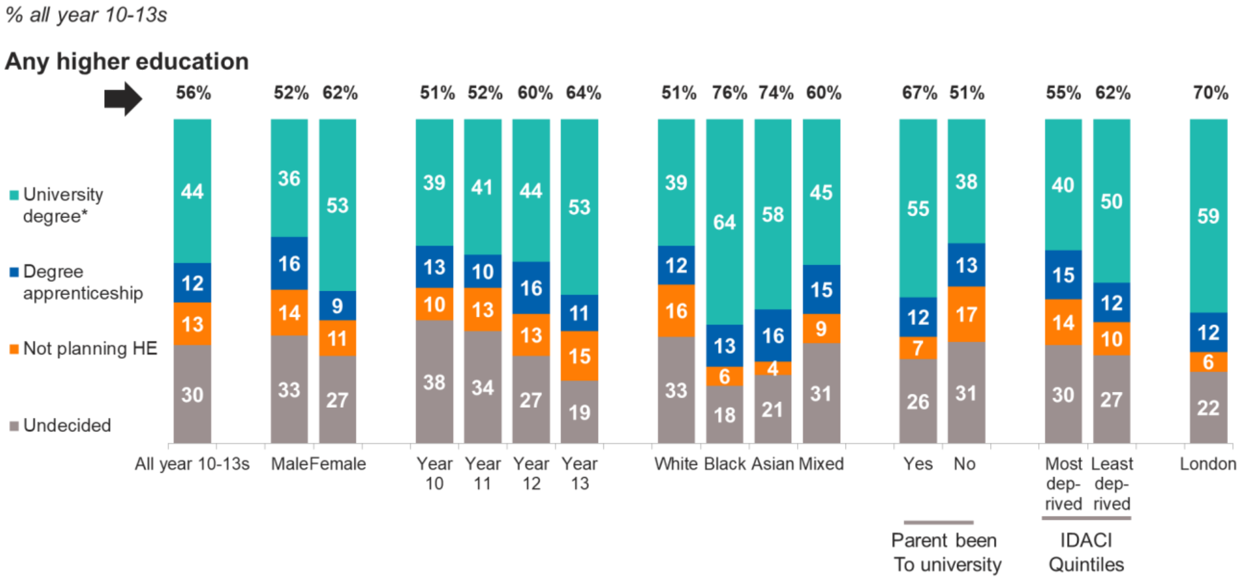
The higher education intentions of students in years 10–13 were also explored (Figure 9.2). The overall percentage of year 10–13 students who said they were definitely considering entering higher education was 56%: 41% looking to study for a university degree, 3% intending to pursue another type of higher education qualification, and 12% planning a degree apprenticeship. Three in ten (30%) were undecided, which means that overall 86% were at least considering higher education.

A change in the way the question was presented in 2023 means that direct comparisons with previous years are not possible[28]. However, there is a broad indication that the gender gap in university intentions has widened since 2019, which matches the findings also observed among those in years 7–9.

Higher education intentions become more confirmed as young people progress through school or college: 38% of those in year 10 were undecided about whether to go onto university, but this percentage had halved by year 13 (19%). The percentage who were definitely considering any form of higher education rose considerably by school year from 51% in year 10 to 64% in year 13.

[28] In 2023, degree apprenticeships were included in the question as a separate option, whereas in 2019 the question only referred to ‘higher education’ in general, which means that the definitions of higher education are not comparable.

Figure 9.2: Percentage of year 10–13 students considering higher education pathways (2023)



Are you thinking about going on to study at university or for a higher education qualification in any area of study? (FutHEQu)
Bases: All year 10–13s (4,179); male (1,893), female (2,135); year 10 (1,057); year 11 (1,076); year 12 (1,040); year 13 (1,006); White/Black/Asian/Mixed (2,940/304/533/255); Parent at university yes/no (1,891/1,892); IDACI Most deprived/least deprived (992/775); London (634)

* This includes a very small percentage of students (3% overall) planning to study other HE qualifications such as HNC, HND, HE Diploma.

As for years 7–9, there were differences in higher education intentions by type of student (Figure 9.2), and these largely reflect the year 7–9 patterns (see section 9.2 above). The demographic patterns also reflect Sutton Trust (2023) data on higher education application and entry profiles. The overall percentage of students in years 10–13 firmly considering any higher education pathway was 56%, and this was raised among the following groups:

- Female students (62% vs 52% of males).
- Students from a Black or Asian background and, to a lesser extent, a mixed ethnic background (76%, 74% and 60%, respectively vs 51% of white students).
- Students with a university–educated parent (67% vs 51% without a university–educated parent).
- Students living in London (70% vs 56% overall).
- Students with a strong science identity (86% vs 43% who that science is 'not for me').
- Students living in the least deprived quintile (62% vs 55% in the most deprived quintile).

The differences cited above were mainly driven by the percentage who were considering a university degree. The rate at which young people were considering a degree apprenticeship was more stable across these subgroups, although interest in this option was higher among males compared to females (16% vs 9%).

It is noteworthy that disadvantage measures were associated with higher education intentions at years 10–13, but not years 7–9. This is likely to be because older students are more aware of the financial costs associated with higher education.

9.4 Family influence on decisions about higher education

Analysis in the previous section indicates that family experience of university is strongly linked to higher education intentions: students with a parent who had been to university were more likely to be considering higher education. A brief discussion below considers the extent of this family experience and how closely this experience may be linked to other potential influences on decision–making.

Just under half of students (47%) reported that one or both of their parents had gone to university, with clear differences in this by type of student, suggesting that differences in intention by family experience are also likely to be related to other demographic factors: groups more likely to have a parent that had been to university included the following:

- Year 7–9s (52% vs 43% of year 10–13s).
- Students from a Black or mixed ethnic background (58% for each of these groups vs 45% white and 48% Asian).
- Less disadvantaged students: those in the least deprived IDACI quintile (63% vs 35% in the most deprived quintile).

9.5 Planned higher education choices

Specific higher education subject choices

Contextual HESA data

According to national data published by HESA (2023), in 2021/22 the most popular STEM subjects among all university entrants in 2021/2022 were subjects allied to medicine (such as nursing and pharmacy) (13%), followed by engineering and technology (6%), computing (6%), biological and sports sciences (4%), medicine and dentistry (3%), physical sciences (2%) and mathematical sciences (2%). Males were much more likely to study engineering and technology (12% of male students vs 2% of female students) and computing (10% vs 2%, respectively), while females were much more likely to choose subjects allied to medicine (18% vs 6% of males).

SET 2019 survey data

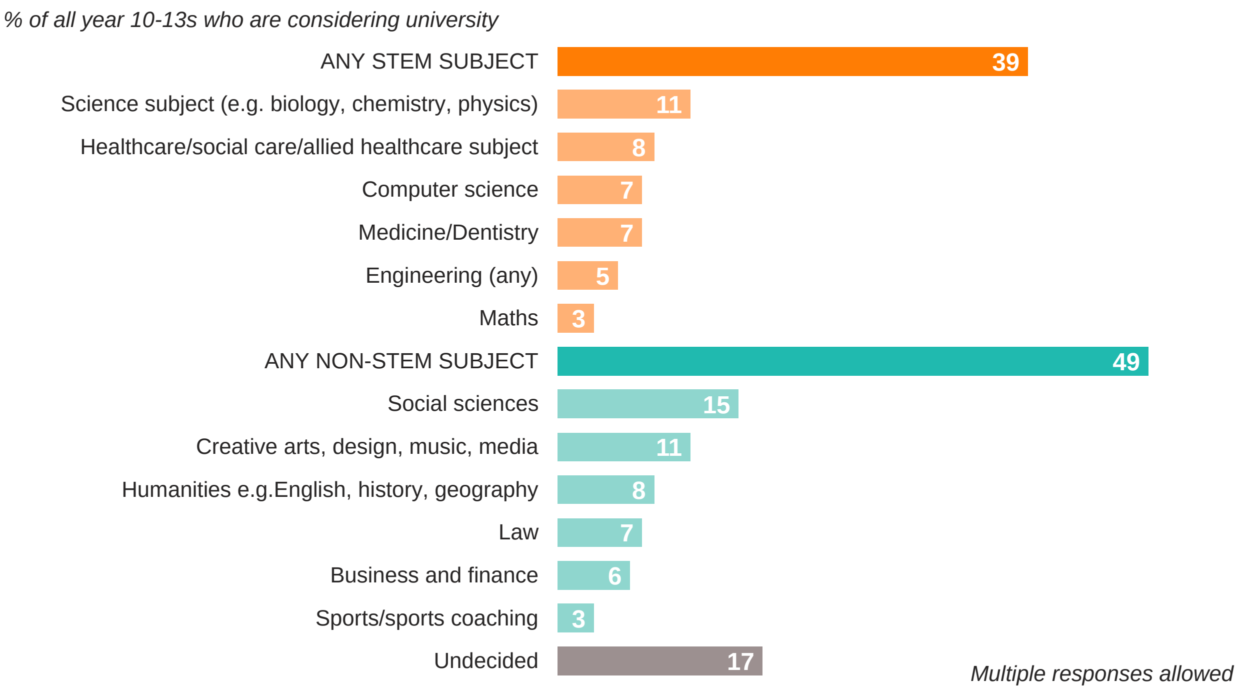
In SET 2023, students who were considering a university pathway were asked what subjects they were interested in studying. Respondents provided their answers in verbatim format, and could provide multiple subjects they were interested in; these responses were then coded into subject categories. Given changes in the way data on subject intentions were collected, it is not possible to compare trends over time on these measures (Figure 9.3).

While the subjects are not classified in the same was as HESA, the STEM subject choices mentioned by survey respondents broadly align with the aforementioned external data. The most popular STEM subjects being considered were the sciences (11%), healthcare or social care (8%), computing (7%) and medicine/dentistry (7%). The most popular non–STEM subjects were the social sciences (15%), creative arts (11%), humanities subjects (8%) and law (7%).

In line with HESA (2023) data (see above), males were more likely than females to consider studying engineering (11% vs 1%, respectively) and computing (13% vs 2%, respectively), while females were more likely than males to opt for higher education pathways in healthcare (12% vs 3%, respectively) and medicine (9% vs 5%, respectively). In terms of non–STEM pathways, females were more likely to choose social sciences (17% vs 11% males).

Focusing on gender within ethnic groups, some subgroups stood out in terms of desire to study certain subjects. Asian females were particularly likely to want to study medicine (18% vs 7% of all year 10-13s considering university), Black females to study healthcare (19% vs 8%), Asian males to study engineering (18% vs 5%), white females to study creative arts/media (16% vs 11%), and mixed ethnicity females to study social sciences (24% vs 15%).

Figure 9.3: Subject(s) considered for university or higher education among all year 10–13s considering higher education (2023)



Thinking about university or higher education qualifications, what are you interested in studying? Please type in your answer (FutHESu)

Bases: Year 10–13s considering HE or university: (1,770)

STEM vs non–STEM higher education choices

Contextual HESA data

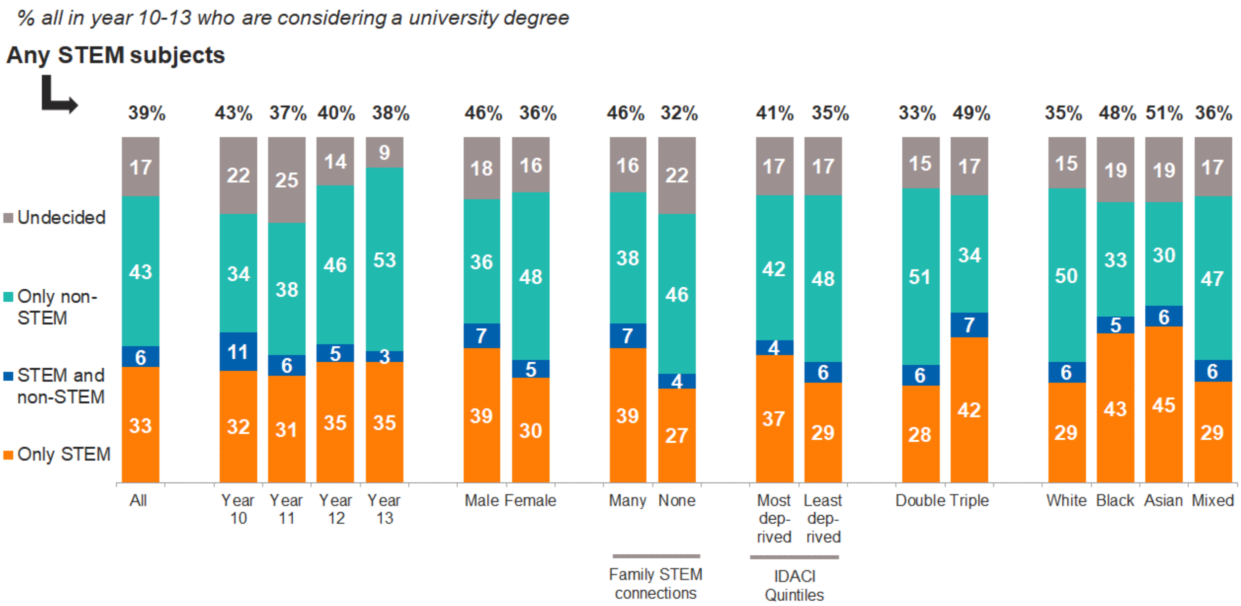
According to national data published by HESA (2023), in 2021/22 among all university entrants, a lower percentage of students chose STEM subjects (45%) than non–STEM subjects (55%) but there was a much greater STEM/non–STEM gap among women (43% vs 57%) than men (49% vs 51%). However, among females there has been a very small shift towards choosing STEM subjects over recent years (from 41% in 2019/20 to 43% in 2021/22) while for males this rate has remained stable (49% at both time points)[29].

SET 2023 survey data

Figure 9.4 provides the data on higher education subject choices in summarised form, looking at a broader categorisation of STEM versus non–STEM choices.

In SET 2023, among all year 10–13 students with university in mind, more students were considering non–STEM subjects (49%) than STEM subjects (39%), which concurs with expectations based on HESA (2023) profiles. Most students had a clear idea of whether they wanted to follow a STEM or non–STEM pathway. A third (33%) were exclusively considering STEM subjects, 43% were exclusively considering non–STEM subjects, while only 6% were considering subjects that spanned both. Overall, 17% were undecided, with firmer decisions being made as students progressed through the school years: indecision was highest at 25% in year 11 and fell to 9% in year 13.

Figure 9.4: Intended higher education subjects for students in years 10–13 who were considering higher education by demographic subgroups (2023)



Thinking about university or higher education qualifications, what are you interested in studying? (FutHESu)

Bases: Year 10–13s considering HE or university: All years 10–13 (2,004); Year 10/11/12/13 (437/476/506/585); male/female: (745/1,190); Family STEM connections many/none (583/206); IDACI Most/Least deprived (437/416); Double/Triple GCSE (981/934); white/Black/Asian/mixed (1,258/205/329/124)

Figure 9.4 also displays the variation in subject choices among all in years 10–13 who aspired to go to university by different subgroups. The percentage who wanted to study STEM was highest among younger cohorts in year 10 (43%), dropping over time to 38% of year 13s whom by that stage would

[29] The STEM vs non–STEM classification is based on HESA definitions of subjects and does not exactly match the way STEM has been defined in the SET survey.

have made more confirmed choices. By year 13, non–STEM became an increasingly attractive choice among those aspiring to university (from 46% in year 10 to 56% in year 13).

The overall percentage considering a STEM subject (whether or not also considering a non–STEM subject), and the percentage exclusively focusing on STEM, was higher among the males, students with many family STEM connections, students living in more deprived areas, students studying triple science at GCSE, and Asian and Black students.

On the other hand, non–STEM pathways were more appealing to females, those with fewer family STEM connections, students living in less deprived areas, students studying double science, and students from white or mixed ethnic backgrounds.

10. Careers guidance and STEM work experience

This chapter focuses on young people's gateways to a future possible career in science, technology, engineering or maths (STEM) through examining uptake of careers advice and guidance, and access to STEM work experience. Findings are compared with SET 2019 and where relevant.

Key findings

Changes over time

Access to some types of careers information fell between SET 2019 and SET 2023: The percentage of year 10–13 students consulting the following sources has declined: parents (from 68% in 2019 to 64% in 2023), teachers (from 48% to 44%), searching online (from 40% to 35%) and attending a careers event or fair (from 30% to 23%). The last of these findings is likely to be related to reduced exposure to in–person events during the pandemic.

The decline in access to careers advice between SET 2019 and SET 2023 was mostly concentrated among year 12 students. This is likely to indicate a pandemic impact as this cohort would have been in Years 10-11 during the most pandemic-disrupted academic years of 2020/21 and 2021/22, which is when many schools tend to arrange such activities.

There was reduced access to work experience in 2023 compared with 2016 and 2019, although the percentage doing STEM work experience remained stable. The percentage of year 10–13 students who had done any work experience dropped from 69% in 2016 to 67% in 2019 and to 57% in 2023, while the percentage who had done STEM work experience remained between 13% and15% over this time period. The drop in work experience rates is highly likely to be driven by the COVID–19 pandemic, while the greater stability for STEM work experience might be due to increased opportunities for remote work experience in these sectors (for more detail on this, see below).

2023 findings

Family networks played an important role in terms of access to careers information and work experience. Parents were the most important source of careers advice for students in years 10–13, and students from families with many science connections were more likely than those without any to consult a range of sources about careers advice and to secure work experience. There was also evidence that increased family science connections helped facilitate STEM work placements: students with many such connections were more likely than those with no connections to arrange STEM work experience by themselves or through family and friends, while those with no family connections were more likely to make arrangements via their school.

More students undertook non–STEM than STEM work placements. Access to STEM work experience was related to level of disadvantage. Over half (57%) of year 10–13 students had completed any work experience, though only 15% had completed a STEM–based placement. STEM work experience take–up was higher among students with many family science connections (see above) and living in more affluent areas. For these more advantaged groups, STEM work experience was more likely to be arranged through family and friends, and less likely to be facilitated via the school.

A quarter of years 10–13 students wanted to secure STEM–related work experience but had been unable to do so. Barriers to STEM work experience centred on a lack of knowledge about or an inability to find relevant opportunities, or not having the right contacts, which further reinforces the central role of family contacts in this area.

The COVID–19 pandemic led to more limited opportunities for older cohorts (years 12–13 in the 2022–23 school year) to access STEM work experience, especially in–person. Of those unable to secure STEM work placements, overall a quarter (25%) said that the pandemic had restricted their opportunities, this being the most important barrier for those in year 13 (46%). Among students who did take part in STEM work experience, 80% had participated in–person and 36% had participated remotely, though students in years 12–13 (41% and 48%, respectively) were particularly likely to participate online.

10.1 Context

The availability of good–quality careers information, advice and guidance is critical to enabling young people to make informed choices. It helps to prepare young people for the workplace by providing a better understanding of different career paths and how these relate to wider society, as well as helping them to develop relevant skills.

The Department for Education published an updated careers strategy in January 2023 containing a range of measures designed to improve the careers advice available to young people (DfE, 2023b). This includes a commitment for all schools to meet the eight Gatsby benchmarks that define excellence in careers provision (Gatsby, 2014). The benchmarks include, for example, a stable schools' career programme, personal guidance, employer encounters, and linking curriculum learning to careers. Positively, recent data (The Careers & Enterprise Company, 2023) indicate an improvement in the number of schools meeting the Gatsby benchmarks between 2020/21 and 2022/23.

