Evaluation of the Primary Science Campaign

A report for the Wellcome Trust

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Foreword

We're delighted to publish the latest in our series of 'State of the Nation' reports for primary science education. Our first report in 2017 formed the baseline for our campaign for primary science, aiming to see more and improved quality science being taught in UK primary schools. In 2017 science was low on the list of priorities in many UK primary schools: not enough pupils received sufficient science teaching to enable them to fully understand the curriculum, many teachers lacked confidence to teach science, and few of those responsible for leading science in schools had dedicated leadership time or access to continuing professional development (CPD).

This year our report shows that there is some timely positive change. In England 61% of science leaders now have dedicated release time and it's becoming a meaningful amount. The amount of science teaching time is increasing, and science is an important focus in many schools' development plans. But data for this report was mostly collected before schools closed due to the COVID19 pandemic.

Since the school closures, we've all become aware of science being discussed and debated publicly as decisions are made that affect us all. As we learn more about the virus and how it spreads, we can make better decisions. Science isn't a static recall of information but is dynamic, and we should make sure that our pupils have opportunities to learn how to think scientifically.

Pupils have returned to school to find that things have changed as we try to limit the spread of the virus. Now, more than ever, it's essential that children realise how science is helping us understand what is happening and how we can best keep each other safe. Let's make sure we build on this opportunity to equip young people for their futures by continuing to prioritise primary science teaching and learning as part of the rich curriculum that every child should experience.

Wellcome Trust, Primary Science Campaign

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Contents

Authors and acknowledgements

The authors of this report are Sarah Leonardi, Sophie Spong, Hayley Lamb, Sarah Tazzyman, Chris Milner and Michelle Hansel.

The wider CFE research team who supported the data collection and analysis are: Peter Howe and Nariah Francis.

We would also like to thank all of the staff from the schools who spared time to take part in the study.

EXECUTIVE SUMMARY

CFE Research, with support from the University of Manchester, has been commissioned by Wellcome to undertake monitoring and evaluation of its Primary Science Campaign. The campaign's vision is that all pupils will experience an exciting, inspiring and relevant science education at primary school that leaves them well-prepared to progress further in science, and well-informed about science in their everyday lives. A key part of the campaign is Explorify,[1] a free resource of engaging, creative science activities for all primary school teachers. Explorify launched in autumn 2017 following a pilot in spring of that year. It has been designed to stimulate curiosity, discussion and debate and is intended to support teachers to encourage children to think like scientists.

The research explores the nature of science delivery across the UK and evaluates the impact of the Primary Science Campaign, reporting annually from 2019 until 2021. In 2017, research was undertaken to examine how science is taught across the UK, including the number of hours it is taught for and attitudes towards science. It captured the baseline position from which the outcomes and impacts of the Primary Science Campaign will be determined, and that were reported in the *State of the Nation* report of UK primary science education.[2]

This report presents data captured from schools in **England** using Explorify in the 2019/2020 academic year to explore the outcomes and impacts of the campaign on science delivery and compares science delivery to similar schools not using the resource, which are referred to as comparator schools within this report.

Approach

The following methods were used to capture the views of Explorify and comparator schools:

— A survey of **853** Science Leaders[3] (definition described below), or other senior leaders, which explored their school's strategic direction of science, awareness of Explorify, and their experience of using it (where applicable). The sample frame of Explorify schools was created using Wellcome's usage data. A comparator sample was created to assess awareness of and barriers to using Explorify, and to make comparisons between delivery methods and time spent teaching science in Explorify and non-Explorify schools. Throughout this report, findings from this survey are reported as the **science leadership survey**.

— An online survey of **421** teachers disseminated through two methods: a) via respondents to the science leadership survey; and b) via a direct email to teachers who had signed up to Explorify and who were employed in a school that was represented in the science leadership survey. The survey asked respondents about how they teach science to classes they are responsible for and their experience of using Explorify (where applicable). Throughout this report, findings from this survey are reported as the **teaching survey**. For key questions relating to science teaching, the samples have been combined across both surveys to aid analysis and reporting.

— 32 semi-structured interviews with a range of school staff, including teachers and Science Leaders who have used Explorify. These interviews explored science teaching; how interviewees use Explorify; and how it impacts on them, their pupils and their school more widely.

Throughout the report all differences in the commentary are statistically significant.

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[1] https://explorify.wellcome.ac.uk/
[2] https://wellcome.ac.uk/sites/default/files/state-of-the-nation-report-of-uk-science-education.pdf
[3] Due to variation in the delivery of science across the UK, this study defines a Science Leader as an individual who is responsible for leading science development and teaching in schools either as an individual subject or cross-curricular topic area.

Key findings

Using Explorify

Explorify, being a **free** resource, is critical in encouraging individuals to sign up and use it. The website being **simple to use** and containing **high-quality images** encourages science leaders and teachers to want to use it. Science leaders highlight that due to the activities being concise, with accompanying teaching notes, this can encourage less-confident teachers to use it as the preparation is ‘done for them’.

Respondents continue to use Explorify in science lessons, other lessons and throughout the school day. On average, respondents use Explorify once a week, although this varies, and almost all plan to continue using it in the future.

Impact of using Explorify

Impact on pupils

Teachers who use Explorify regularly report a wide range of impacts on their pupils when using the resource:

	‘Strongly agree’	‘Agree’
Encouraged the whole class to engage in discussions	50%	45%
Pupils ask more questions	37%	49%
Pupils enjoy science lessons more	25%	51%

As reported last year, **increased levels of pupil discussion** is a repeatedly reported impact due to the visual nature of the resource. This enables **pupils of all abilities to contribute** to class discussions as it does not rely on strong literacy skills. The nature of the activities results in pupils having **less fear of being wrong** which also increases their engagement in discussions.

Teachers also report a range of lasting impacts on their pupils since using the resource:

	‘Strongly agree’	‘Agree’
Increased science vocabulary	18%	57%
Increased science knowledge	13%	67%
Increased confidence	11%	55%
Improved literacy skills	3%	27%

Alongside these impacts the development of pupils’ **oracy** was often described especially for younger pupils, those with low literacy levels and pupils with SEN.