The need for good–quality careers advice is especially important in the context of STEM careers, given the growing skills gap in sectors such as engineering and technology (see Chapters 11, 12). However, there are concerns about equality of access to careers education and work experience. For example, Archer et al. (2020) found that formal careers education provision was patterned by social inequalities, with working–class, minority ethnic students, females and lower–attaining students being significantly less likely to receive and benefit from high quality careers support.

The COVID–19 pandemic clearly had a major impact on education more generally, but it also impacted on the extent to which schools were able to offer careers guidance and arrange work experience. A Gatsby (2020) survey found that a fifth of schools and colleges in England had put career guidance activities on hold during that time, and that in half of institutions, there had been a reduction in the time learners were spending on careers guidance activities. However, the Gatsby survey also found that 72% of schools and colleges considered that career guidance provision had become even more important as a result of the pandemic.

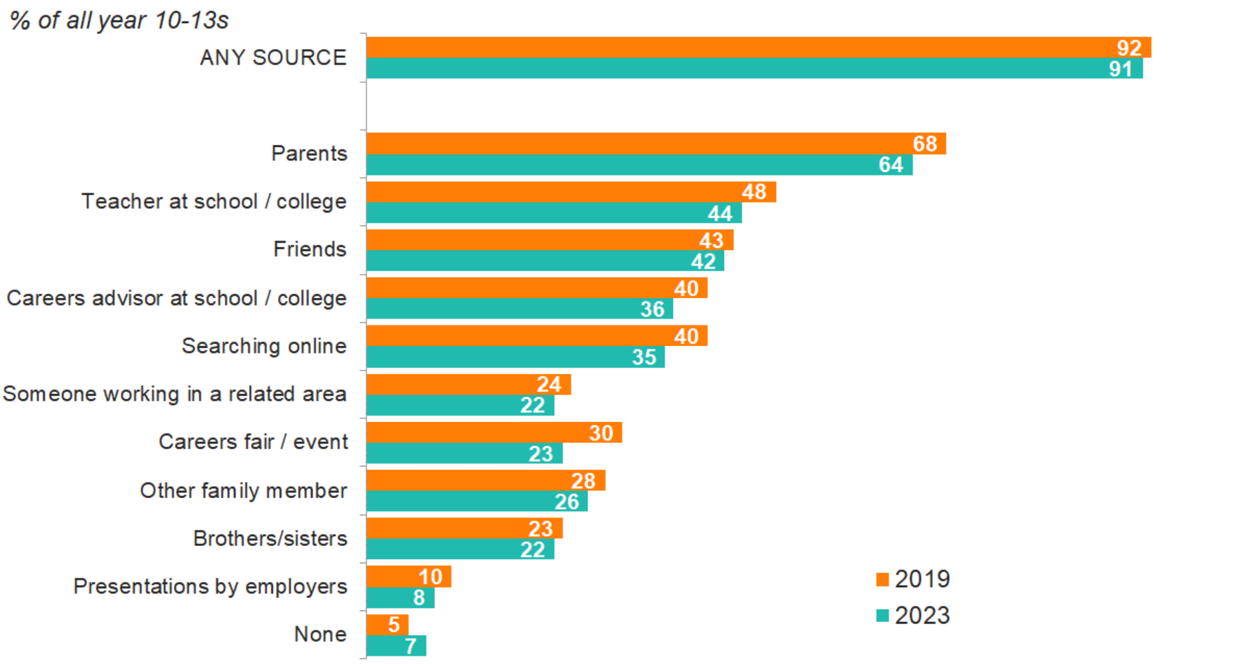
Against this background, this chapter looks at the trends in experience of careers guidance and work experience over time.

10.2 Where do young people get advice and guidance about careers?

Throughout this report, family networks have been shown to be a key influence on future aspirations throughout school life. It is therefore of no surprise that parents are also the most important source of careers advice for young people in years 10–13, with two in three (64%) students mentioning this as a source (Figure 10.1). Other important sources of advice included teachers (44%), friends (42%), careers advisors (36%) and conducting searches online (35%), while around a quarter consulted other family–related sources such as siblings (22%) and other family members (26%).

While the overall pattern of results in terms of relative importance of the different sources remains similar to SET 2019, there have been some declines in receipt of certain types of advice sources, namely parents (from 68% in 2019 to 64% in 2023), teachers (from 48% to 44%), searching online (from 40% to 35%) and attending a careers event or fair (from 30% to 23%). This last finding is likely to be related to reduced exposure to in–person events during the pandemic, although it is noteworthy that advice and guidance from other sources have also decreased over this period.

Figure 10.1: Sources of careers advice among those in years 10–13: 2019 and 2023



Have you ever received any information or advice from any of these sources about what you may do for a career in the future? (CarAdv)
Bases: All year 10–13s: 2019 (4,095); 2023 (4,179)

However, while there has been an indication of a decline in access to careers events between SET 2019 and SET 2023, further inspection of the data reveals that this decline was mainly focused among the year 12 cohort. This is likely to indicate a pandemic impact as this cohort would have been in Years 10–11 during the most pandemic-disrupted academic years of 2020/21 and 2021/22, which is many schools tended to arrange such activities. The steepest falls for year 12 were in relation to online searches (53% among years 12s in 2019 vs 46% among years 12 in 2023), consulting teachers (53% vs 46%, respectively), and attending a careers event (44% vs 36%, respectively).

Focusing on SET 2023 data, there were some differences by demographic subgroup in terms of sources of advice used among students in years 10–13:

- Female students were more likely to consult teachers (47% vs 42% males), search online (41% vs 30%) and attend careers events (27% vs 19%).
- Students with strong family STEM connections were more likely than those with no family STEM connections to consult a range of sources, suggesting that these students were able to use their family connections to tap into wider networks. For example, this group was more likely to consult parents (73% vs 47% with no family STEM connections), siblings (26% vs 14%), other family members (30% vs 16%), and someone working in a related field (33% vs 11%). However, they were also more likely to consult a range of other sources outside their social networks, including careers advisors (39% vs 27%), teachers (47% vs 35%), carrying out online searches (43% vs 25%) and attending careers fairs (28% vs 16%).
- Students living in the least deprived area quintile as measured by IDACI were much more likely to consult parents (72% compared with 56% in the most deprived quintile) and someone working in a related area (25% vs 18%).

These findings suggest that disadvantage and lack of family connections are likely to affect the extent to which students can draw on wider networks to find out about the different types of careers available.

10.3 Access to work experience in STEM and other areas

In 2023, just over half of students in years 10–13 (57% overall) had completed work experience of some kind, and 15% had completed STEM–related experience (Figure 10.2). Therefore, most work experience placements were related to non–STEM sectors.

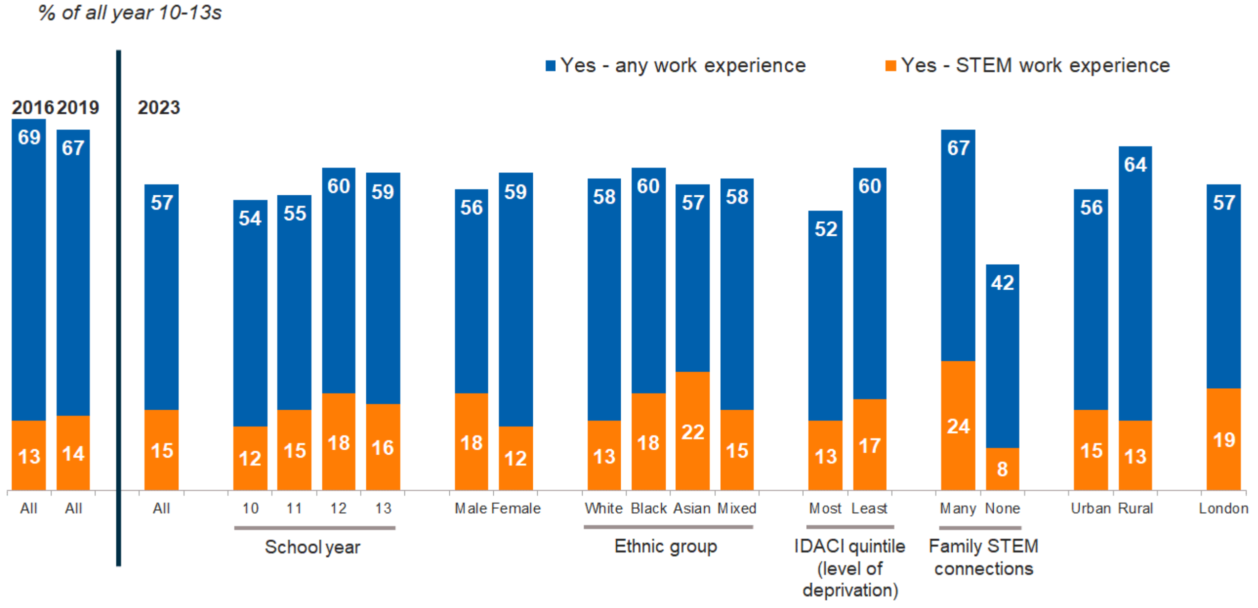
Exposure to any work experience in 2023 (57%) had dropped since 2019 and 2016 (when these percentages were 67% and 69%, respectively). This is likely to be related to the COVID-19 pandemic, which would have restricted access to these types of opportunities during periods of school closures. Reinforcing this, the decline in any work experience was mostly concentrated among year 12 students (77% in 2019, 60% in 2023) and year 13 students (76% in 2019, 59% in 2023), who would have been in Years 10–11 during the most pandemic–disrupted academic years, when many schools tend to arrange such careers and work experience activities.

However, while exposure to work experience of any type has fallen, the rate of exposure to STEM–related work experience has remained stable (15% in 2023, 14% in 2019, 13% in 2016). This could be because the STEM sector provided more opportunities for remote access to work experience compared with other sectors (see section 10.4 below for further discussion on this).

The propensity to have done any work experience increased with school year (54% had undertaken work experience in year 7, rising to 60% and 59%, respectively, in years 12 and 13) and was also more prevalent among students in the least deprived IDACI quintile (60% vs 52% in the most deprived quintile), living in a rural area (64% vs 56% living in an urban area), and among those with many family STEM connections (67% vs 42% with no such connections).

When looking specifically at STEM work experience, this was higher than the average (15%) in year 12 (18%), among males (18%), Asian students (22%), and those with many family STEM connections (24%). Having access to family STEM connections was a particularly important factor here; students with many family STEM connections were three times as likely as those with no science connections to have done STEM work experience (24% vs 8%). The rate of access to STEM work experience was also notably higher in London (19%) than all other regions.

Figure 10.2: Whether year 10–13 students had ever done work experience in STEM or other areas (2016, 2019 and 2023); and by school year, gender, ethnicity, IDACI quintiles, family STEM connections (FSCI_STEM), population density and region (2023)



Have you ever done any work experience? (Workexp)
Bases: All year 10–13s: 2016 (4,045), 2019 (4,095), 2023 (4,179)
Bases 2023: Year 10 (1,057); year 11 (1,076); year 12 (1,040); year 13 (1,006); males (1,893); females (2,135); white (2,940); Black (304); Asian (533); mixed (255); IDACI quintiles most deprived (992); least deprived (775); family STEM connections many (944); family STEM connections none (636); Urban (3476); rural (700); London (634)

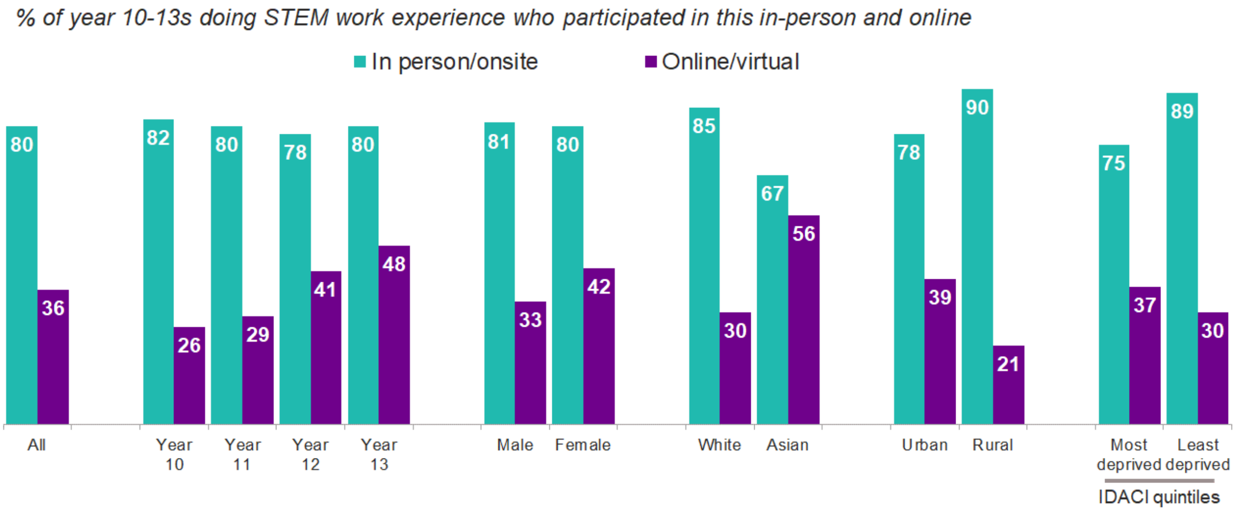
10.4 Whether STEM work experience was in–person or online

In the light of the COVID–19 pandemic, when many activities which would traditionally have taken place in–person moved to remote platforms, a new question was added in 2023 to establish how students who had taken part in STEM work experience had accessed this.

Of those who had taken part in at least one STEM–related work experience, 80% had participated in–person and 36% had participated remotely (18% had experienced both online and in–person work experience) (Figure 10.3).

Younger cohorts, who would have experienced work experience more recently, were much more likely to participate in on–site work placements while those in years 12–13 were much more likely to participate online: 41% of year 12 students and 48% of year 13 students who had taken part in STEM work experience said that this was done remotely. This is likely to be a cohort effect related to pandemic disruption to education. As work experience is often arranged during years 10 and 11 the cohort of students in years 12 and 13 in the 2022–23 academic cycle could have taken part in work experience during the 2019–21 academic cycles, which coincided with these periods of disruption (see also section 10.1 for further context on this).

Figure 10.3: Percentage of students in years 10–13 doing STEM–related work experience who participated in–person and online by year group, gender, ethnicity, population density, and IDACI quintiles (2023)



Thinking about any work experience you have done involving Science, Computer science, Engineering or Maths, was this…? (WorkExpType)
Bases: All year 10–13s who have ever done STEM work experience (670); year 10 (130); year 11 (160); year 12 (200); year 13 (180); male (369), female (281); white (412); Asian (129); urban (572); rural (98); IDACI quintiles most deprived (138); least deprived (135)

10.5 How STEM work experience was arranged

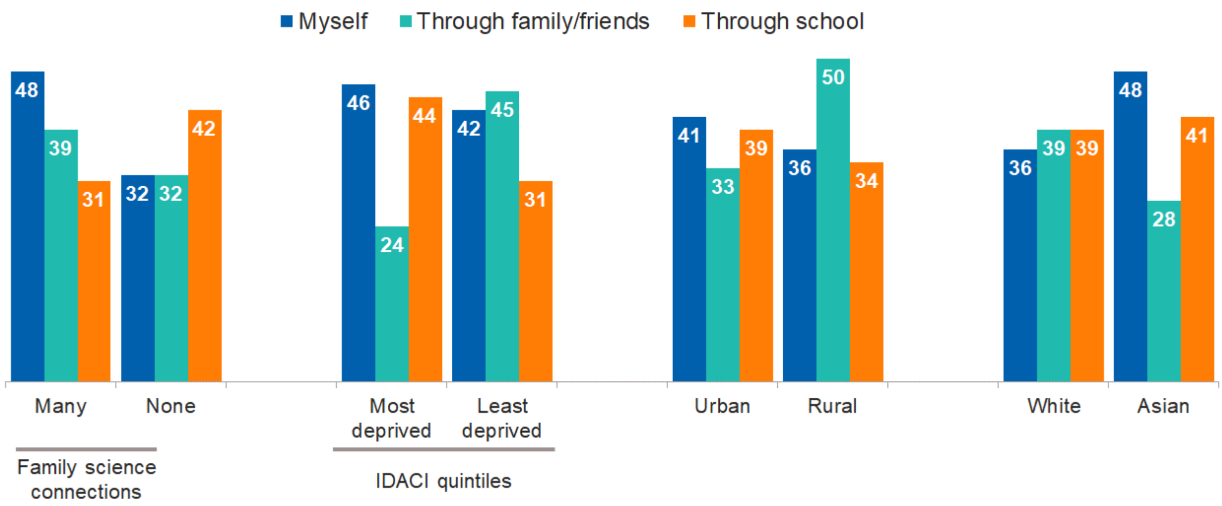
Young people in years 10–13 who had been on at least one science–related work experience placement were asked how their most recent science–related work experience had been arranged. Young people could indicate if they used more than one means of securing a placement. Two in five (41%) indicated that they arranged their placement personally, while 36% relied on family or friends and 39% arranged it through their school. These findings remain in line with SET 2019 findings.

The routes by which young people secured STEM placements varied by school year. In year 10, placements were most likely to be made through the school (54% vs 39% overall); in year 11, family and friends was the most common route (43% vs 36% overall); while in years 12–13, STEM work experience placements were most likely to be self–sourced (48% and 56% of those in years 12 and 13, respectively, vs 41% overall).

The means by which STEM work placements were arranged also varied by levels of disadvantage (as measured by IDACI quintiles), family science connections, population density and ethnicity (Figure 10.4).

Figure 10.4: How STEM–related work experience of those in years 10–13 was arranged by FSCI, IDACI quintiles, population density and ethnicity (2023)

% of year 10-13s doing STEM work experience who have arranged work experience through each method



Thinking about your most recent work experience involving Science, Computer science, Engineering or Maths, how was this arranged? (Workexparr)
Bases: All year 10–13s who have ever done STEM work experience (670): IDACI quintiles most deprived (138); least deprived (135); urban (572); rural (98); white (412); Asian (129)

Figure 10.4 shows the following findings:

- Students with many family science connections were more likely than those with no science such connections to arrange STEM work experience by themselves or through family and friends, while those with no family science connections were more likely to make arrangements via their school.
- Students living in rural areas were much more much likely than those living in urban areas to arrange work experience through family and friends.
- Asian students were much less likely than white students to arrange STEM work experience through family and friends, and were instead more likely to arrange it themselves.
- Students from more disadvantaged backgrounds, as measured by IDACI quintiles, were less likely than those not entitled to arrange placements via family and friends.

This indicates that more disadvantaged pupils, students from an Asian background, and those with fewer family science connections did not have the same access to work experience through personal networks. This underlines the importance of schools, and the education system more widely, in helping students who are not able to find relevant work experience through their own family networks.

10.6 Barriers to obtaining STEM work experience

Students lacking opportunities to participate in STEM work experience

A quarter of young people (26%, no change from 2016 or 2019) reported wanting to secure science–related work experience but being unable to do so. The types of students who were most likely to feel they had been denied this opportunity were also those who were most likely to aspire to pursuing science pathways, as evidenced throughout this report.

Therefore, this percentage was higher among Black and Asian students (both 41%); those with many family STEM connections (34%); and among those with a strong science identity who actively seek out science–related news and activities (64%). Males (29%) were also slightly more likely than females (23%) to feel that they had missed out on a STEM–related work experience opportunity.

Barriers to accessing STEM work experience also varied by region and population density. The percentage of students who wanted to participate in a STEM work placement but were unable to was higher than average in London (36%) and in urban areas (27% compared with 20% of students living in rural areas).

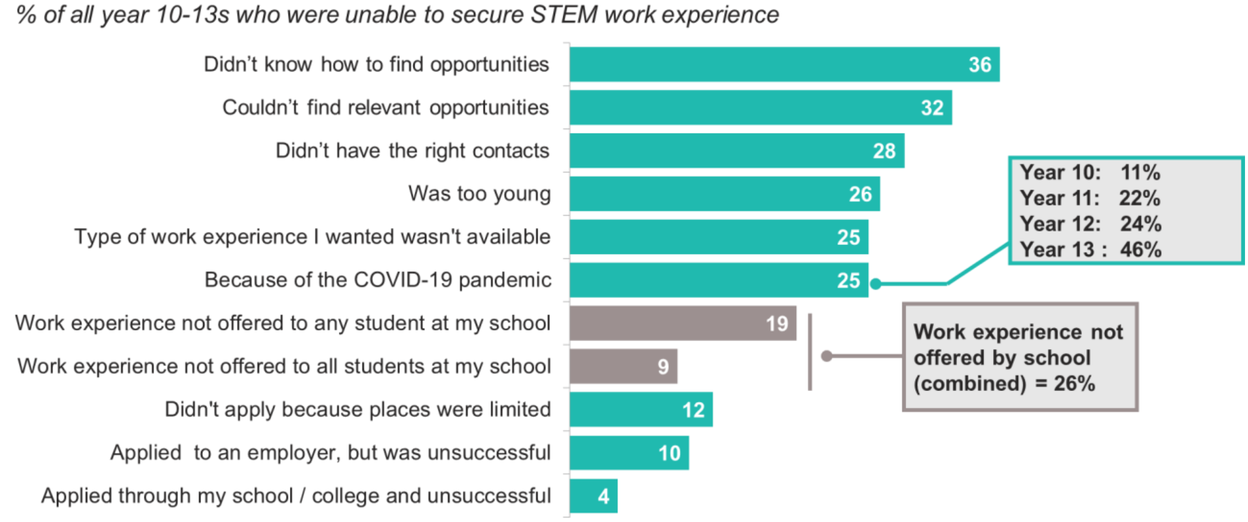
Students who had already participated in STEM work experience were more likely to want to do more of this compared with those who had not previously done this (40% vs 24%).

Reasons for being unable to secure STEM work experience

The most common reasons for not being able to secure STEM–related work experience related to difficulty in knowing how to find relevant opportunities, either because students didn't know how to go about it (36%) or because they couldn't find relevant opportunities they were interested in (32%). The other key reasons were lacking relevant contacts (28%), not meeting age criteria (26%) and the school not offering work experience (26%). The last response option was made up of students either saying that *no* students were offered work experience by their school (19%) or that it was selectively not offered to all students (9%). (Figure 10.5).

The barriers to obtaining STEM work experience were very similar in 2023 compared to 2019, although in 2023 an additional option was included to cover COVID–related barriers to work experience. A quarter (25%) of students in 2023 who had been unable to secure STEM work experience said this had been due to the pandemic. This barrier was especially cited among students in year 13 (46%) who would have been most likely to miss out on work experience opportunities during the period of COVID–related disruption.

Figure 10.5: Reasons for not being able to do STEM work experience among year 10–13 students who wanted to (2023)



Why were you unable to do this work experience? (Workexpwhy)
Base: All year 10–13s who wanted to do STEM work experience but were unable to (1,131); year 10 (313); year 11 (314); year 12 (245); year 13 (259)

Students with a long–standing disability were more likely to cite an inability to find the relevant opportunities as a barrier compared to those without a disability (46% compared with 30%).

11. Career aspirations in STEM

This chapter focuses on young people's attitudes regarding a future career in science, technology, engineering or maths (STEM), covering knowledge of and attitudes towards STEM career pathways, motivations and barriers to a career in STEM, and a more in–depth analysis of specific career pathways that young people are interested in. Findings are compared with SET 2016 and SET 2019 where relevant.

Key findings

Changes over time

Between SET 2016 and SET 2019, an increased percentage of students viewed science careers as being accessible 'to me' and to people without high grades. The percentages of students in years 10–13 agreeing that science careers are 'suitable for someone like me' increased since 2019 reversing a previous reduction between 2016 and 2019: 36% in 2016; 32% in 2019; 39% in 2023. The percentage of year 10–13s who agreed that science careers require high grades has decreased over time from 89% in 2016 to 78% in 2019 and to 75% in 2023.

2023 findings

A quarter of students in years 10–13 considered a career in science as being 'not for me' while three–quarters felt such careers require high grades, although as noted above, in comparison with previous survey results, there were some positive changes on these measures over time.

Perceived knowledge of different types of STEM career was relatively low. Between 32% and 38% of those in years 10–13 considered themselves to know at least a fair amount about careers in science, engineering, maths, and computing and technology. Younger students – who perhaps do not yet appreciate the scope and complexity of these careers – were more likely to feel they had a reasonable knowledge of these types of careers.

Three–quarters of students had some interest in at least one type of STEM career: 77% were interested in at least one type of STEM career, with interest in individual STEM areas ranging from 46% for engineering, to 45% for science, to 38% for both maths and computing/technology.

There were strong gender divides in relation to the 'TEM' (technology, engineering and maths) aspect of STEM careers, while knowledge and interest in science careers was more balanced by gender. Males had much higher levels of perceived knowledge and interest in 'TEM' careers, while knowledge and interest in science careers were more even.

Interest in STEM careers declined by school year, especially among female students. The percentage of all students in years 7–13 interested in at least one type of STEM career was highest in year 7 (82%) thereafter declining steadily by school year to 69% of students in year 12. This decline is likely to be related to a narrowing of choices as students get older. The rate of decline in interest in a STEM career by school year was steeper for females compared with males. Linked to the finding above, the declining interest in STEM careers by school years is more associated with 'TEM' careers; interest in a science career was more balanced by school year.

Higher rates of knowledge and interest in a STEM career were found among various demographic subgroups: that is Asian and Black students, with many family STEM connections, with a strong science identity, living in London and on the triple science GCSE pathway.

Motivations for pursuing a STEM career focused mainly on interest, pay, being 'good' at the subject, and valuing the range of career options, while barriers mainly centred on lack of interest and having alternative plans. Males were more likely than females to be motivated by pay, while females were more likely than males to be incentivised by a desire to help people or society. Females expressed a wider range of reasons for being disinclined towards pursuing a STEM career and were more likely than males to be discouraged by a lack of enjoyment or preference for other subjects, or because they lacked confidence in their ability in science.

Year 10–13 students with some idea about what they wanted to do as a future career were twice as likely to aspire to a non–STEM career as a STEM career. STEM career aspirations varied by gender. Future career aspirations were collected in an open format: 73% mentioned a non–STEM career and 38% mentioned a STEM career. Males were much more likely than females to aspire to engineering (14% vs 2%) and computing (12% vs 2%), while females were more likely than males to aspire to a job in healthcare (20% vs 6%).

11.1 Context

The UK STEM skills gap is well–recognised, and this has been a persistent and growing problem over recent decades (House of Lords Science & Technology Committee 2022). It is also important that they recognise that STEM careers are open to young people from all backgrounds, and with a range of abilities, so that an increasing percentage of young people see STEM careers as 'for me'.

However, a UK parliamentary select committee report (UK Parliament, 2023) found that opportunities to gain the skills required by STEM employers are not equally distributed across society, with an under–representation of women, people from certain ethnic backgrounds, people with disabilities, those from disadvantaged socio–economic backgrounds, and those who declared themselves as LGBTQ+, in some areas of STEM employment settings. The report notes that children who are able to 'see' themselves as engineers and scientists are more likely to pursue the required subjects.

As noted in Chapter 10, access to formal careers events and work experience has fallen between 2019 and 2023, which is thought to be attributable to educational disruption caused by the pandemic. This is likely to have further impacted efforts to engage young people in STEM careers.

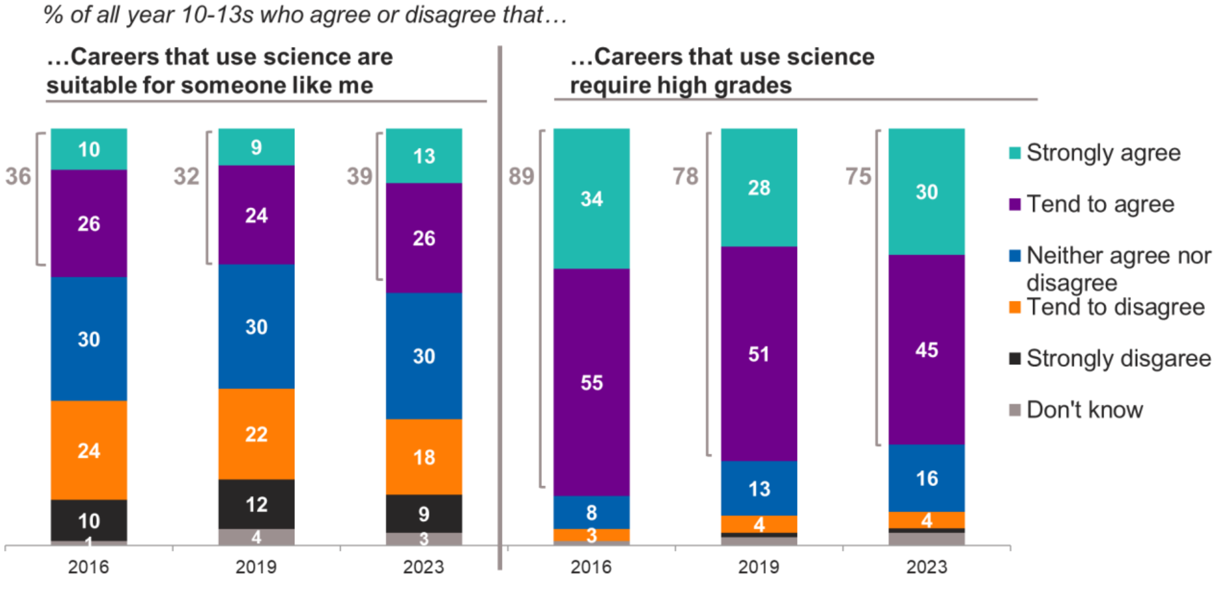
Although several measures in the survey can be tracked over time, the SET 2023 survey took a different approach to measurement of knowledge and interest in STEM careers. In previous surveys, opinions on STEM careers were asked about in aggregate, whereas in SET 2023 we asked about the constituent parts of STEM careers separately, which allows a more detailed exploration of the differences in attitudes to careers in science, technology, engineering and maths.

11.2 Attitudes towards science careers

Perceptions of science careers were captured using two measures that can be tracked over time since 2016. Students were asked to what extent they considered science careers as 'suitable for someone like me' and which 'require high grades'. Results have been re–based on all in years 10–13 to allow comparisons with data from previous surveys (Figure 11.1).

Following a drop between 2016 and 2019, the percentage of students in years 10–13 who agreed that science careers are 'suitable for someone like me' increased from 32% in 2019 to 39% in 2023. In addition, the percentage who agreed that science careers require high grades decreased over time from 89% in 2016 to 78% in 2019 and to 75% in 2023. Together, these trends suggest that students are increasingly likely to perceive science careers as accessible to a wider group of young people. However, despite these positive trends, it is noteworthy that a relatively large minority of students in years 10–13 in 2023 still regarded science careers as not being suitable for 'someone like me' (26% in 2023) and three quarters still thought that these careers require high grades (75%).

Figure 11.1: Perceptions about science careers among years 10–13 (2016, 2019, 2023)



How much do you agree or disagree with the following statements? (SciCarA/SciCarB)

Bases: All years 10–13: 2016 (4,081); 2019 (4,095); 2023 (4,179)

The following subgroups of students in years 7–13 were mostly likely to *disagree* that science careers are 'suitable for someone like me':

- White students (27% compared with 15% of Asian students) and especially white females (30%).
- Students with no family science connections (33% compared with 16% who have many connections).
- Students who self–reported difficulties relating to emotions, concentration, behaviour or social skills (28% compared with 20% who did not report any of these problems).
- Students in years 7–9 who did not rate themselves as good at science (46% compared with 9% who think they are good at science). There were similar findings among those in years 10–13 in terms of self–ratings of ability in each of biology, chemistry and physics.
- Students who said they knew little, not very much or nothing about science careers (31% compared with 14% who said they knew a lot or a fair amount).
- Students in years 10–13 on the double science pathway (32% compared with 18% taking triple science).

Students across years 7–13 who agreed that science careers require high grades tended to be disproportionately concentrated in subgroups which are typically associated with high levels of engagement and achievement in science:

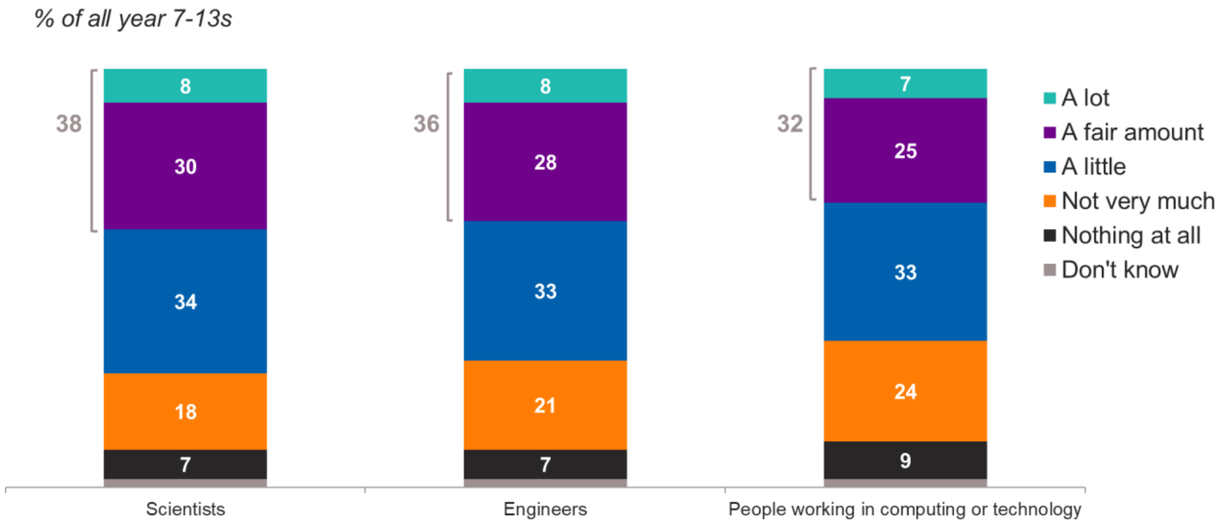
- Students with many family science connections (83% compared with 66% with no such connections).
- Students living in more affluent areas (80% of students living in the least deprived IDACI quintile compared with 72% of those living in the most deprived quintile).
- Students in years 7–9 who felt that they were 'good' at science (85% compared with 66% who did not think this). There are similar findings among those in years 10–13 in terms of self–ratings of ability in each of biology, chemistry and physics.
- Students in years 10–13 on the triple science pathway (85% compared with 75% on the double science pathway).
- Students with a strong science identity (89% compared with 67% who felt that science is 'not for me').

11.3 Perceived knowledge about STEM careers

Self–assessed knowledge of STEM careers was measured by asking young people in years 7–13 how much they knew about the different types of things done by engineers, scientists and people working in computing or technology; these questions were asked for the first time in SET 2023. A more detailed analysis of knowledge of engineering careers can be found in section 12.2.

The patterns of perceived knowledge were fairly similar across the three disciplines, although perceived knowledge was highest for scientists (38% thought they knew at least a fair amount) and lowest for people working in computing or technology (32% thought they knew at least a fair amount (Figure 11.2)

Figure 11.2: Extent to which young people in years 7–13 felt they knew about different STEM careers (2023)



How much do know about the different types of things the following people do in their jobs? (CarKnow)
Bases: All years 7–13 (7,256)

Some common trends emerge in terms of the types of students who felt more knowledgeable about these STEM careers. Across all three STEM careers, the percentage of students who felt they knew either a fair amount or a lot was higher in the following subgroups.

- Younger students in years 7–9
    - Engineering: years 7–9 (41%) vs years 10–13 (32%).
    - Science: years 7–9 (45%) vs years 10–13 (32%).
    - Computing and technology: years 7–9 (38%) vs years 10–13 (28%).
- Asian and Black students
    - Engineering: Asian (41%); Black (42%); white (34%).
    - Science: Asian (49%); Black (44%); white (35%).
    - Computing and technology: Asian (45%); Black (41%); white (29%).

- Students with many family STEM connections
  - Engineering: Many (46%) vs none (22%).
  - Scientists: Many (52%) vs none (23%).
  - Computing and technology: Many (41%) vs None (19%).
- Students with a strong science identity
  - Engineering: Actively engaged in science (55%) vs Science is not for me (28%).
  - Scientists: Actively engaged in science (78%) vs Science is not for me (20%).
  - Computing and technology: Actively engaged in science (52%) vs Science is not for me (23%).
- Students who have participated in STEM work experience
  - Engineering: Participated (49%) vs Not participated (29%).
  - Science: Participated (50%) vs Not participated (30%).
  - Computing and technology: Participated (41%) vs Not participated (25%).

In addition, there was a strong gender divide in perceived knowledge of engineering and of people working in computing and technology, while perceived knowledge of scientists by gender was more balanced.

- Engineering: Males (45%); Females (28%).
- Scientists: Males (36%); Females (40%).
- Computing and technology: Males (40%); Females (24%)..

Students studying triple science were more likely to think they knew at least a fair about scientist careers (41% compared with 30% studying double science) although science GCSE pathway was not related to perceived knowledge of engineering or computing and technology.

Perceived knowledge of scientist and computing/technology careers was higher in London (45% and 39%, respectively) compared to average (38% and 32%, respectively).

It is interesting to note that younger students in years 7–9 felt that they knew more than older students in years 10–13 about these different careers. The explanation for this could be that, as students get older, they begin to realise that these jobs are more varied and complex than first thought. In other words, this could mean that older students are more likely to recognise gaps in their knowledge, whereas younger students may be basing their understanding on simpler self–definitions.

11.4 Level of interest in a STEM career

The approach to asking about STEM careers was revised in SET 2023 to obtain a more detailed picture of interest in the different types of STEM career, as opposed to careers in STEM in general. This means that results in SET 2023 are not comparable with earlier surveys in the SET series. A more detailed examination of interest in engineering careers specifically can be found in section 12.6.

Before asking questions about interest in these types of STEM careers, to help students (and especially younger students) understand the nature of these types of careers a brief definition of each was provided as detailed below[30].

Science careers: Jobs that involve scientific knowledge and investigation skills. People in science work in a range of areas including medicine, space, nature, energy and the environment.

Engineering careers: Jobs that involve finding solutions to problems. The work of engineers involves designing, creating, fixing and improving things like products, transport, software, buildings and machines.