Impact on teachers

Teachers who use Explorify regularly report a wide range of impacts on them and their teaching:

	'Strongly agree'	'Agree'
Encouraging pupils to take part in class discussions about science more frequently	47%	46%
Encouraging pupils to predict what will happen when they do a science investigation more frequently	20%	47%
Enjoy teaching science more	23%	57%
Increased confidence teaching science	12%	52%

Two-fifths (40%) of all teachers who use Explorify regularly state it has **increased the time they spend teaching science** with them being able to use spare time between or before lessons to use Explorify activities. One-third of interviewees state that although Explorify has not had an impact on the amount of science they teach, it has had **a positive impact on the quality of science they and others teach**.

> ***"The difference is, that two hours will be more useful and more meaningful."***

Science leadership in schools

Almost all schools have (98%) a science leader.

Science leaders

95%

of science leaders are classroom teachers.

57%

have **undertaken external Continuing Professional Development** to help them lead or develop science in the last year.

61% of science leaders get specific **release time** to lead science in their school, in addition to time to plan their own lessons. This is slightly **higher than reported in the baseline report**, with **52%** of science leaders in England receiving this. Science leaders in larger schools are more likely to receive release time alongside those who include science on their School Development Plan and where the school views science as important.

62% of schools report that science is **included in their School Development Plan** and 62% are also currently reviewing the way science is taught across the school.

Importance of science

Respondents to both surveys indicate **how important** they think certain subjects are to the Senior Leadership Team of their school which is unchanged since the baseline report:

- **88%** think **English** is '**very important**' and 7% 'important'
- **86%** think **maths** is '**very important**' and 8% 'important'

— **31%** think **science** is '**very important**' and 52% 'important'

A much higher proportion of (**67%**) of Headteachers/Acting Headteachers/Deputy Headteachers or Assistant Headteachers state that **science** is '**very important**' compared to **28% in all other roles**.

Support for teachers to deliver science

Teachers identify **what support their school has given them** to improve their science teaching in the last 12 months. Teachers most frequently report the following methods:

— The school providing **access to lesson plans and materials** (**58%**)

— **Science training** from their Science Leader (**50%**)

— **Coaching** or **mentoring** from their Science Leader (**46%**)

91% of teachers report they have **received** some form of **support** for **science teaching** from their school in the last 12 months. There are differences between groups:

— **98%** of teachers **from a school where Explorify is used received support** compared to **78%** of teachers in schools **who do not use Explorify**.

— In schools with a science leader, **96%** of teachers report receiving support in schools where the **science leader has received CPD in the last 12 months** compared to **86%** who had a **science leader who has not received CPD**.

— In schools with a science leader, **95%** of teachers whose **science leader receives release time** for their role receive support compared with **87%** of teachers from schools where their science leader **does not receive release time**.

— **99%** of teachers from schools that **hold or are applying for PSQM** compared to those who do not hold PSQM 89%.

Science delivery

92% of respondents to the science leadership survey report that in their school **classroom teachers deliver** most **science lessons**. **4%** of schools **have a dedicated science teacher** who takes science lessons whilst **4%** have a mix of the two.

Weekly science teaching

Science is taught weekly by most teachers who responded to the survey. **Standalone lessons** are more prevalent for older year groups. Younger pupils (especially Reception) are more likely to receive cross-curricular work (**65%** of weekly lessons are delivered through **cross-curricular work only** for Reception).

Where schools teach science weekly, on average, across both surveys, science is **taught weekly** for an **average of 1.4 hours** (1 hour and 24 minutes). Younger year groups receive fewer hours of weekly science lessons with the amount of science taught increasing for those in older year groups. Across year groups, **on average, 55% of classes are not receiving two hours of weekly science**.

Science teaching across the year

Science is taught across schools in a **wide variety of ways**. The majority of teachers teach some form of science weekly and over two-thirds combine this with other types of activity such as dedicated science weeks, science days and visits.

Across these methods, science is taught on average for **1.8** hours a week (1 hour and 48 minutes – as reported across both surveys). Younger year groups receive, on average, slightly fewer hours. Across primary school year groups including reception, on average, **50% of classes receive the equivalent of two hours of science per week**.

Only 56% of respondents think enough time is spent teaching science in their school and around half of all interviewees would like to teach more science but state it is not possible due to other subjects being prioritised.

Confidence teaching science

Teachers (excluding Science Leaders) indicated **how confident** they are teaching certain subjects:

— **51%** state '**very confident'** and 44% state 'confident' to **maths**

— **49%** state '**very confident'** and 46% state 'confident' to **English**

— **29%** state '**very confident'** and 60% state 'confident' to **science**

The characteristics that are associated with being confident when teaching science are:

— Enjoying teaching science

— Being a science leader in a school compared to non-science leaders

— Viewing science as important to the school

— Holding a science A Level or Advanced Higher qualification

Whilst the number of Explorify activities a respondent has undertaken with their classes does not influence their confidence in teaching science, 'enjoying teaching science' does and taking part in Explorify increases teachers' enjoyment of teaching science.

1. Introduction and methodology

This section introduces the aims and objectives of the study, summarises the research methods implemented and provides contextual information on science teaching throughout the UK.

1.1 Aims and objectives of the overall evaluation

CFE Research, with the University of Manchester, has been commissioned by Wellcome to undertake monitoring and evaluation of its Primary Science Campaign. The campaign's vision is that all pupils will experience an exciting, inspiring and relevant science education at primary school that leaves them well prepared to progress further in science, and well informed about science in their everyday lives. A key part of the campaign is Explorify,[4] a free resource of engaging, creative science activities for all primary school teachers. Explorify launched in autumn 2017 following a pilot in spring of that year. It was designed to stimulate curiosity, discussion and debate and is intended to support teachers to encourage children to think like scientists.

The research explores the nature of science delivery across the UK and evaluates the impact of the campaign, reporting annually from 2019 until 2021. Specifically, our research activity focusses on three over-arching objectives:

- monitoring awareness and the geographical reach of the campaign across UK schools, to examine the national picture at each time point;
- measuring the impact of the campaign on the profile, quality and quantity of science teaching in primary schools, in particular the average number of hours taught per week by classroom teachers on either a discrete or cross-curricular basis; and
- examining how the campaign is bringing about changes within schools and the nature of the impacts on subject leaders, classroom teachers, pupils and schools as a whole.

1.2 About this study

In 2017, research was undertaken by CFE, with support from The University of Manchester, to examine how science is taught across the UK, including the number of hours it is taught for and attitudes towards science. It captured the baseline position from which the outcomes and impacts of the Primary Science Campaign will be determined, and that were reported in the *State of the Nation* report of UK primary science education.[5]

This report presents data captured from schools in **England** using Explorify in the 2019/2020 academic year to explore the outcomes and impacts of the campaign on science delivery and compares science delivery to similar schools not using the resource.

Approach

The data presented in this report was captured via three methods, described below.

[4] https://explorify.wellcome.ac.uk/
[5] https://wellcome.ac.uk/sites/default/files/state-of-the-nation-report-of-uk-science-education.pdf

Science leadership survey

A survey of **853** Science Leaders[6] drawn from both Explorify and comparator schools in England was undertaken and explored a series of questions about the strategic direction of science, awareness of Explorify, and their experience of using it (where applicable). To maximise the number of responses, the survey was undertaken via online and telephone methods. Throughout this report, this survey is referred to as the **science leadership survey**.

The sample frame of Explorify schools was created using Wellcome's Explorify usage data[7], which was analysed to create a sample of schools with one or more teachers who were 'engaged viewers' or 'super engaged viewers'. 'Engaged viewers' were teachers who have looked at more than nine activities and visited the site at least two months after signing up; 'super engaged viewers' were teachers who have looked at more than nine activities and visited the site at least a year after signing up[8]. Those who took part in the science leadership survey in 2019 were removed from the sample to reduce research burden. In total, 3,390 schools met these criteria and schools were then randomly selected to take part, focussing initially on those with the most reported usage. This study has not examined the views of those who have signed up to Explorify but have not yet used it.

A comparator sample was created to assess awareness of, and barriers to, using Explorify and to make comparisons between delivery methods and the time spent teaching science in Explorify and non-Explorify schools. The comparator school sample was compiled using data from 'Get Information about Schools', which lists all schools in England. Schools with one or more teachers who had signed up to Explorify were removed to ensure the study obtained views from schools not using Explorify. A sub-sample was then identified via a random stratified sample to ensure it was representative with regard to key characteristics[9]. The survey was undertaken between October 2019 and January 2020.

The overall sample initially comprised 448 Explorify schools and 405 comparator schools using the original definition devised. However, a small proportion needed to be reclassified at the point of analysis due to differences in Explorify usage reported in the surveys. For example, comparator schools reporting they used Explorify and Explorify schools reporting that they were not aware of, and did not use, Explorify. This resulted in 509 Explorify schools, 322 comparator schools and 22 whose status was inconclusive.

Teaching survey

An online survey of **421** teachers drawn from both Explorify schools and the comparator schools was disseminated through two methods: a) via respondents to the science leadership survey; and b) via a direct email to teachers who had signed up to Explorify and who were employed in a school that was represented in the science leadership survey. The key characteristics of those responding to this survey are outlined in Appendix 1.

In total, responses were received from teachers at 204 schools. The surveys were completed between February 2020 and June 2020. The survey was launched only a few weeks before schools were closed to most pupils as a result of COVID-19. To avoid any unnecessary burden on schools, reminder emails that were scheduled were not sent. The fieldwork was paused until mid-April, when only those teachers we had direct email addresses for were asked to respond to the survey, with limited chasing. The survey was amended to ask teachers to reflect on how they taught science prior to COVID-19, although this could have introduced some bias into the research. The total number of responses to the survey is also lower than in previous years.

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[6] Or other senior leaders where there was no Science Leader in the school or they were unavailable at the time of interview.
[7] Wellcome Explorify usage data provides information about the level of engagement for each individual teacher who has signed up to Explorify.
[8] Explorify was launched in September 2017.
[9] School characteristics were school type and school size.

A minority of respondents indicated that they were science leaders (n=29) in this survey; the views of these individuals are excluded from questions where their role could bias the teacher-only findings. The survey asked respondents about how they teach science within their school and their views of science. Throughout this report, this survey is referred to as the **teaching survey**.

Qualitative interviews

Qualitative research with a cross-section of Explorify schools was undertaken to further explore and provide contextual information about science teaching, how teachers use Explorify, and how it impacts them and their school. This research involved interviews with a variety of staff to elicit a range of perspectives, including:

- headteachers or senior leaders;
- science leaders or someone with responsibility for leading science in a school (including World Around Us coordinators); and
- teachers with responsibility for teaching science to their classes.

Schools were initially selected through the sample of science leaders and teachers who participated in the science leadership or teaching surveys. This enabled interview recruitment to be based on Explorify usage of both individuals and their school, and allowed for further exploration of survey responses. An alternative method was also used to increase school participation, including inviting teachers and headteachers to take part directly from Wellcome's Explorify usage data.

In total, 32 semi-structured interviews were undertaken with staff drawn from 31 schools during the Spring and Summer terms of 2020. Again, due to COVID-19, we suspended recruitment between March and April. The key characteristics of those responding are outlined and highlight a mix of different school roles. In one school, two interviews were undertaken.

Role	Number of interviews
Headteacher/senior leader	1
Science leader	23
Classroom teacher	8

1.3 About the report

This report presents the findings from the two surveys. Differences in the findings by school and respondent characteristics are explored. The samples have been combined to aid analysis and reporting of key questions relating to science teaching across both surveys.

All differences have been tested for statistical significance and only those that are statistically significant at the 5% level are reported in the commentary of the report.[10] Multivariate analysis was also undertaken, with information about the nature of the tests performed provided in footnotes.