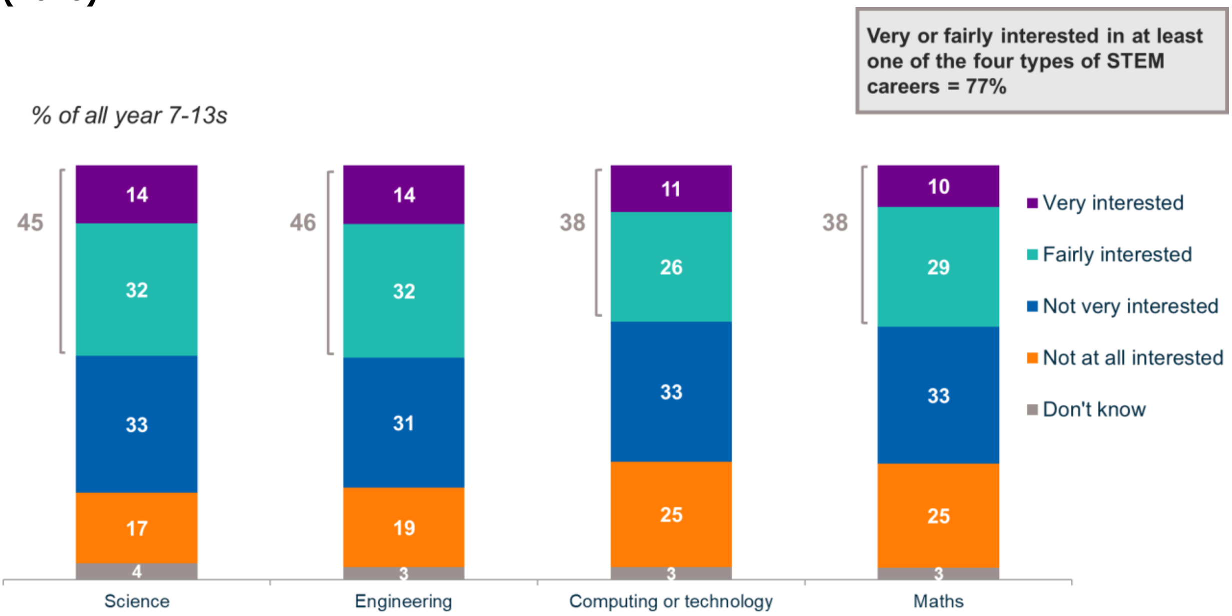
Computing or technology careers: Jobs that involve creating, maintaining or improving technology, equipment or devices, including computer software and hardware.

Maths careers: Jobs across many areas of employment that involve an expert knowledge of mathematics, using calculations and analysing data to solve problems.

As shown in Figure 11.3, across all in years 7–13, just under half were very or fairly interested in a career in science (45%) or engineering (46%) while just under two in five were very or fairly interested in a career which involved computing/technology or maths (both 38%). Combining responses across all four STEM career types, three–quarters (77%) of students in years 7–13 were very or fairly interested in at least one of the four STEM career types.

[30] Definitions were developed as part of the cognitive pre–testing stage.

Figure 11.3: Level of interest in different types of STEM careers among years 7–13 (2023)



How interested are you in a future career that involves any of the following: Science, Computer Science, Engineering or Maths? (CarInt)

Bases: All years 7–13 (7,256)

Consistent with gender differences observed throughout SET 2023, there were wide gender divides in terms of level of interest in engineering, computing and maths careers, as well as level of interest in at least one type of STEM career (Figure 11.4a). However, the level of interest in science careers was much more equal with 47% of males and 44% of females expressing an interest in this type of career.

Figure 11.4b also displays how interest in at least one type of STEM career changes by school year at an overall level and by gender. At an overall level, interest in STEM careers is highest in year 7 (82%) thereafter declining steadily by school year to 69% of students in year 12, followed by a small uptick in interest at year 13 (72%), which is mainly driven by an increase in interest between year 12 and 13 among females.

The same year group patterns were observed within gender, and the gender divide already noted at an overall level (Figure 11.4a) was also seen within each school year (Figure 11.4b). However, the rate of decline in interest in a STEM career between year 9 and year 12 was steeper for females compared with males, and there was a particularly sharp fall in level of interest among females between year 11 and year 12.

The reason for the decline by school year between students in years 7 and 12 could be related to a narrowing of choices as students get older. Younger students may be more open to careers in a range of different areas but then become more focused as they progress through school; their academic performance and interest in different subject areas could also be relevant. However, the uptick in interest among students between years 12 and 13 is interesting and suggests that as students start to make more decisive choices regarding future pathways, a STEM career may start to become more attractive.

Figure 11.4: a) Percentage of year 7–13 students who were very or fairly interested in different types of STEM careers by gender (2023); b) Percentage of year 7–13 students who were very or fairly interested in at least one type of STEM career by year group and gender

Chart a)

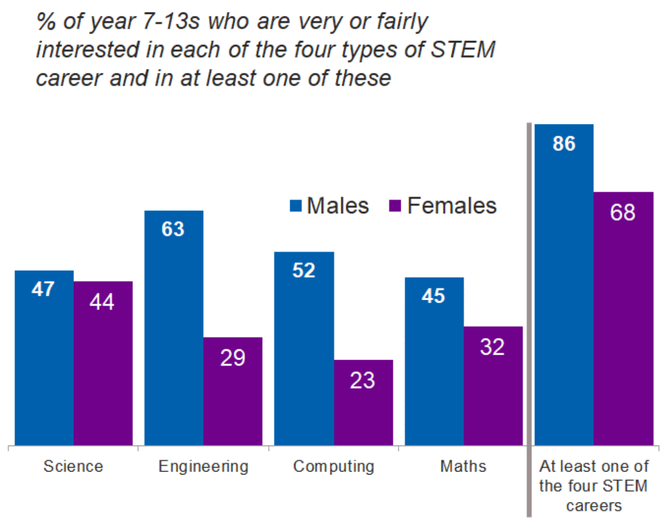
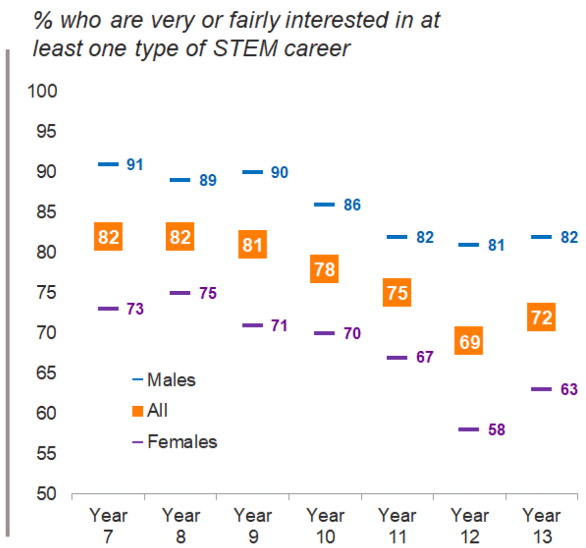


Chart b)

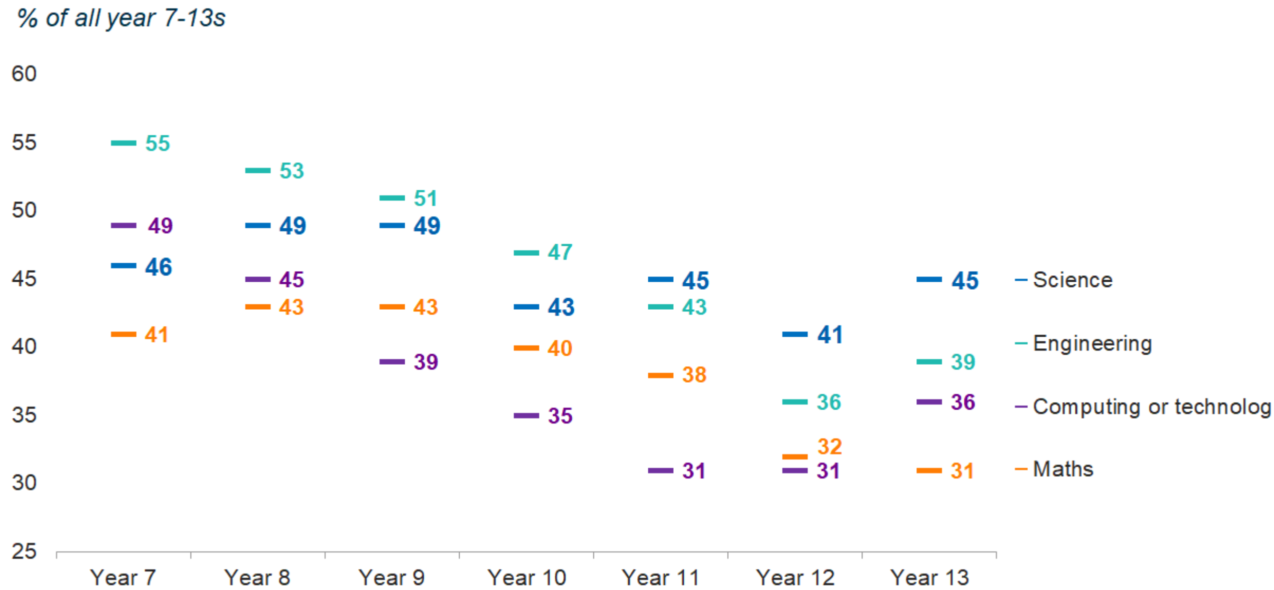


How interested are you in a future career that involves any of the following: Science, Computer Science, Engineering or Maths? (CarInt)

Bases: All years 7–13 (7,256); males (3,428); females (3,601); year 7 (993); year 8 (1,032); year 9 (1,052); year 10 (1,057); year 11 (1,076); year 12 (1,040); year 13 (1,006)

Figure 11.4 above indicates a general pattern of decline between year 7 and year 12 in levels of interest in a STEM career. Building on this, Figure 11.5 displays the level of interest in each different type of STEM career by school year. This shows that the patterns by year group within individual STEM disciplines differ. There are steep declines by school year in levels of interest in a computing or technology and engineering career. Between year 7 and year 12, the level of interest in computing or technology declines from 49% to 31% among students in years 7–12, and the level of interest in engineering declines from 55% to 36%. While there is also a decline in interest in a maths–related career, the rate of decline is much shallower. While there is some volatility, the level of interest in a science career remains more stable by school year.

Figure 11.5: Percentage of year 7–13 students who were very or fairly interested in different types of STEM careers by school year (2023)



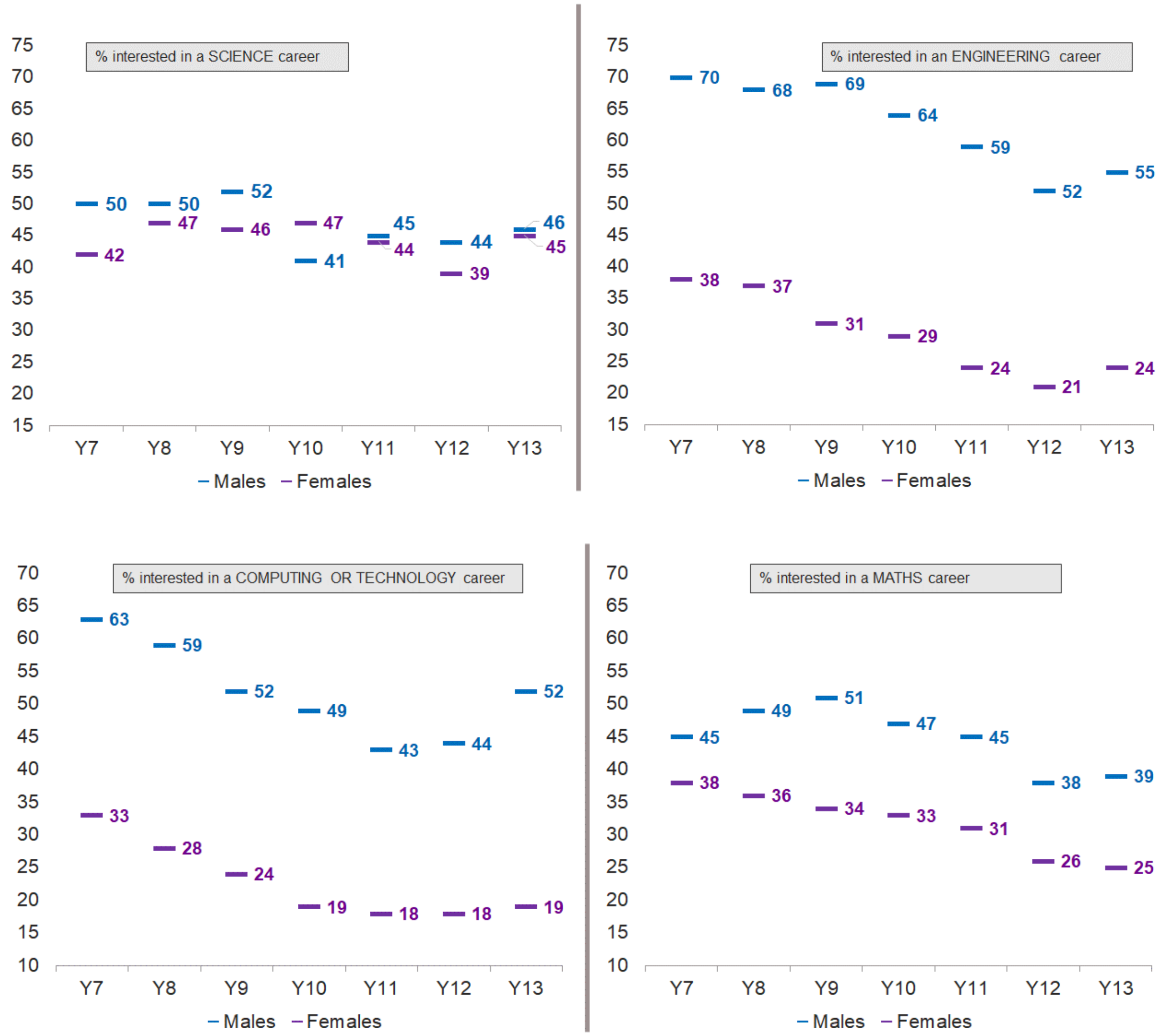
How interested are you in a future career that involves any of the following: Science, Computer Science, Engineering or Maths? (CarInt)

Bases: All years 7–13 (7,256); year 7 (993); year 8 (1,032); year 9 (1,052); year 10 (1,057); year 11 (1,076); year 12 (1,040); year 13 (1,006)

Figure 11.6 provides the percentage of young people interested in each of these four types of career by gender within school year. This shows that, for interest in science careers, the widest male–female gender gaps are found in Year 7, with no clear or consistent pattern by gender in later years. Compared with other career types, the gender gaps for interest in science careers were much narrower.

For interest in engineering and computing/technology careers, there is a consistently wide male–female gender gap throughout the whole of secondary school, while the gender/year group pattern for maths careers is different. There is a narrow male–female gender gap in year 8, the gap then widening between year 9 and year 13. However, the gender gaps are narrower for maths careers compared with engineering and computing/technology careers.

Figure 11.6: Percentage of year 7–13 students who were very or fairly interested in different types of STEM careers by school year and gender (2023)



How interested are you in a future career that involves any of the following: Science, Computer Science, Engineering or Maths? (CarInt)
Bases: All years 7–13 (7,256); year 7 (993); year 8 (1,032); year 9 (1,052); year 10 (1,057); year 11 (1,076); year 12 (1,040); year 13 (1,006)

Figures 11.4 to 11.5 above display the variation in level of interest in STEM careers in general by gender and school year. Figure 11.7 displays the level of interest across different types of STEM careers by other demographic subgroups. This shows some common features across all types of STEM careers.

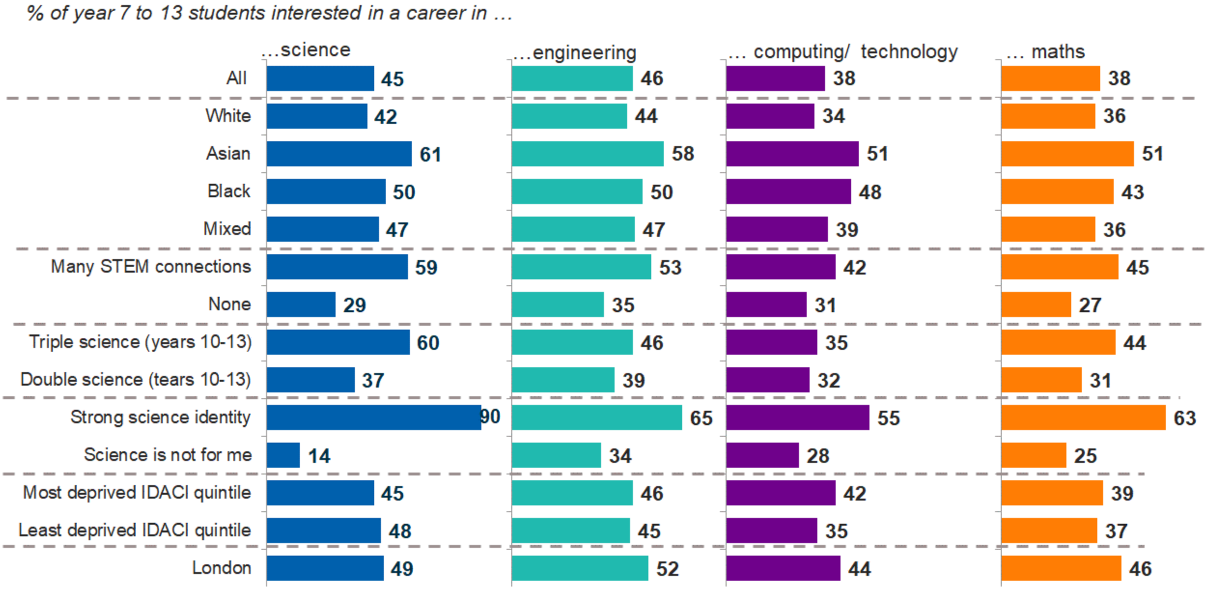
Across all STEM careers, level of interest is raised among the following subgroups:

- Asian and Black students.
- Students with many family STEM connections.
- Students with a strong science identity (those who actively seek out science information and activities).
- Students living in London.

For some characteristics the pattern is slightly different for level of interest in careers related to computing or technology:

- While taking triple rather than double science was strongly associated with interest in science, engineering, and maths careers, it was not associated with interest in a computing or technology career.
- Overall there was relatively little difference in level of interest in other STEM careers by level of deprivation as measured by IDACI quintiles. However, students living in the most deprived areas were more interested in computing/technology careers than those in the least deprived areas. In Chapter 5 (section 5.3), a parallel finding was observed in that students from more deprived backgrounds were also more interested in computing at school.