Interviews produce a significant volume of qualitative data. For this study, a coding frame was applied to transcripts and was cross-checked for consistency using *NVivo* text analysis software. This led to the generation of a series of themes on which to build an understanding of the overarching and interlocking issues. Sample attributes were assigned to transcripts based on school and individual-level characteristics of interviewees to interrogate differences by sub-group. Due to the semi-structured nature of the interviews, no inferences can be drawn about the scale or frequency of particular attitudes or opinions. For this reason we do not quantify the number of responses to a particular theme. To aid the reader, we provide an assessment

[10] Please note that some graphs contain statistically insignificant findings. Please refer to the text for statistically significant differences.

as to the proportion of interviewees who commented under a given theme. However, please note that other interviewees may also hold this opinion or undertake these activities but did not describe this during the interview. Throughout the report, findings from interviews are presented alongside survey findings.

Following this introduction, the report is structured in four main chapters: **Chapter 2** looks at awareness and use of Explorify, while **Chapter 3** examines the impact that Explorify has on teachers and pupils. **Chapter 4** explores the leadership and delivery of science in respondents' schools and **Chapter 5** summarises the key conclusions emerging.

2. Awareness and use of Explorify

This section explores how Explorify is used within schools, how regularly it is used and any barriers to using it.

Explorify is a free online resource created by Wellcome. It includes engaging, creative science activities that were designed to spark curiosity, discussion and debate. It includes various types of activities which include images, videos and hands-on activities designed to prompt discussion and investigation. There are a wide range of curriculum-linked, ‘low-prep’ activities, the majority of which could be completed in 15 minutes or less, and others that last longer.

2.1 Awareness and use of Explorify

Across all respondents to the science leadership and teaching surveys, 69% are aware of the Explorify resource (this is partially a result of purposively selecting schools and individuals who are currently using Explorify). Most respondents (96%) from Explorify schools (where one or more teacher uses Explorify) are aware of the Explorify resource[11], compared with 19% from comparator schools.

Over three-quarters (77%) of those who are aware of Explorify have undertaken activities with pupils in their school. Only 9% have not used Explorify and the remaining 14% have not undertaken activities with pupils in their *current* school but have previously used it. On average 7 teachers (including the science leader where applicable) use Explorify in each school that is using the resource.

Science leaders continue to find out about Explorify through attending science Continuing Professional Development (CPD) or conferences with examples such as science network leader meetings or courses provided by STEM Learning. Explorify is often a resource which is suggested alongside other resources by CPD providers. A few science leaders describe how Explorify was demonstrated to them to allow them to see how it worked.

> ***“The person that was running the course was going through a number of [resources], [Explorify] is one of them, and she demonstrated how you could use it, how useful it was and just navigated it a little bit, just to show people how you could use it in your classroom.”***
>
> **Science leader**

Around half of the science leaders interviewed describe how they then demonstrate the resource to colleagues during meetings to ensure they know how the website works and understand the breadth of resources available. Science leaders also introduce staff to Explorify via email, in addition to talking about it during staff meetings. Almost all teachers interviewed without science leadership responsibilities found out about Explorify through a colleague, usually their science leader.

Initial motivations

Explorify, being a free resource, is critical in encouraging individuals to sign up and use it, especially when so many other science resources require a regular subscription or one-off fee. Once users visit the website or see it through demonstrations, the fact that it is simple to use and has high-quality images encourages

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[11] Not all teachers at a school use Explorify, and therefore may not be aware of the resource.

them to want to further explore the resource. The high-quality visual aspect of the website was mentioned by at least half of all interviewees as an influencing factor, with a couple describing how this also distinguishes it from other resources.

Once logged onto the website, the layout is described as important as it encourages teachers to keep using it, especially the filtering function which enables easy browsing through the large number of activities available on Explorify. This allows teachers to review content and understand how it can relate to their teaching and, ultimately, decide whether to use it or not.

Science leaders say that due to the activities being concise, with accompanying teaching notes, this can encourage less-confident teachers to use it as the preparation is ‘done for them’. Also, as described by one teacher, this reduces the time needed to prepare a science lesson, further encouraging them to use it:

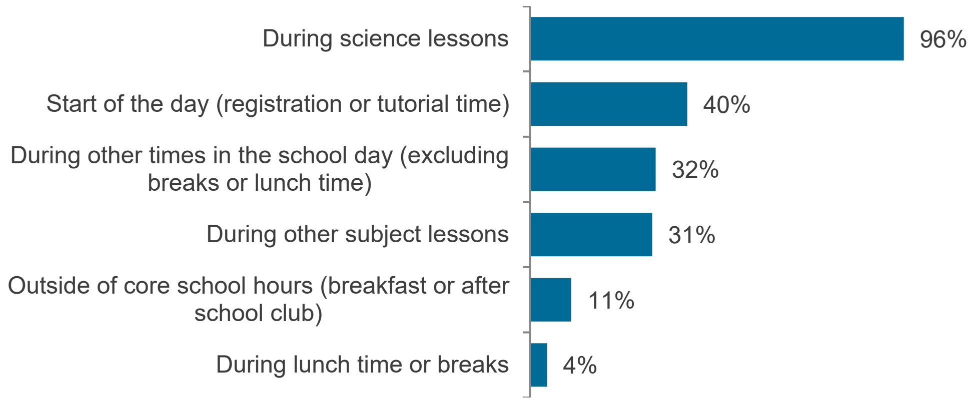
> ***“I think teachers can, and I know I've been the same, can be, not afraid of teaching science sometimes, but reluctant to do it. They see it as such a big thing, I've got to get this [equipment] out and I've got to do this, and I've got to do that and it becomes quite a big task, whereas I think Explorify removes that barrier.”***
>
> **Teacher**

2.2 How Explorify is used

The majority of respondents (96%) who use Explorify use the resource during science lessons (Figure 1). In addition, one-third (31%) also use it during other subject lessons. Two-fifths (40%) use Explorify at the start of the day prior to lessons commencing, while just under one-third (32%) use Explorify at other times during the day (excluding breaks and lunchtime).

The majority (86%) of respondents to both surveys *only* use Explorify with pupils in their classroom (during lessons, registration or tutorials). Less than 1% use it *only* during lunchtimes or breaks and outside core hours. The remaining 14% use a blended approach, using Explorify during the day in the classroom and during lunchtime, breaks, or outside of school core hours.

Figure 1: When Explorify is used as reported in the science leadership and teaching surveys. Base=570–651.



The majority of interviewees describe how they use Explorify at the start of a science lesson to introduce a new concept or subject area. This allows pupils to start to explore a topic before the ‘main’ lesson begins. While it is useful to introduce a new topic, half of all interviewees use Explorify at the start of lessons to stimulate discussion and collaboration not only for science but during other lessons such as English, maths and PE.

> ***“It doesn't even have to be part of the science lesson or even fit with the topic. You can literally pick anything that will engage them and you've got a discussion going”***
>
> **Science Leader**

Whilst most teachers plan when they will use Explorify, it is a useful resource to 'fill time' when lessons finish earlier than planned. It is also used at the end of lessons before another begins to ensure they have the correct mind-set.

> ***"Sometimes, [pupils] might have had to have done an RE lesson or something then they have to switch to science and it's like, how do we get their minds ready to learn?"***
>
> **Science leader**

Teachers describe how they use the resource at other times, such as during assemblies or during extra-curricular clubs. Due to its suitability across age groups, a couple of teachers described how they used the resource during the COVID-19 pandemic, where they had key worker children in small classes with mixed age groups.

Regularity of use

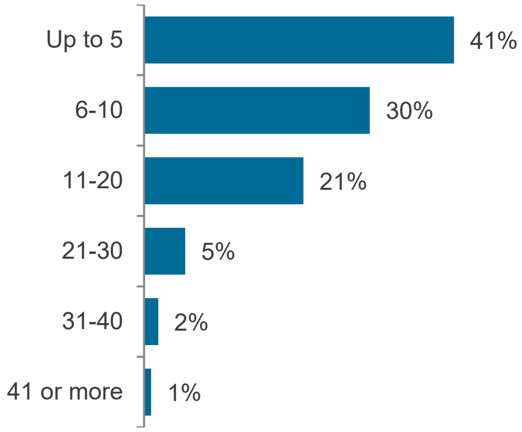
Survey respondents most commonly report using Explorify on a weekly or two-weekly basis (Table 1) across all year groups. On average, respondents report that they use Explorify activities approximately once a week over the course of an academic year (based on calculating a weekly equivalent figure which equates to 0.8), with only small differences between year groups.

Table 1: Regularity of Explorify use as reported in the science leadership and teaching surveys.

How regularly Explorify activities are used with classes taught	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Across all years
Base	***58***	***108***	***135***	***134***	***146***	***135***	***146***	***862***
I haven't used it yet	5%	0%	1%	1%	0%	2%	1%	1%
I do not use Explorify regularly	9%	5%	4%	10%	7%	10%	8%	7%
Approximately every week	28%	44%	29%	24%	19%	21%	19%	26%
Approximately every two weeks	21%	24%	28%	32%	31%	30%	25%	28%
Approximately every month	21%	16%	23%	16%	27%	22%	23%	21%
Approximately every half term	14%	9%	12%	12%	13%	14%	16%	13%
Approximately every term	2%	1%	2%	4%	3%	1%	5%	3%
Other	2%	1%	1%	1%	1%	0%	2%	1%
Mean activities per week	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.8

On average, respondents had used Explorify activities 10 times with each class they teach at the time of completing the survey. Over two-thirds (71%) of respondents have completed up to 10 activities with each class they teach, a fifth (21%) have completed between 11 and 20, and just under a tenth (8%) have completed 21 or more activities (Figure 2).

Figure 2: Breakdown of the average number of Explorify activities each respondent has completed per class. Base=423.



Almost all respondents (99%) using Explorify in their current school plan to continue using its activities with their pupils.

2.3 Views of Explorify

Website

The website is not only important in encouraging teachers to initially use Explorify but also to maintain engagement with the resource. As it is quick and easy to navigate, the website is easy to search, filter and save activities to undertake with classes. The updates to the search and save functions have made it easier for teachers to use.

> ***"Now that the filtering system on the website is much better, it's a lot easier for staff to find the resources and then save them on their dashboard as well. It's much simpler."***
>
> **Science leader**

Most interviewees comment on the accessible layout of the website and like the visual content, particularly the 'fantastic' images and videos. The clear organisation of the activities by topic, subject and year groups is viewed as essential by science leaders.

Due to Explorify being web-based, around one-quarter of interviewees have experienced difficulties when they have wanted to use it either due to outdated/no equipment or an unreliable internet connection. However, this is not always a problem and has not prevented them from continuing to use it.

Content

Explorify has regular updates to ensure its content remains fresh and relevant to users. This is cited by around half of interviewees as being important to avoid repetition for pupils and provide the opportunity for progression in pupils' learning. Almost all interviewees describe how Explorify has a wealth of visually appealing activities and are keen to see more added.

In almost all cases, interviewees felt that the content of the website was accessible and clearly linked to year groups. Two interviewees said that clearer links to the national curriculum could be made within Explorify, which would help newly qualified teachers, especially as workload continues to be a challenge in schools.

"I think if [activities] were explicitly linked to what the national curriculum program study brings then teachers would feel much more confident".

Teacher

One science leader did, however, describe how links to the national curriculum were clearer since the recent website update and, in any case, a direct link to the national curriculum is not always viewed as critical by others, as the resource can be used to encourage discussion and generate scientific inquiry among pupils. Whilst Explorify is designed for Key Stage 1 and 2 pupils, one teacher requested activities appropriate for early years' pupils to be included in the content.

A few science leaders said more activities focussed on technical and scientific language would be beneficial, especially to help the development of those with English as a second language. The terms used in science are akin to learning a new language and content that supports this would be welcomed.