Figure 11.7: Percentage of year 7–13 students who were very or fairly interested in different types of STEM careers by various demographic subgroups (2023)



How interested are you in a future career that involves any of the following: Science, Computer Science, Engineering or Maths? (CarInt)

Bases: All years 7–13 (7,256); white (5,115); Asian (935); Black (487); Mixed (450); many STEM connections (1,898); no stem connections (960); triple science (1,489); double science (2,251); strong science identity (654); science is not for me (2,228); IDACI quintiles most deprived (1,703); least deprived (1,358); London (1,070)

11.5 What are the motivations for pursuing a STEM career?

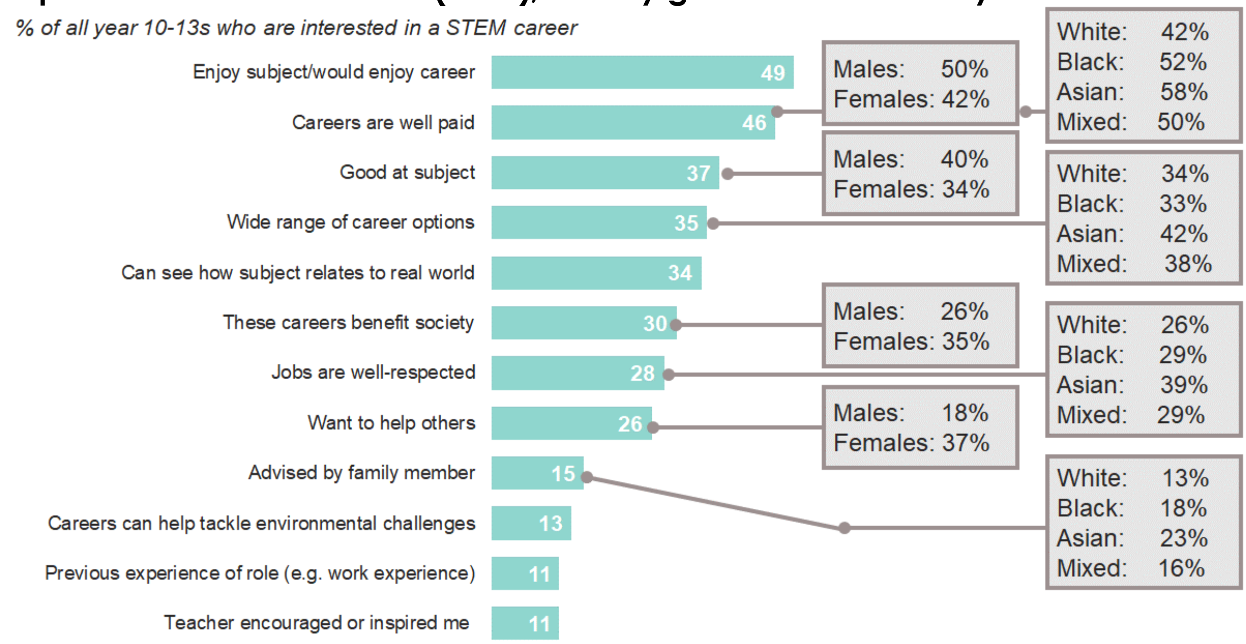
To investigate what is driving interest in a science career, young people in years 10–13 who expressed any interest in any of the four types of STEM career were asked why, and they were able to choose as many answers as they wished from a list (Figure 11.8). It is not possible to compare with SET 2019 due to changes in the composition of the list and the subgroup of students asked this question.

The main motivation was based on enjoyment of the subject or potential future career (49%), although level of pay (46%), feeling they are 'good' at the subject (37%), and breadth of career options (35%) were also important motivations.

Several motivations centred around the application of a STEM career to meet societal challenges: 34% said they could see how a STEM job would relate to the real word; 30% thought this career would benefit society; 26% wanted to help others and 13% identified associations with solving environmental challenges. A further 28% thought a STEM career would be well–respected.

Influence from family and teachers played a more limited role in students' interest in STEM careers: 15% mentioned influence from family while 11% mentioned being encouraged by a teacher.

Figure 11.8: Reasons for interest in a STEM career among year 10–13 students who expressed an interest in this (2023); and by gender and ethnicity



Why are you interested in a career involving Science, Computer science, Engineering or Maths? (Carwhy)

Bases: Year 10–13s interested in a STEM career (3,067); white (2,065); Black (247); Asian (454); mixed (188); males (1,574); females (1395)

As shown in Figure 11.8, there were some demographic differences:

- Males and females were motivated by different aspects of a STEM career: males were more motivated by pay and because they felt they were good at the subject, while females were more incentivised by a desire to help people (which was also reflected in their specific career aspirations – see section 11.7).
- Students from an Asian background were more likely than white students to be influenced in their desire to pursue a STEM career by the perceived esteem of a STEM career, and by their parents. Students from an Asian or mixed ethnic background were more likely to be encouraged by the variety of jobs available requiring these skills.

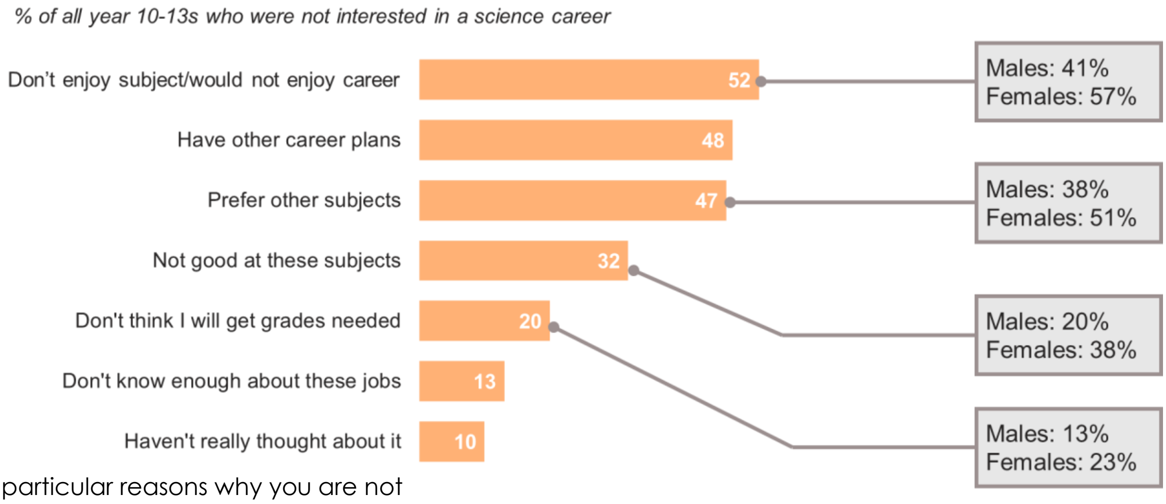
Students with many family science connections generally selected a wider range of reasons than students with no such connections.

11.6 What are the barriers to pursuing a STEM career?

Having little or no interest in a STEM–related career was primarily a result of not enjoying the subject/career (52%), having other career plans (48%), a preference for other subjects (47%) and a lack of perceived ability; the last point was expressed as students thinking that they were not good enough in the relevant subjects (32%) or thinking they would not get the grades required (20%). Around one in ten (13%) said that not knowing enough about the jobs available was a disincentive. (Figure 11.9).

In general, females expressed a wider range of reasons for being disinclined towards a STEM career and were more likely than males to be discouraged by a lack of enjoyment, preference for other subjects or because they lacked confidence either in their ability or to get the required grades.

Figure 11.9: Reasons for not being interested in a STEM career among year 10–13 students who stated no interest (2023); and by gender



Are there any particular reasons why you are not interested in a career involving Science, Computer science, Engineering or Maths? (Carwhyno)

Bases: Year 10–13s not interested in a STEM career (980): males (264), females (682)

11.7 What careers are young people interested in?

Interest in STEM and non–STEM careers

Overall, 78% of students in years 7–13 said they had at least some idea of a future career (32% had a firm idea and 46% some idea) with similar patterns among those in years 7–9 and those in years 10–13.

All year 10–13 students[31] who had at least some idea of a future career were asked what careers they were interested in. Respondents could give as many answers as they wished; answers were collected in an open format and later coded into categories. Figure 11.10 displays all careers mentioned by at least 4% of this subgroup. A more detailed explanation of some of the STEM–based categories are footnoted below the chart.

Figure 11.10 shows that the large majority of year 10–13 students with at least some idea of a career were thinking about a non–STEM rather than a STEM career: students were twice as likely to aspire to a non–STEM career than a STEM career (73% vs 38%)[32]. Furthermore, students could give multiple responses and not all students interested in a STEM career were exclusively interested in this: 27% only mentioned a STEM career, and 12% were thinking about a range of ideas, including both STEM and non–STEM careers.

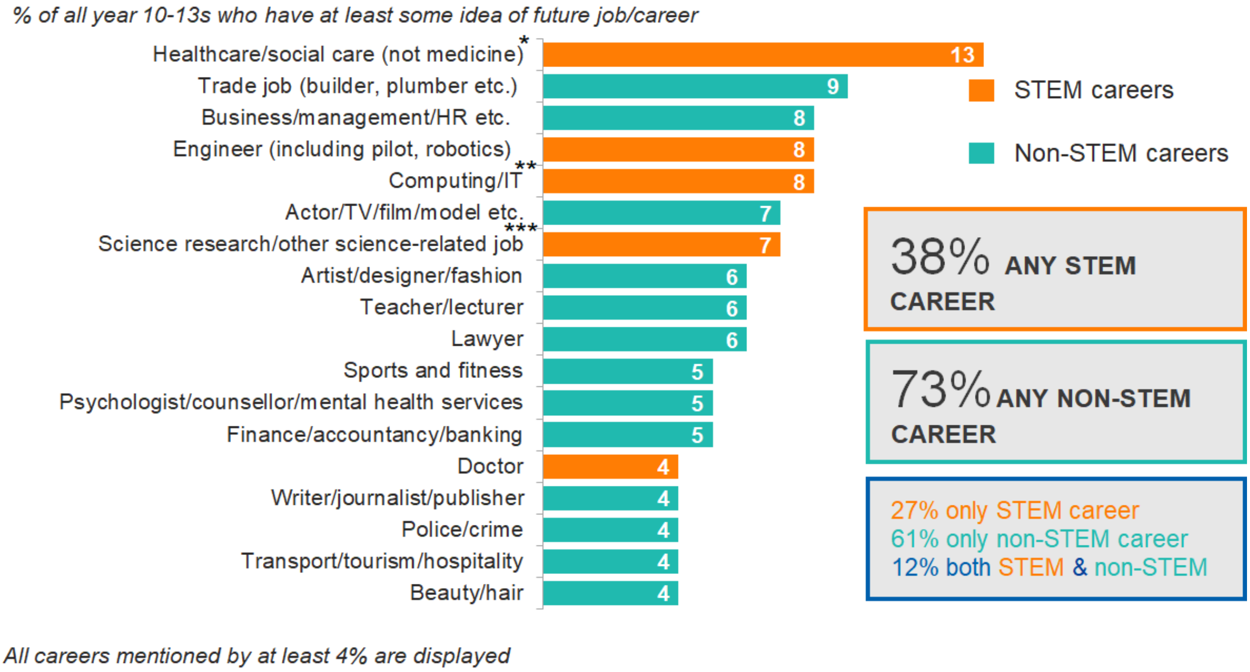
The SET 2023 results for this question were not directly comparable with SET 2019 due to the differences in presentation of the question. However, at a broad level, the profile of career aspirations by type of job has remained very similar to SET 2019 and there are no indications of any significant changes over time.

Overall, 38% were interested in a STEM career and the most popular choices were healthcare or social care, engineering, computing/IT, another science–related job (examples included physicist, biologist, lab work, etc.), and medicine.

[31] This question was tested among year 7–9s at the cognitive testing phase for SET 2019. However, among these younger pupils, career ideas tended to be very vague and therefore this question was focused on the older age groups (years 10–13) only.

[32] The classification into STEM vs non–STEM is based on the general nature of the career, although it is appreciated that some non–STEM careers may also require STEM skills (e.g. finance/accountancy/banking would require maths).

Figure 11.10: Career aspirations among year 10–13s who had at least some idea of a future career (2023)



Bases: Year 10–13s who have at least some idea of future career (3,267)
*Includes, for example, paramedic, nurse, midwife, pharmacist, physiotherapist, healthcare, social care, social worker, optician and any other jobs related to health or social care
**Includes any job related to computing, e.g. software engineering, software developer, web design, computer games design, cyber–security and artificial intelligence (AI)
***Includes science–related jobs or science–related research, e.g. physicist, biologist, astronomy, medical research, biochemist, forensic scientist and working in a lab
Other science careers (not shown here as < 5%) included vet, dentist and other STEM careers

It is worth noting that of those in years 10–13 with some idea of a future career, 77% said that they were very or fairly interested in at least one type of STEM career when asked in a general way (see section 11.4 above). However, when this same group of students (those with at least some idea of a career) were asked to give examples of specific careers they were interested in, the percentage who mentioned a specific STEM career was only 39%. This suggests that for many young people of this age, aspirations to study STEM subjects were not necessarily based on any fixed ideas or detailed knowledge of individual careers. In fact, of the 77% who said they were interested in a STEM career, only about half (46%) of them mentioned a STEM career in response to the open question. This suggests that although there is a general desire to pursue a career in STEM for a sizeable percentage of young people, there is a need for students to be better informed about the range of STEM career options available.

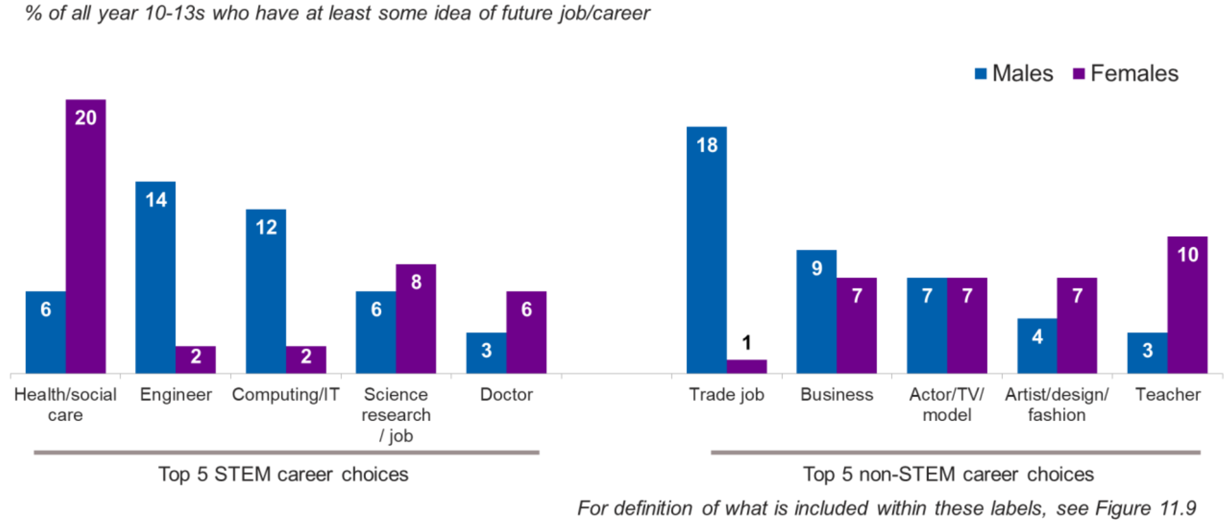
STEM and non–STEM careers by gender

Figure 11.11 displays the top five STEM and non–STEM choices among those in years 10–13 who had at least some idea of a future career by gender. This shows that some career choices were heavily gendered.

Female students were much more likely to aspire to a career in healthcare or social care (20% females vs 6% of male students) and slightly more likely to aspire to a career in medicine (6% vs 3%). Male students, on the other hand, were much more likely to express interest in engineering (14% males vs 2% females) and computing/IT (12% vs 2%).

Of the non–STEM career choices, male students were more likely to aspire to a trade profession, while females were more inclined towards a career in teaching or art/design/fashion.

Figure 11.11: Career aspirations among year 10–13 students who had at least some idea of a future career: top 5 STEM careers and top 5 non–STEM careers by gender (2023)



What careers are you interested in? (Carwht) [Answers collected in an open verbatim format and later coded into categories]
Bases: Year 10–13s who have at least some idea of future career (3,267): males (1,476), females (1,695)

12. Engineering as a career

This chapter explores awareness, knowledge and attitudes among young people towards engineering as a career. These questions were asked for the first time in 2023.

Key findings

2023 findings

Overall, 36% of students in years 7–13 said they knew at least a fair amount about engineering, and 69% said they knew at least a little. Perceived knowledge was higher among students who were interested in school STEM subjects (science, computing, design and technology, physics) and with wider connections to STEM – for example among those interested in climate change, and who had undertaken STEM work experience.

Around half of students thought they had the capability to become an engineer while 30% thought that engineering was a suitable career 'for me': 46% of students in years 7–13 thought that they either definitely or probably could become an engineer regardless of future career intentions, while 30% agreed that engineering was a 'suitable career for someone like me'. Young people with higher levels of confidence in their abilities in school STEM subjects were more likely to consider an engineering career as being within their reach.

Most students regarded engineering careers as creative and versatile. 72% of year 7–13s agreed that an engineering career involves creativity while 66% agreed that this provides access to a range of different roles. Males were more positive about the benefits of engineering careers than females.

About a half of students said that they were interested in an engineering career although enthusiasm for this fell with school year: 46% of those in years 7–13 expressed some level of interest, with interest being highest among year 7 students (55%) and lowest among year 12 (36%) and year 13 (39%) students.

More students would consider a technical or vocational route into engineering than a university route: Amongst all young people in years 10–13 who expressed an interest in an engineering career, 36% indicated a preference to pursue a technical or vocational route while 28% indicated a preference for a university route. The main perceived benefits of a vocational route were financial, while preference for a higher education route centred around longer–term prospects such as flexibility of career options, and better pay and career progression; many also cited a more general desire to have the experience of going to university.

As for STEM careers more generally (see Chapter 11), knowledge and interest in engineering careers were associated with groups typically associated with higher STEM engagement; that is males, Asian and Black students, and students with many family STEM connections, with a strong science identity, and who had undertaken STEM work experience.

12.1 Context

Engineering plays a vital role in the UK economy, helping provide innovative solutions to the complex problems we face in everyday life now and in the future including in the fields of transport, infrastructure, environmental sustainability, healthcare, and technology. It also helps drive economic growth in the UK. However, the Institute of Engineering and Technology estimated a shortfall of 173,000 workers in the STEM sector in 2022 (IET, 2022) and reported that 49% of engineering businesses were experiencing difficulties in the skills available to them when trying to recruit (IET, 2021).

This clearly underlines the need for better promotion of engineering as a career among young people both in the school setting and outside of it. As the 2022 IET report states 'Children eagerly learn about science and maths, but the connection to engineering – the link between these subjects, their purpose and application to the world in which we live – is not currently being made'.

The COVID–19 pandemic is likely to have exacerbated the challenges in familiarising young people with the applications of engineering, given that it restricted young people's access to careers events, open days, work experience and other STEM–related outreach activities (see Chapter 10 for more detail on these types of activities).

Against this backdrop, the SET 2023 survey included for the first time a new set of questions to capture knowledge and attitudes in relation to engineering as a career and the pathways into this. The SET 2023 questions built on selected questions from the Engineering Brand Monitor (EBM) surveys, which have explored similar themes among young people at secondary school in the UK (see EngineeringUK, 2022 for the most recent report).

Survey pre–testing for SET 2023 indicated that many young people did not have a clear understanding of what a career in engineering involved. Therefore, after collecting data on knowledge of engineering as a career, young people were provided with a simple definition of engineering to help contextualise later questions about engineering careers:

> "Engineers find solutions to problems. Their work involves designing, creating, fixing and improving things like products, transport, software, buildings and machines."

12.2 Perceived knowledge about engineering careers

Before being asked detailed questions about attitudes towards engineering careers, young people were asked how much they knew about engineering as a career. See also Chapter 11 for further discussion of this in the context of other STEM careers.

The Engineering Brand Monitor 2021 (EngineeringUK, 2022) found that 55% of young people agreed that they knew about the different types of things engineers can do in their jobs. The SET 2023 survey explored more granular levels of knowledge using a different scale so the two sets of results cannot be compared. However, the SET 2023 results indicate that detailed perceived knowledge of engineering careers is much lower than this.