"I always find that I have to do lots of intervention groups in the summer terms, because we're getting to the end of the year and they work scientifically brilliantly, they share ideas and all of these things. But the thing they do not have is the technical side of the language"

Science leader

Interviewees most frequently use Odd One Out, Zoom In, Zoom Out and the 'What's Going On' video clips. These can all be used to quickly engage pupils when there is only a small amount of time and encourage class discussion. When interviewees discussed the content on the website, they primarily referred to the Explorify activities, with only a few using the additional resources such as the blogs, downloads or newsletters. Those who read them do so to get ideas for lessons or activities and to keep up to date with courses they can attend. At least half of interviewees are not aware that Explorify provide these alongside other content and highlight they would have used them had they been aware.

"I'm sitting here with it in front of me and I've seen the blog button for the first time ever... I've never actually noticed it... As soon as you're gone, I shall have a play."

Science leader

A few interviewees report they do not receive emails containing the newsletters. Around a quarter of interviewees are aware of the blogs, downloads and newsletters, but did not have the time to look at these in detail.

2.4 Recommending Explorify

Nearly three-quarters (71%) of respondents to the science leadership survey who were aware of Explorify formally advocate its use by teachers in their school, with a further 17% stating they do so 'to some extent'. There are a number of factors that influence whether respondents formally advocate its use:

— Explorify users are more likely to advocate its use than non-users (81% compared with 30%);

— respondents who have undertaken CPD in the last 12 months are more likely to advocate it than those who had not (75% compared with 64%); and

— respondents from a school that holds or is applying for PSQM are more likely to advocate it than those who do not hold a Primary Science Quality Mark (PSQM) award (82% compared with 67%).

The majority of respondents (92%) who advocate the use of Explorify have done so to 'all' colleagues at their school. The remaining 8% advocate it to selected groups and/or individuals (e.g. certain year groups, new teachers to the school, line reports).

Of the 69 respondents to the science leadership survey who have not advocated its use, just over one-quarter (28%) have recommended it to their colleagues more informally. Therefore, in total, 91% of respondents who are aware of Explorify either advocate or recommend it to their colleagues.

Two-thirds (66%) of respondents to the teaching survey who are aware of Explorify have recommended it to their colleagues and have done so to an average of 4.5 colleagues. Under half (43%) of those who have not recommended it to their colleagues yet are 'likely' to do so in the future and just over one-quarter (26%) are 'very likely'.

All science leaders interviewed have repeatedly recommended Explorify to their colleagues within their school and to colleagues in other schools when they are part of a trust or academy. A few describe how they set 'expectations' in their school for it to be used during science lessons and actively monitor this through learning walks or sign-in sheets.

A few science leaders describe it as particularly useful for teachers who may not be specialists in science or who lack confidence in teaching science, describing it as inclusive and easy to navigate and, therefore, recommend its use.

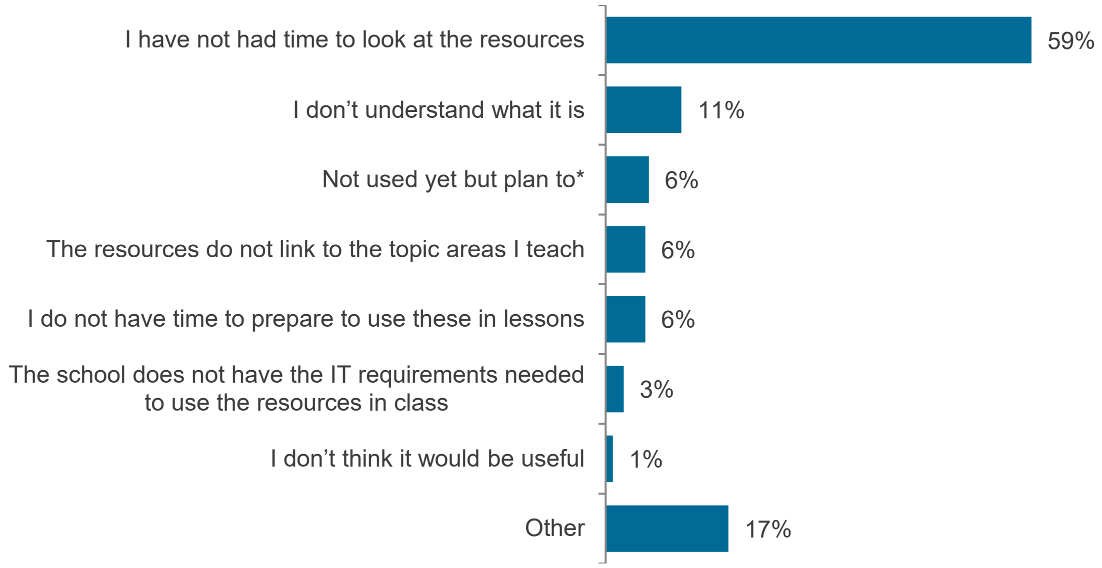
> ***"I think the chunks of background information for the teachers are the perfect size, you know, they're not too onerous."***
>
> **Science leader**

All teachers who were interviewed have also recommended Explorify to their colleagues. This is either through suggesting its use as part of science lesson plans, through staff and CPD meetings or informal discussions.

2.5 Barriers to using Explorify

A lack of time is the primary reason given by over half (59%) of all respondents to the survey who were aware of the resource in describing why they had not yet used it with pupils in their school. Other reasons varied, with just over one in ten (11%) reporting a lack of familiarity with the resource, 6% who plan to use it in the future and 6% who state the resource does not link to the topic areas. A further 17% of respondents state an 'other' reason, which may include: them teaching early years; the school uses a different resource; or someone else plans lessons for them. Very few respondents state they do not think it will be useful.

Figure 3: Reasons for why Explorify not used with pupils in the school as reported in the science leadership and teaching surveys. Base=199. Those with a * were back coded from 'other', therefore were not asked to all respondents.



Although interviews were undertaken with those who use Explorify, around one-fifth highlight that a lack of time means they have not fully explored the content and, as a consequence, perceive they may not be maximising its benefits. A few science leaders also acknowledge that some staff are not using Explorify as regularly as they would like, again due to workload pressures. A few interviewees say there is too much content, which prevents them from using it because it takes time to find the activities they want. However, as described earlier in the chapter, having a wealth of activities is critical to its continued use for most.