Overall, in SET 2023, 8% of students across all years 7–13 said they knew a lot, while 28% said they knew a fair amount, and 33% reported knowing a little. Around three in ten (28%) said they did not know very much (21%) or nothing at all (7%).

Figure 12.1 displays the percentage of people in different groups who considered that they knew either a lot or a fair amount about engineering. While this knowledge was clearly based on a subjective assessment, it is interesting to note that younger students in years 7–9 felt that they knew more than older students in years 10–13. As also noted in section 11.3, the explanation for this could be that, as students get older, they begin to realise that engineering is more varied and complex than first thought. In other words, this could mean that older students are more likely to recognise gaps in their knowledge, whereas younger students may be basing their understanding on a simpler self–definition of engineering.

Across both age ranges, male students reported a greater level of knowledge than female students. Amongst years 7–9, 50% of males considered that they knew at least a fair amount compared with 33% of females, while among years 10–13 the equivalent figures were 40% and 23% for males and females, respectively.

Asian and Black students reported greater knowledge of engineering compared with white students, and this was the case within both genders. The level of perceived knowledge among Asian males (50%) and Black males (48%) was particularly high.

Students with many family STEM connections were twice as likely to report knowing at least a fair amount (46% compared with 22% who had no science connections).

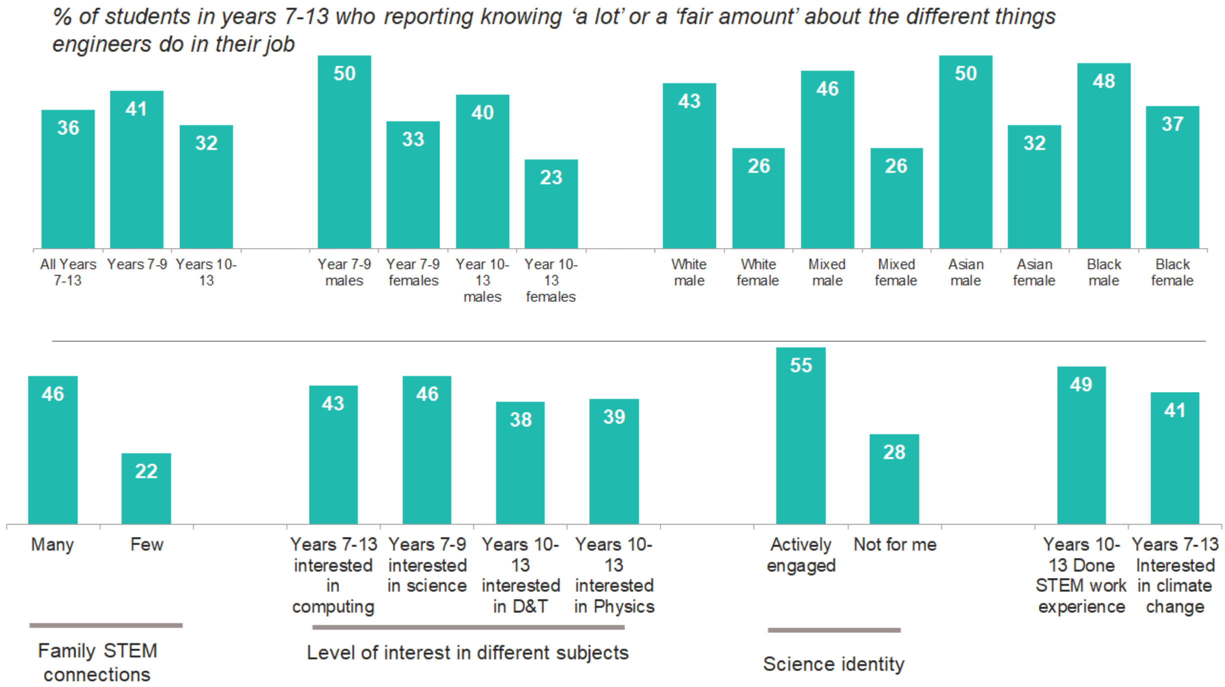
Students who were more interested in relevant school subjects were also more likely to perceive themselves as having knowledge of engineering careers.

- Compared with all students in years 7–13 (36%), the percentage who said they knew at least a fair amount about engineering was higher among those who said they were interested in computing at school (43%).
- Compared to all those in years 7–9 (41%), the percentage who said they knew at least a fair amount about engineering was higher among those who said they were interested in science at school (46%).
- There was a similar differential for years 10–13 interested in design and technology (38%) and physics (39%) compared with all students in years 10–13 (32%).

More generally, students who had an interest or exposure to STEM in wider society were more likely to report knowing at least a fair amount about engineering careers.

- Students in years 7–13 who were actively interested in science matters.
- Students in years 7–13 with an interest in climate change issues.
- Students in years 10–13 who had undertaken any STEM work experience.

Figure 12.1: How much did young people in years 7–13 think they knew about the different types of things engineers do in their jobs, by various subgroups (2023)



How much do you know about the different types of things the following people do in their jobs?(CarKnowA)
Bases: All year 7–13s 2023 (7,256): years 7–9 (3,077); years 10–13 (4,179); year 7–9 males (1,535); year 7–9 females (1,466); year 10–13 males (1,893); year 10–13 females (2,135); white male (2403); white female (2551), mixed male (217), mixed female (221); Asian male (469); Asian female (449); Black male (220); Black female (258); family STEM connections many/few none (1898/960); years 7–13 interested in computing (3,333); years 7–9 interested in science (2,187), years 10–13 interested in D&T (2,427); years 10–13 interested in Physics (2,234), science identity actively engaged/not for me (654/2,228), years 10–13 done STEM work experience (670); years 7–13 interested in climate change (3,365)

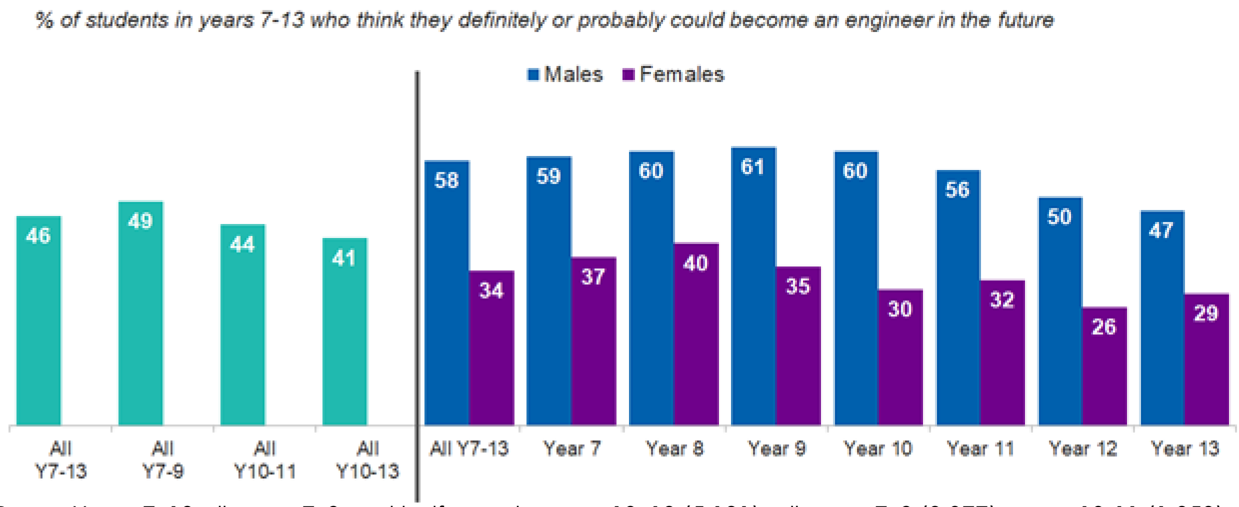
12.3 Perceived capability of becoming an engineer

Just under half (46%) of all students in years 7–13 thought that they either definitely (8%) or probably (37%) **could** become an engineer in the future, regardless of whether this career path was of interest to them, while 46% thought that this career was probably not (32%) or definitely not (14%) within their reach.

As shown in Figure 12.2, young people in years 7–9 were most likely to consider an engineering career as within reach (49%), although the percentage who held this view decreased by school year to 44% of those in years 10–11 and 37% of those in years 12–13. This is likely to be related to the narrowing of pathways among students in the post–GCSE years. For example, students who have chosen an arts or humanities pathway in year 12 and 13 may consider that engineering is no longer an option for them by this stage.

Male students were far more likely to consider that they could do engineering as a career (58% compared with 34% of females) and this differential was evident across all school stages. For males, levels of perceived capability stay broadly stable between year 7 and year 10, and then begin to fall away again from year 11 onwards. For females, this drop begins a little earlier from year 10.

Figure 12.2: Perceived capability of becoming an engineer among young people in years 7–13 by year group and gender (2023)



Bases: Years 7–13 all years 7–9 and half sample years 10–13 (5,131): all years 7–9 (3,077); years 10-11 (1.050); years 12-13 (1,004); half sample B years 10–13 (2,054); year 7 males (494); year 7 females (475); year 8 males (536); year 8 females (470); year 9 males (505); year 9 females (521); year 10 males (239); year 10 females (261); year 11 males (251); year 11 females (266); year 12 males (220); year 12 females (267); year 13 males (223); year 13 females (245)

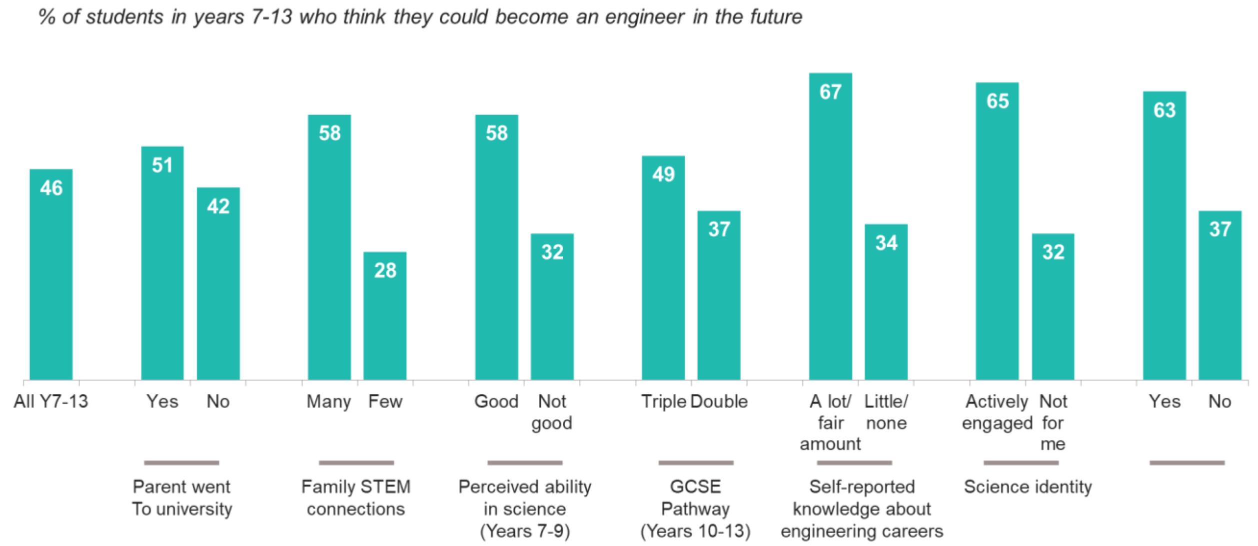
Various factors were associated with young people's belief in their ability to become an engineer (Figure 12.3).

Young people with university–educated parents (51% compared with 42% whose parents did not go to university) and with many family STEM connections (58% compared with 28% with no family STEM connections) were much more likely to see an engineering career as within reach.

Propensity to believe they could become an engineer was also higher for young people who considered they knew at least a fair amount about engineering as a career; for students in years 10–13 who were or had been on the triple science pathway; and for young people who had taken part in STEM work experience.

Young people with higher levels of self–belief in science (years 7–9) were also more likely to consider that they could become an engineer (58% of year 7–9s who thought that they were 'good' at science compared with 32% who thought they were 'not good'), with similar patterns for students' self–belief in computing (years 7–13), and in each of the three individual sciences and design & technology (years 10–13).

Figure 12.3: Perceived capability of becoming an engineer among young people in years 7–13 by various subgroups (2023)



Regardless of whether you would want to do this as a career, do you think you could become an Engineer in the future?(EngCould)
Bases: Years 7–13 all years 7–9 and half sample years 10–13 (5,131): parent went to university yes/no (2,570/2,057); family STEM connections many/few no (1,411/633); perceived ability in science good/not good (1,531/486); GCSE pathway triple/double science (742/1,098); self–reported knowledge about engineering careers a lot or fair amount/little or none (1,951/3,065); science identity actively engaged/not for me (452/1,553); STEM work experience yes/no (320/1,644)

12.4 Attitudes towards careers in engineering

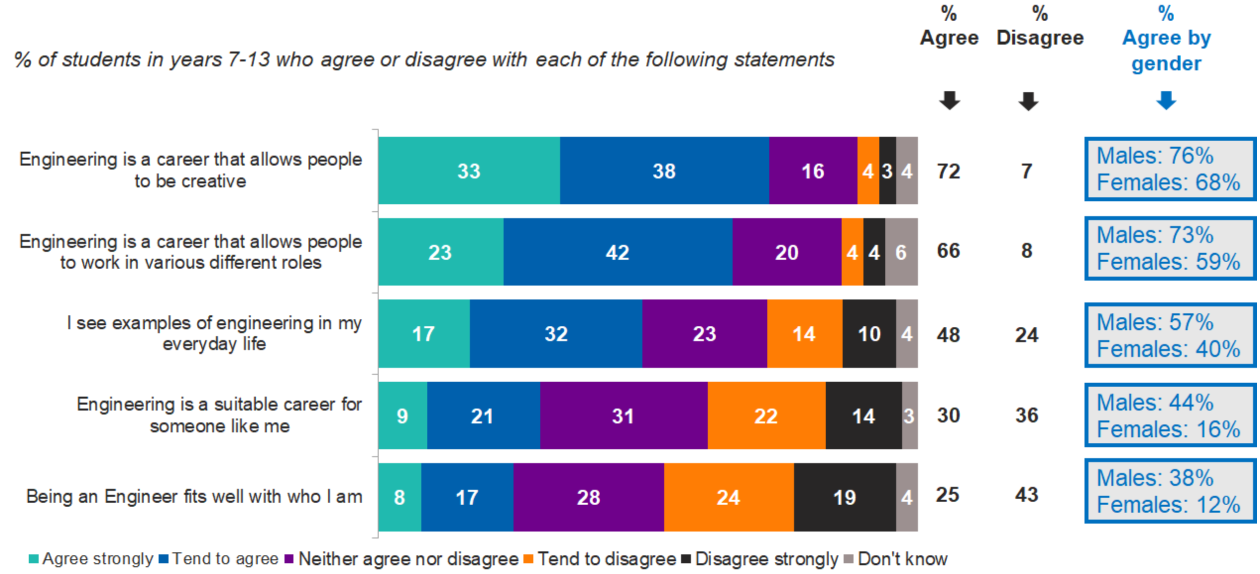
In SET 2023, young people across all year groups were asked how much they agreed or disagreed with a range of statements about engineering careers (Figure 12.4). The results show that most young people understood that a career in engineering can be creative and versatile. Overall, 72% agreed that a career in engineering allows people to be creative and 66% agree that it provides options for various different roles. Around half (48%) agreed that they see examples of engineering in everyday life.

However, despite these positive overall opinions about engineering, a minority regarded a career in engineering as either 'suitable for someone like me' (30% agree) or which 'fits well with who I am' (25% agree).

There were wide gender gaps in levels of agreement to these statements. Male students were considerably more likely than females to perceive engineering as a career which is suitable for them (44% males vs 16% females) or which fits well with who they are (38% males vs 12% females). Males also had more positive opinions than females in terms of their perception of engineering careers as creative (76% males vs 68% females) or allowing people to work across different roles (73% males vs 59% females), as well as observing engineering examples as part of their everyday life (57% males vs 40% females).

As well as a marked gender difference in the percentage who regarded engineering as a suitable career for someone like them, this perception was also more pronounced among Asian students (38% compared with 28% of white students), among students with many family STEM connections (37% compared with 20% with no connections), among year 7–9 students who think they are 'good' at science (39% compared with 22% who do not consider themselves good at the subject) and among those year 10–13s who have taken up STEM work experience (47% compared with 24%).

Figure 12.4: Attitudes towards engineering as a career among young people in years 7–13 (2023)



How much do you agree or disagree with the following statements?(EngUse)
Bases: Years 7–13 all years 7–9 and half sample years 10–13 (5,131)

12.5 Opinions on whether engineers help or harm the environment?

A more specific question sought to establish the views of young people in years 7–13 about the relationship between engineering careers and the environment. More young people felt that on balance engineers do more to help the environment (21%) than harm it (11%). However, a majority held a more neutral opinion, with 52% saying that they do an equal amount of good and harm when it comes to the environment. A further 16% did not have a view.

Students from Asian and Black backgrounds are more likely than white students to feel that engineering does more to help the environment (Asian 27%, Black 29%, white 19%). People with many family connections in STEM were also more likely than those with no family connections in STEM to hold this view (23% compared with 16%). Young people who were interested in an engineering career (26% vs 16% who were not interested) and those who considered themselves to know at least a fair amount about engineering (26% vs 17% who had lower levels of perceived knowledge) were also more likely to hold a positive view about the environmental contribution of engineers.

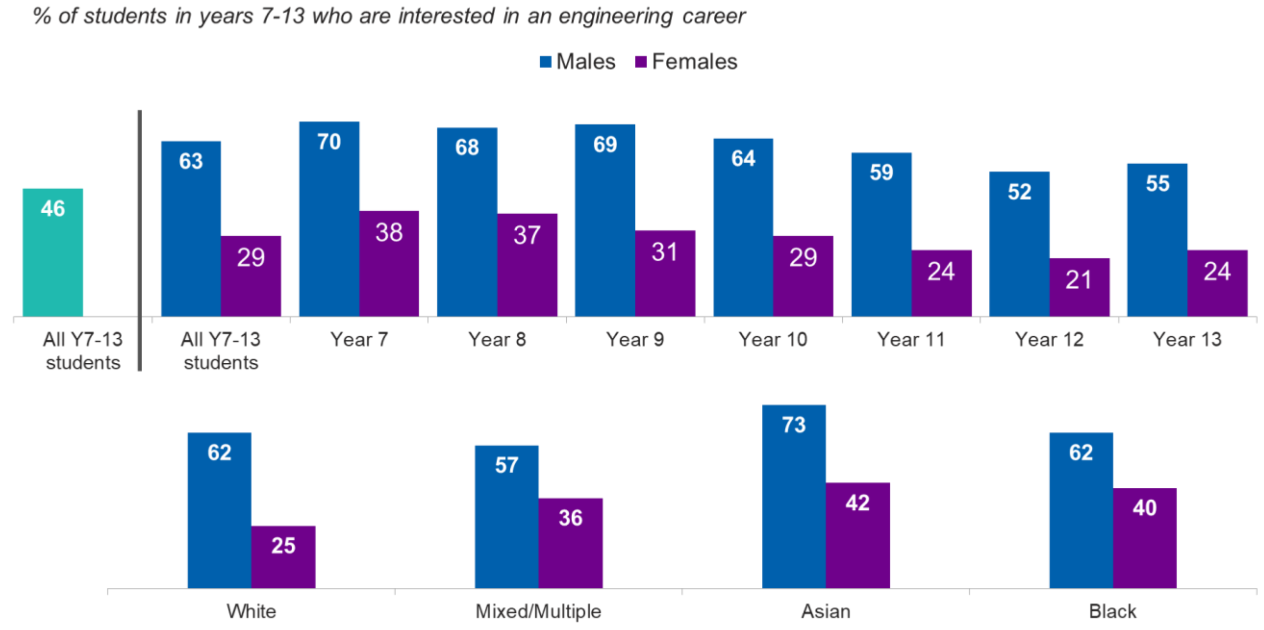
12.6 Interest in engineering as a career

Overall, 46% of all young people in years 7–13 expressed some level of interest in a career in engineering: 14% were 'very interested' and 32% were 'fairly interested'. On the other hand, 50% were either not very interested (31%) or 'not at all interested' (19%) (Figure 12.5). See also Chapter 11 for further discussion of this in the context of other STEM careers. The percentage who declare themselves interested in an engineering career closely matches the findings from the Engineering Brand Monitor (Engineering UK, 2022).

Interest was highest in year 7 (55%), dropping gradually over time as young people start to narrow their future career choices to 36% in year 12 and 39% in year 13. Across all year groups, there was a substantial gender gap in levels of interest in engineering, with male students around twice as likely as female students to express interest in this. This gender gap mirrors findings in the ASPIRES 2 research which also reports wide gender gaps in aspirations to become an engineer (Archer et al., 2020).

Asian and Black students were particularly likely to express an interest in an engineering career (58% of Asian students, 50% of Black students, 44% of white students). The difference by gender already noted is also observed with each ethnicity group. However, there was a much wider gender gap among white students than among students from other ethnic backgrounds as shown in Figure 12.5

Figure 12.5: Level of interest in an engineering career among young people in years 7–13 by year group, ethnicity and gender (2023)



How interested are you in a future career that involves any of the following….b) Engineering? (Jobs that involve finding solutions to problems. The work of engineers involves designing, creating, fixing and improving things like products, transport, software, buildings and machines) (CarInt)
Bases: All year 7–13s 2023 (7,256): years 7–9 (3,077); years 10–13 (4,179); year 7 males (494); year 7 females (475); year 8 males (536); year 8 females (470); year 9 males (505); year 9 females (521); year 10 males (493); year 10 females (538); year 11 males (496); year 11 females (542); year 12 males (454); year 12 females (550); year 13 males (450); year 13 females (505); white male (2,403); white female (2551), mixed male (217), mixed female (221); Asian male (469); Asian female (449); Black male (220); Black female (258).

Other groups with a higher propensity to consider an engineering career included students with many family STEM connections (53% compared with 35% who had no such connections) and students who had taken part in STEM–based work experience (63% compared with 38% who had not taken part in this).

Interest in an engineering career was also higher among people living in London (52% compared with 46% overall). As might be expected, students who were interested in physics, computing, and design and technology at school were much likely than those who were not interested to show an interest in engineering as a career.

In addition, young people who felt that engineers do more to help than harm the environment were more interested in an engineering career (48%) than those who considered that engineers do more to harm than help (35%) or do an equal amount of harm and good when it comes to the environment (40%).

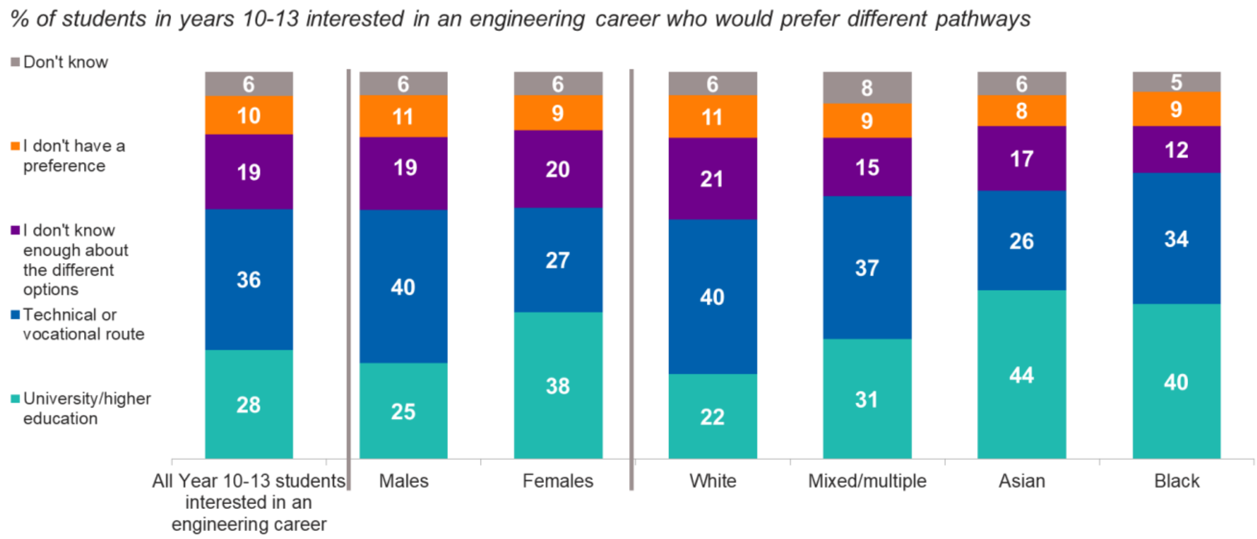
12.7 Pathways into engineering among those considering engineering as a career

Amongst all young people in years 10–13 who expressed an interest in engineering as a career, a slightly higher percentage thought that they would prefer to follow a technical or vocational route (36%) than a higher education route (28%), while 29% felt that they either didn't know enough about the options or did not have a preference either way (Figure 12.6).

Amongst those who expressed an interest in engineering, female students were more in favour of the higher education route (38% vs 25% males) while males were more favour of a vocational pathway (40% vs 27%). Asian students were more inclined towards a higher education route (44% vs 22% of white students) while white students were more inclined towards a vocational route (40% vs 26% of Asian students).

Whether or not at least one of their parents had attended university was strongly associated with the young person's choice of career pathway. Among students interested in an engineering career, 39% with a university–educated parent expressed a preference for the higher education route, compared with 21% of those with no parent who attended university. Amongst this same subgroup, young people living in an area in the least deprived quintile were more likely than those living in an area in the most deprived quintile to opt for the university route (32 % vs 23%), as were those studying triple rather than double science at GCSE (41% compared with 24%, respectively).

Figure 12.6: Preferred route into engineering, among young people in years 10–13 who had expressed interest in this as a career (2023)



You said earlier that you were fairly or very interested in a career in Engineering. If you did decide to pursue a career in engineering, which of the following routes would you be most likely to consider?(Engroute)
Bases: Years 10–13 who have expressed an interest in engineering as a career (1,672): males (1,094); females (529); white (1,097); mixed/multiple (104); Asian (271); Black (136)

Those who indicated a preference for either a vocational route or a higher education route into engineering were asked to explain their reasoning (Figure 12.7) [33].

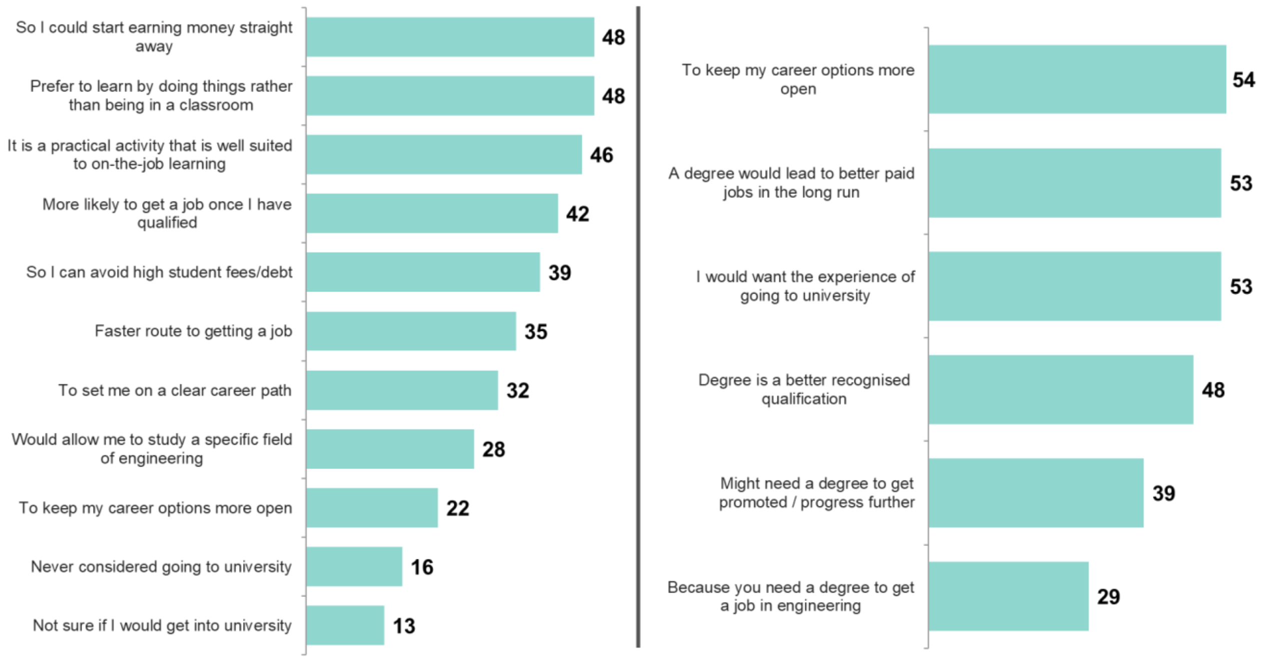
Focusing first on the vocational route, financial reasons were an important factor here, with 48% saying they would choose this so they could start earning money straight away, and 39% saying that this meant they could avoid student debt. Around half of those preferring a vocational route expressed a preference for learning by 'doing' (48%) and because they felt engineering is well suited to on–the–job learning (46%).

Others felt that a vocational route was good for career prospects with 42% thinking this would be more likely to lead to a job, 35% thinking this to be a faster route into employment, 32% feeling it would set them on a clear career path, 28% thinking that it would allow them to specialise, and 22% feeling it would allow them to keep their options more open.

Many of the reasons underlying a preference for a higher education route into learning centred around longer–term prospects: to keep career options more open (54%), because it will lead to a better–paid job in the long run (53%), a feeling that a degree is a better recognised qualification (48%), or because they feel a degree will lead to better promotion prospects or progression in their career (39%). Three in ten (29%) felt that a degree was a necessity for a career in engineering while half (53%) wanted the experience of going to university more generally.

Figure 12.7: Reasons for preferring vocational vs academic pathways into engineering among year 10–13 students interested in an engineering career (2023)

a) Vocational route **b) Higher education route**



You said you would choose a [technical or vocational route] [university/higher education as a route] into Engineering. Why would you choose this route?
Bases: Years 10–13 vocational route/academic route (590/519)

[33] Respondents were presented with a list and could choose as many options as applied.

13. Attitudes towards environmental sustainability

This chapter explores year 7-13 students' interest in issues related to environmental sustainability, whether they are interested in a future career that will help reduce the impact of climate change, and their attitudes towards issues related to climate change. These questions were asked for the first time in 2023.

Key findings

2023 findings

Two–thirds of students in years 7–13 were interested in issues related to climate change and interest was higher among females, students with many family STEM connections, those living in London, and students from more affluent areas. Interest in climate change issues by school year decreased among males (from 65% in year 7 to 54% in year 13) but remained stable for females with around seven in ten expressing interest across all school years.

One in three students were interested in a career that will help tackle climate change and interest was higher among students interested in an engineering career.

There was confusion around media reporting related to climate change and some scepticism regarding the efficacy of climate change actions. Just under half of year 7–13s (45%) believed that 'When it comes to climate change, it's difficult to know what to believe" and one in three (36%) agreed that 'It's pointless doing things to help reduce the impacts of climate change unless others do the same'.

Females were more interested than males in a range of issues associated with the environment including climate change, biodiversity loss, sustainable fashion and diet, while males were more interested in transport. Students living in rural areas were especially likely to be interested in biodiversity while those living in London were more interested than average in air pollution.

13.1 Context

Climate change is one of the most important issues facing the planet and awareness of this has grown in recent years. Substantial media coverage of events such as the COP Climate Change Conferences, world government net zero initiatives and climate change protests have helped to promote interest in the causes and mitigation of the effects of climate change. In particular, the youth climate change movement has targeted the engagement of young people in these issues.

In the context of this survey, the link between net zero and the engineering sector is also important. Engineers play a crucial role in helping to reduce carbon emissions in sectors such as transport, energy, manufacturing and the built environment. Therefore, it is important for young people to recognise the availability of jobs within engineering and other sectors that will help promote environmental sustainability.

For SET 2023, some new questions were asked around the subject of environmental sustainability, to understand young people's interest in the subject, which topics are of most interest, the likelihood of considering a career related to this, and their opinions about issues related to climate change.

13.2 Which topics are young people most interested in?

Young people were asked which specific topics related to the environment they were most interested in. Respondents were presented with a list and could select up to three items from it.

As shown in Figure 13.1, the topics of strongest interest were climate change (42% interested) and biodiversity loss (31% interested). Around one in five were interested in each of air pollution, waste and recycling, transport and water pollution.

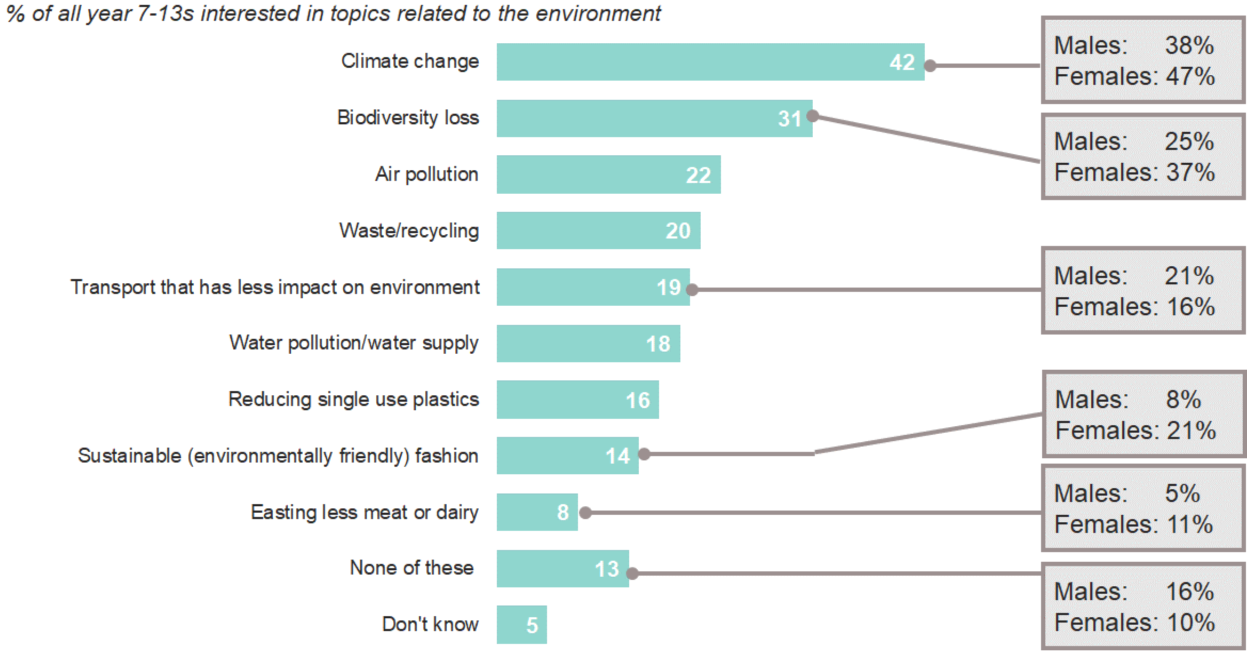
Single use plastic, sustainable fashion and reducing meat and dairy were the topics of least interest.

As also shown in Figure 13.1, females were more interested in climate change, biodiversity loss, sustainable fashion and diet, while males were more interested in low-impact transport.

Students living in rural areas were especially likely to be interested in biodiversity (38% compared with 29% who live in urban areas) while those living in London were more interested than average in air pollution (27% compared with 22% overall).

Having an interest in science (years 7–9) and having many family STEM connections (all school years) were associated with raised interest in nearly all these topics.

Figure 13.1: Level of interest in topics related to the environment among year 7–13 students by gender (2023)



Which if any of these topics related to the environment are you most interested in? You can choose up to three answers (Environint)
Bases (2023): All year 7–13s (5,130)

13.3 Perceived interest in issues related to climate change

The findings presented in Figure 13.1 show that 42% of young people in years 7 to 13 were interested in climate change when asked to pick their top three topics of interest from among a range of environmental sustainability topics.

To gauge a measure of overall interest in climate change, young people in years 7–13 were also asked directly how interested they were in issues related to climate change. Overall, 64% expressed some level of interest, with 14% very interested and 50% fairly interested (Figure 13.2). Only 8% of young people expressed no interest at all in climate change. There was demographic variation in the percentage who said that they were either 'very' or 'fairly' interested in climate change, as follows:

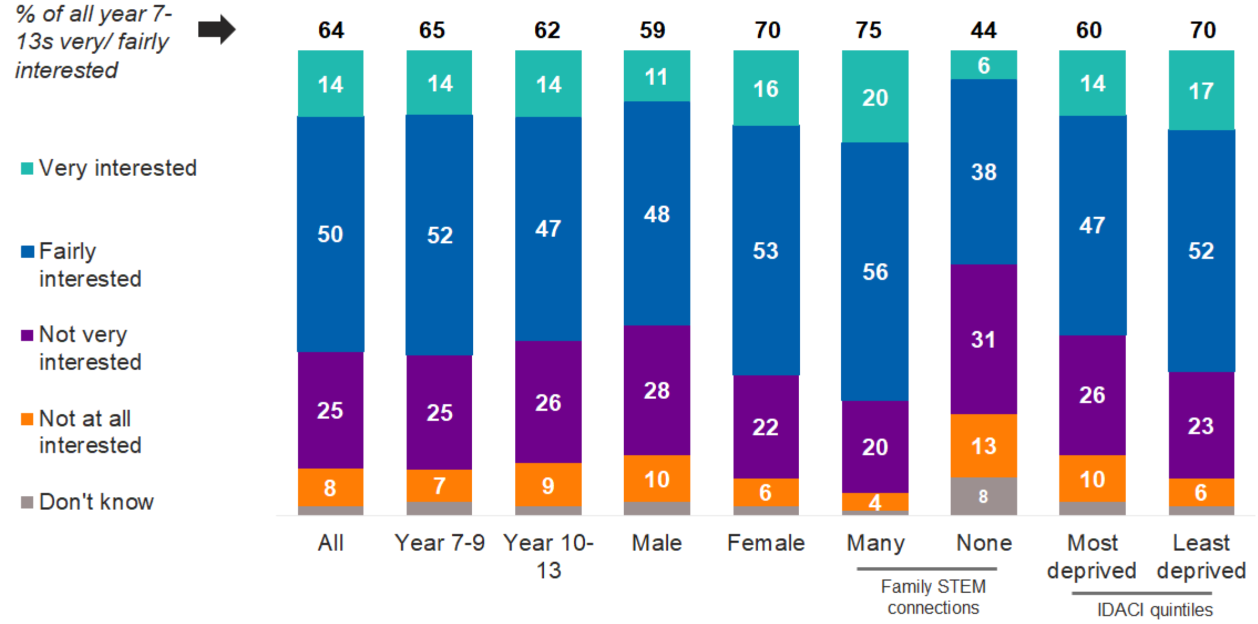
- Female students were more interested than males (70% compared with 59%).
- Interest was highest in London (70%) compared with other regions.
- Students with many family science connections were more interested than those with no such connections (75% compared with 44%).
- Interest was also higher in more affluent areas as measured by IDACI quintiles: 70% in the least deprived areas were interested compared with 60% in the most deprived areas.