One teacher explained that Explorify use had reduced during school closures due to COVID-19, but had used the time to plan and prepare which activities from Explorify they will use when back in September.

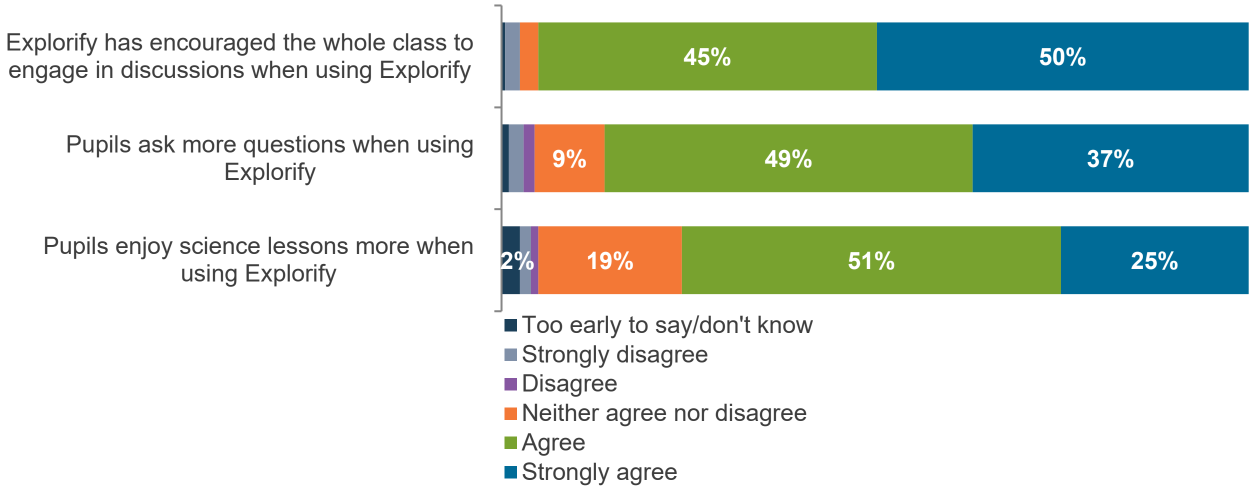
3. The impact of Explorify

This section explores the self-reported impact Explorify is having on pupils, teachers and the school.

3.1 Impact on pupils when using Explorify

Almost all (95%) respondents to both the teaching and leadership surveys who had completed nine or more Explorify activities with their pupils ‘agree’ or ‘strongly agree’ that using Explorify has encouraged the whole class to engage in discussions. Over four-fifths (86%) report that pupils ask more questions when using the resource and just over three-quarters (76%) say that their pupils enjoy science lessons more when using Explorify.

Figure 4: Extent of agreement about impact of Explorify on pupils as reported in the science leadership and teaching surveys. Base=203.



All survey respondents were asked to outline any additional impacts on their pupils. Encouragingly, respondents believe that Explorify has had a positive impact on pupils, even when not used frequently, with only 1% suggesting that Explorify had had no impact and only 1% stating it was too early to make a judgement. Overall, the positive impact was frequently attributed to the format of Explorify, the quality of the materials and their ability to ‘spark’ discussions. Just over two-fifths of respondents (44%) report Explorify increases discussions between pupils and increases engagement in science lessons: *“Pupils are engaged and curious, offering lots of ideas and predictions.”* Several teachers also articulated that discussions were now more ‘in-depth’ more ‘coherent’, more ‘scientific’.

Under one third (31%) of respondents also identified that pupils were enjoying science lessons or science more broadly. One-in-ten respondents (10%) stated that the activities had raised pupil confidence. The format of ‘Odd One Out’ and ‘Zoom In, Zoom Out’ in particular allow less-confident children to share their ideas without worrying about being right. There were further examples also where Explorify was seen to be inclusive, having raised the confidence of Special Educational Needs (SEN) pupils as well.

> ***“SEN children and disadvantaged children can take part in the conversation and explain their ideas because it's visual”***
>
> **Science leader survey respondent**

These were all key themes highlighted throughout the interviews as described in the sections below.

Engaging in group discussions

Reflecting the survey findings, almost all interviewees describe how Explorify has led to increased pupil engagement in class discussions. The nature of Explorify activities ensures pupils of all abilities are able to take part in class discussions. One interviewee describes how their pupils' excitement and curiosity for Explorify activities motivates them to contribute to discussions:

> ***"They're often quite excited. They want to contribute, and I'd say that's pretty much across the board, all personalities and all levels of ability want to contribute to a discussion. They see things that they recognise or things that get their curiosity or, there's enough in there that is both familiar and new and exciting that most pupils can contribute and want to contribute"***
>
> **Science leader**

The visual nature of Explorify ensures that is an inclusive resource which does not rely on strong literacy skills and encourages children to contribute to discussions, when usually they may not. This focus ensures those from a disadvantaged background, or those with weaker literacy skills, can take part as it does not require them to 'write'. This also enables less-confident pupils to engage in lessons better.

> ***"[we have] 35% pupil premium rate in our school. So our school is in quite a deprived area. Most of the children haven't really been out of the area that they live in. And it just gets them talking. So they haven't got to write or record, it's just a discussion."***
>
> **Science leader**

Just over one-third of interviewees believe that the interactive and visual aspects of Explorify ensures SEN pupils can engage in discussions as it is not reliant on literacy skills. It also supports the development of their language skills and, as a consequence, interactions in class discussions are more meaningful.

Less fear of being wrong

A key factor in encouraging pupils to engage in class discussions is less fear of being wrong. Many of the commonly used Explorify activities do not have a 'right' answer and are designed to spark curiosity and questioning. Most interviewees agree that activities support pupils to explore a range of possible solutions, reinforcing the fact that there is not always a right or wrong answer. Key to this is the premise that pupils should be able to provide a reason for their answer, but equally important is that these assumptions can be challenged by others. Once pupils understand this and have experience of taking part in activities, their engagement in discussions increase.