In addition, interest in climate change issues was linked to interest in school science more generally. Students who were interested in school science (years 7–9) were more interested in climate change issues than those who were not interested in school science (71% vs 52%). A similar pattern was found in relation to older students interested in each of biology, chemistry and physics.

Younger year groups were most interested, with 67% of those in year 7 interested compared to between 60% and 64% of those in years 10–13 (Figure 13.2). However, this decrease in interest was associated only with male students. The percentage of female students interested in climate change remained stable at around seven in ten across all school years.

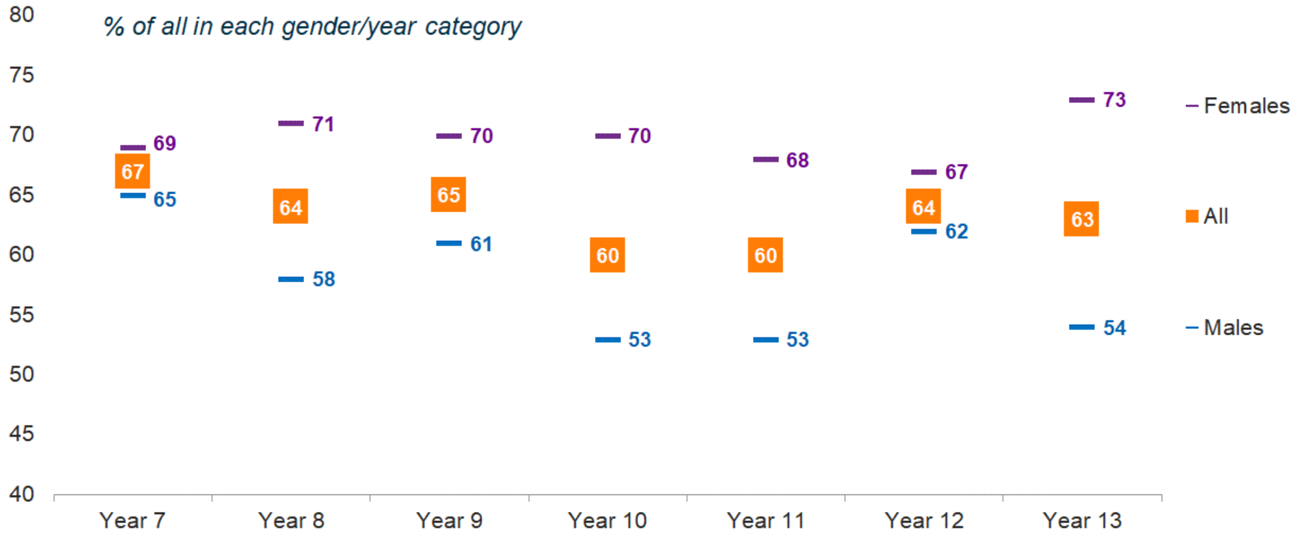
The gender divide changes by school year (Figure 13.3). Females were only slightly more interested in climate change issues in Year 7 (69% compared with 65%) but this gender gap widens over time between year 8 and year 11, contracts again in year 12, and then widens further in year 13.

Figure 13.2: Level of interest in issues related to climate change among year 7–13 students by school year, gender, family STEM connections and IDACI quintiles (2023)



How interested are you in issues related to climate change? (ClimintA)
Bases (2023): All year 7 – 13s (5,131);, All year 7–9s (3,077); All year 10–13s (2,054); Male (2,468); Female (2,505;, family STEM connection :many/none (1,411/633); IDACI quintiles most deprived (1203); least deprived (947)

Figure 13.3: Level of interest in issues related to climate change among year 7–13 students by school year and gender (2023)



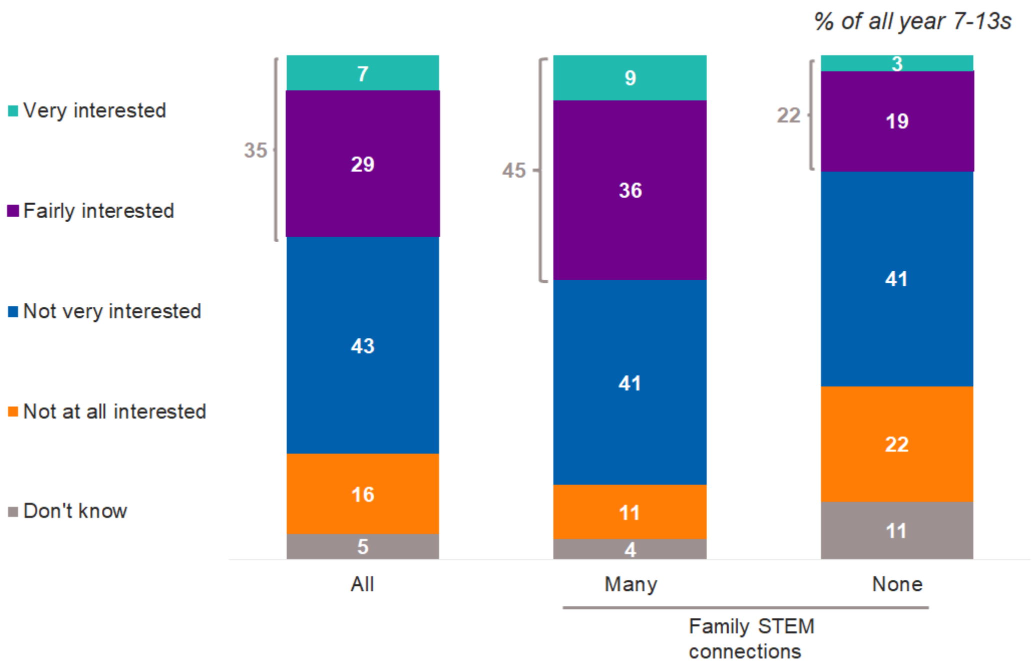
How interested are you in issues related to climate change? (ClimintA)
Bases (2023): year 7 males (494); year 7 females (475); year 8 males (536); year 8 females (470); year 9 males (505); year 9 females (521); year 10 males (239); year 10 females (261); year 11 males (251); year 11 females (266); year 12 males (220); year 12 females (267); year 13 males (223); year 13 females (245)

13.4 Interest in future job or career that will help reduce the impact of climate change

Whilst two–thirds of young people in years 7–13 expressed an interest in climate change, only one in three (35%) stated an interest in a future job or career that will help reduce the impact of climate change, with 7% very interested in this. Young people with many family STEM connections were the most likely to consider a future career related to climate change (Figure 13.4).

Among young people interested in climate change in general, the rate of interest in a career to help tackle this was much higher than average (49%). Interest in a future career in climate change was also associated with interest in a career in engineering: 42% of those interested in an engineering career were also interested in a career that helps address climate change, compared with 30% of those not interested in an engineering career.

Figure 13.4: Level of interest among year 7–13 students in a future job or career that will help reduce the impact of climate change by family STEM connections (2023)



How interested are you in a future job or career that will help reduce the impact of climate change? (ClimintB)
Bases (2023): All year 7 – 13s (5,131); family STEM connection: many/none (1,411/633)

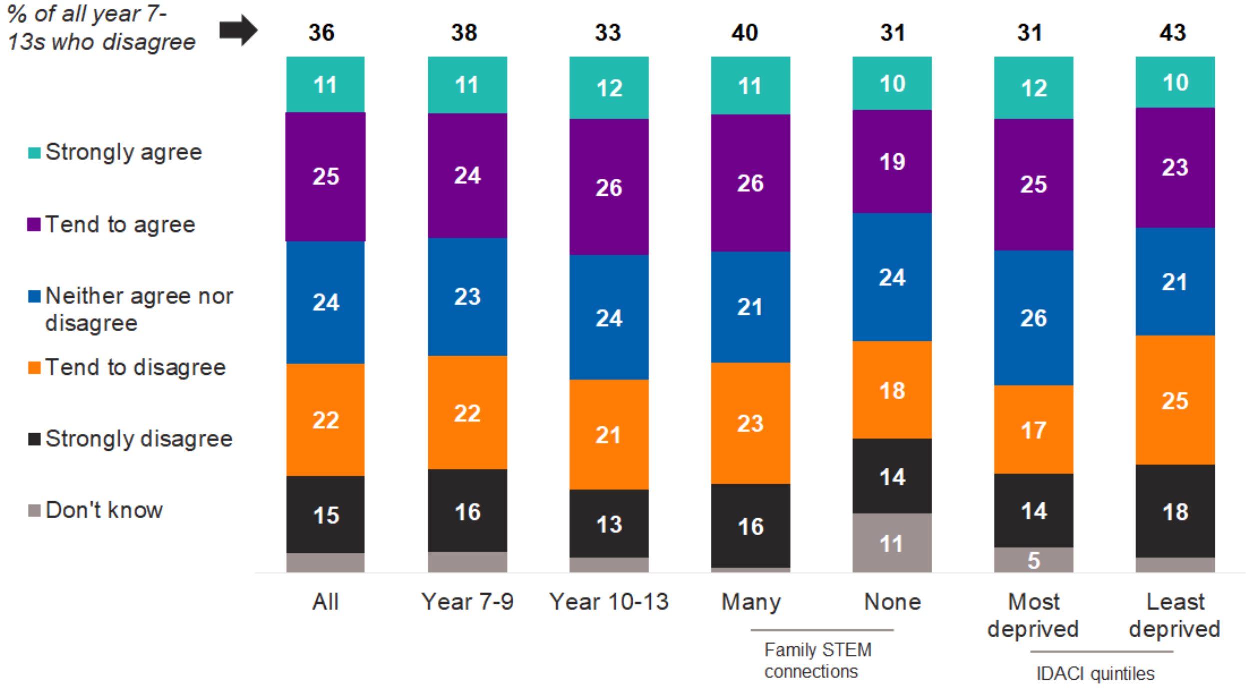
13.5 Opinions on whether actions have an impact on climate change

Young people in years 7–13 were asked how much they agreed or disagreed with the statement "It's pointless doing things to help reduce the impacts of climate change unless others do the same". Disagreement with the statement indicated that young people saw a value in taking personal responsibility to help mitigate the effects of climate change, regardless of whether others do the same.

Overall, opinion was divided evenly between those who agree (36%) and disagree (36%) with the statement, with a quarter giving a more neutral response (Figure 13.5). The percentage who *disagreed* with the statement, as also shown in Figure 13.5, varied by type of area with this opinion being more prevalent among students who had many family STEM connections (40% compared with 31% of those with no family science connections) and those living in the least deprived areas (43% vs 31% in the most deprived areas).

Of all ethnic groups, white (37%) and mixed ethnicity (41%) students were most likely to feel that taking actions to help tackle climate change has value, compared with 30% of Asian students. Students who were interested in climate change were more likely to consider that there is value in taking actions to help tackle climate change (42% compared with 27% who are not interested). Of all the year groups, students in years 7 and 8 were the most likely to feel that taking personal responsibility to help tackle climate change is not futile (41% and 40%, respectively).

Figure 13.5: Opinions on whether 'It's pointless doing things to help reduce the impacts of climate change unless others do the same' among year 7–13 students by school year, gender, family STEM connections and IDACI quintiles (2023)



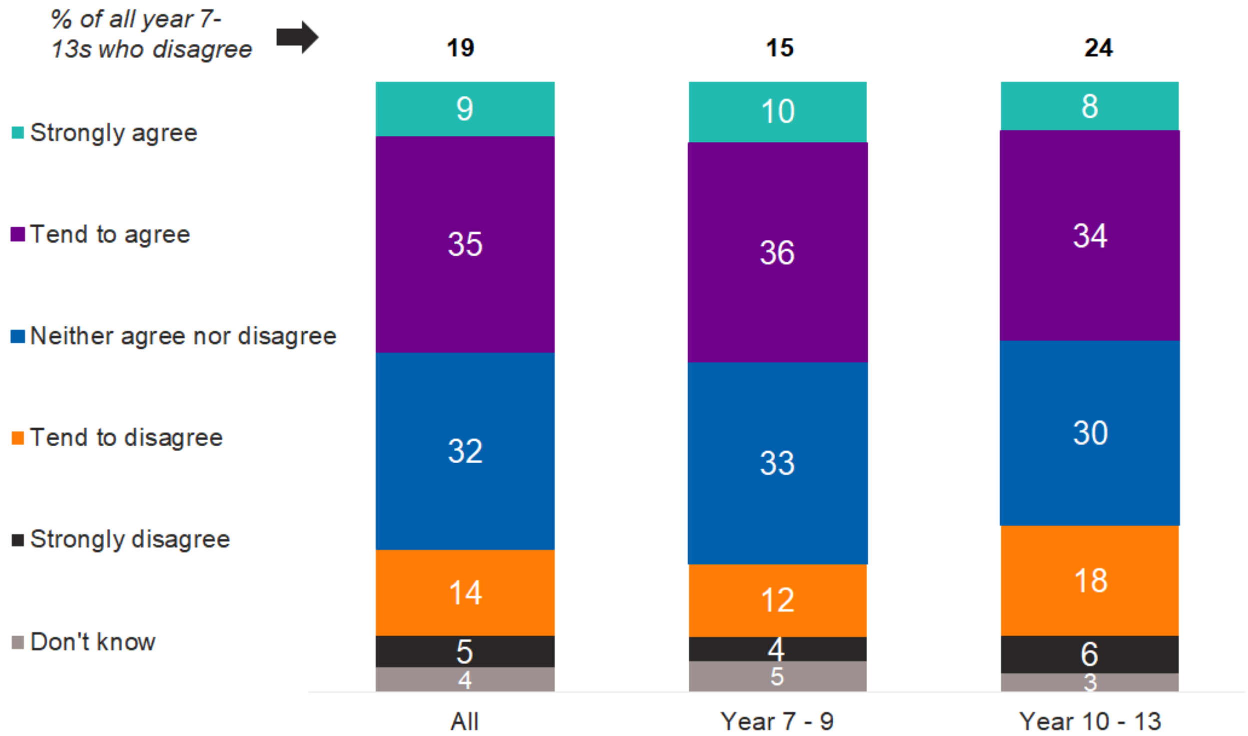
How much do you agree or disagree with the following statements? – It's pointless doing things to help reduce the impacts of climate change unless others do the same (ClimattA)
Bases (2023): All year 7 – 13s (5,131); All year 7–9s (3,077); All year 10–13s (2,054); Family STEM connection many/none (1,411/633); IDACI quintiles most deprived (1203); least deprived (947)

13.6 Opinions on reliability of information sources about climate change

Young people in years 7–13 were asked whether they agreed or disagreed that 'When it comes to climate change, it's difficult to know what to believe'. (Figure 13.6). Nearly half of young people agreed that information about climate change is confusing, with 45% thinking it was difficult to know what to believe, while 19% disagreed that it is difficult. Older year groups were least likely to find information about this confusing, with 24% of those in years 10–13 compared with 15% in years 7–9 disagreeing that it is hard to know what to believe.

Those who agreed that information about climate change may not always be reliable were far more likely to be sceptical about the effectiveness of taking personal action to help tackle climate change. Half (49%) of students who agreed that 'When it comes to climate change, it's difficult to know what to believe' also agreed that 'it's pointless doing things to help reduce the impacts of climate change unless others do the same', while the equivalent percentage among those who disagreed that information is confusing was 25%.

Figure 13.6: Opinions among young 7–13 students on whether 'When it comes to climate change, it is difficult to know what to believe' by school year (2023)



How much do you agree or disagree with the following statements? – When it comes to climate change, it is difficult to know what to believe (ClimattB)
Bases (2023): All year 7 – 13s (5,131);, All year 7–9s (3,077); All year 10–13s (2,054)

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Appendix B: Family Science and STEM connections indices

Figure B.1 and Figure B.2 provide details of the construction of the two family connection indices.

B.1 Family science connection index (FSCI_Science)

This index was constructed by scoring and combining responses to the three questions displayed in Figure B.1.

Figure B.1: The Family Science Connection Index (FSCI–Science): constituent questions and scores

1. Apart from your doctor, do you know anyone with a medical or science–related job that you could talk to about health, medicine or other scientific issues outside of school?

Prefer not to say (score 0); Don't know (score 0); No (score 0); One or two people (score 1); Three or four people (score 2); At least five people (score 2)

2. Do you think your parent(s) or guardian(s) are interested in science?

Prefer not to say (score 0); Don't know (score 0); Neither interested (score 0); One parent/guardian is interested (score 1); Both parents/guardians are interested (score 2*)*

3a. Does anyone in your family work in medicine?

3b. **Does anyone in your family work as a scientist?**

Prefer not to say [both questions] (score 0); Don't know [both questions] (score 0); No–one [both questions] (score 0); Siblings, Other family member in household, Other family member outside household, not parent/guardian [either question] (score 1); Parent/Guardian [either question] (score 2)

Scores across the above questions were then summed to create a scale with a minimum value of 0 and a maximum value of 6.

Respondents were classified into one of three groups based on their score:

Low FSCI–Science score – no science connections – score of 0 (24% of respondents);
Medium FSCI–Science score – score of 1–3 (58% of respondents);
High FSCI–Science score – many science connections – score of 4–6 (18% of respondents).

The highest possible score in the FSCI–Science index was given to those who knew at least three people in a science–related job that they could talk to; who said that both parents were interested in science; and where either parent worked in a science or medical field. The lowest possible score was given to those who knew no–one in a science–related job and where neither parent worked in science/medicine or were considered to have an interest in science.

B.2 Family science connection index (FSCI_STEM)

This index was constructed by scoring and combining responses to the three questions displayed in Figure B.2.

Figure B.2: The Family Science Connection Index for STEM (FSCI–STEM): constituent questions and scores

1. Apart from your doctor, do you know anyone with a medical or science–related job that you could talk to about health, medicine or other scientific issues outside of school?

Prefer not to say (score 0); Don't know (score 0); No (score 0); One or two people (score 1); Three or four people (score 2); At least five people (score 2)

2. Do you think your parent(s) or guardian(s) are interested in science?

Prefer not to say (score 0); Don't know (score 0); Neither interested (score 0); One parent/guardian is interested (score 1); Both parents/guardians are interested (score 2)

3a. Does anyone in your family work in medicine?

3b. Does anyone in your family work as a scientist?

3c. Does anyone in your family work as in engineering?

3d. Does anyone in your family work as in computing or technology?

Prefer not to say [all questions] (score 0); Don't know [all questions] (score 0); No–one [all questions] (score 0); Siblings, Other family member in household, Other family member outside household, not parent/guardian [any question] (score 1); Parent/Guardian [any question] (score 2)

As for the FSCI–STEM index, scores across the above questions were then summed to create a scale with a minimum value of 0 and a maximum value of 6.

Respondents were classified into one of three groups based on their score:

Low FSCI–STEM score – no STEM connections – score of 0 (14% of respondents);
Medium FSCI–STEM score – score of 1–3 (61% of respondents);
High FSCI–STEM score – many STEM connections – score of 4–6 (25% of respondents).

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