> ***"When we first started using it, the children were very keen to find the right answer. It felt like they were a bit more reticent to speak because they didn't want to be wrong. Whereas now some of the answers they're throwing in there, they're really just a bit wild and then you say, 'Well, have you got evidence for that?'***
>
> **Science leader**

Another interviewee describes how the freedom associated with no wrong answer enhances pupils' ability to make predictions.

"There isn't a right answer, and you're predicting, you won't necessarily be right straight away, as long as you've got a reason why you think that, then we can prove or disprove it afterwards."

Science leader

A few interviewees believe that a fear of being wrong is particularly prevalent among pupils who are disadvantaged and therefore lack confidence in their abilities. Explorify enables them to answer questions without the pressure of having to be 'right' and with no fear that they would be "laughed at" if wrong. Another interviewee describes the impact it has had on one of their SEN pupils:

"I can think of one girl in my class who I've had now for eighteen months, but when she first came through to Year 5/6, was so quiet and reserved and the first time I noticed her actually putting her hand up, getting stuck in, wanting to answer, was during an Explorify session... A lot of children are worried about getting the wrong answer and I think she was one who really worries about getting things wrong... She's quite a creative child so I think in particular the visual ones stimulated her."

Science leader

Motivation to learn

Explorify has positively affected pupils' motivation to learn as it makes science fun and engaging. The activities create excitement in classrooms as they "watch the visuals in awe". This engagement then leads to a greater level of contribution by pupils in the class as everyone want to take part. One interviewee notes that pupils with SEN appear to be more engaged in lessons, due to the fun visual activities, which can also act as a 'memory trigger' for them

"Some of our SEN pupils may have experienced things but may have forgotten about them, and having the visual image reminds them, 'Oh yes, I did go to the zoo and I did see a lion, and oh, there's a lion on the screen,' that memory trigger for them because it's visual and not wordy, and not something they've got to read."

Science leader

A few interviewees describe that because it is exciting and engaging, it encourages self-directed learning among pupils without always needing to be led by the teacher. As a consequence, they note that pupils are also able to retain more knowledge when they are engaged during the lesson.

"They might go outside and tell other people, or remember [science] more. It's certainly very engaging and helps to make links to the wider world."

Science leader

A few interviewees describe how it has helped break down stereotypes of science as 'boring or scary', which ensure pupils do not start lessons with a negative attitude. The reduction in the amount of writing they have to do during a lesson is often a contributing factor to this. Linked to this is pupils' understanding that science is 'all around them', leading to them being more curious, which not only helps in lessons but increases their science capital:

"They definitely look for science everywhere now because, you know, it makes them think of things that they probably didn't think of as science. It raised their science capital, especially for pupil premium children who don't have the vocabulary, don't

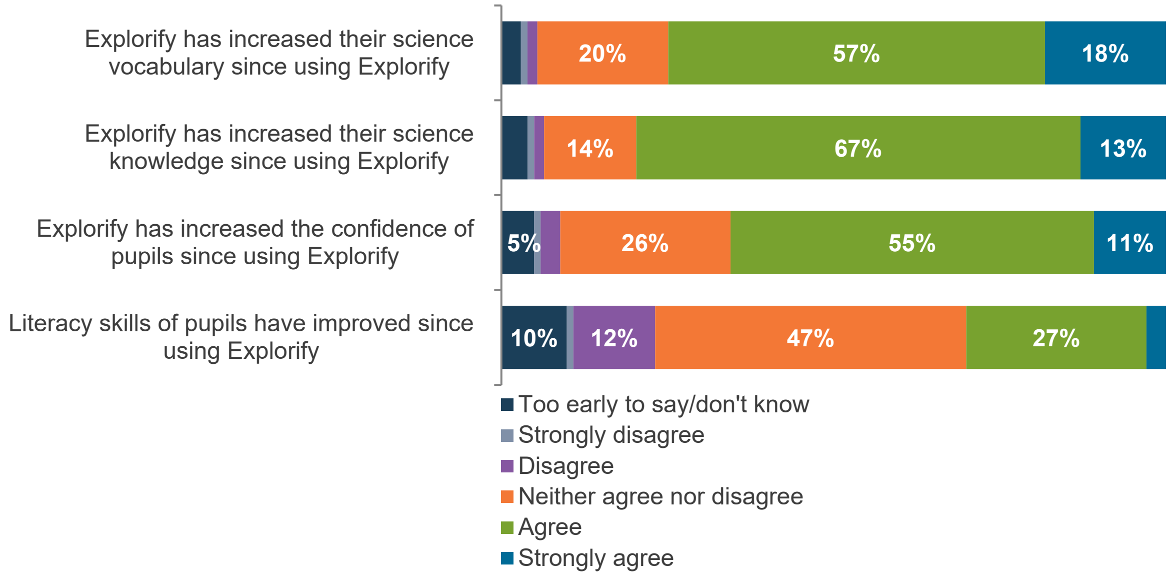
really talk about it at home, and then suddenly they're sitting there discussing what they can see, and what could it be, and looking at similarities and differences."

Science leader

3.2 Impact on pupils in science and other lessons

Explorify not only has an impact when it is directly being used during a lesson but also supports pupils' science development through increased science knowledge (80% 'agree' or 'strongly agree') and increased science vocabulary (75%)[12]. Additional impacts reported by respondents include an impact on pupils' confidence (55% 'agree' and 11% 'strongly agree') and improvements to pupils' literacy skills (30% 'agree' or strongly agree').

Figure 5: Extent of agreement about wider impact of Explorify on pupils as reported in the science leadership and teaching surveys. Base=202-203.



When asked (through an open response question) what additional impacts Explorify has had on pupils, almost a quarter (24%) respondents state that Explorify has had a positive impact on science-related outcomes for their pupils. Explorify develops pupils' scientific vocabulary alongside developing scientific enquiry, the ability to design their own investigations and the ability to handle and analyse data. A sixth (16%) of respondents highlight wider impacts such as improved oracy and pupils being more 'articulate' and 'analytical' in other subjects.

Scientific skills and knowledge

The use of Explorify has enabled pupils to develop skills which they can use in science lessons when not using Explorify. Almost all interviewees describe how Explorify encourages pupils to actively listen when taking part, which then extends to the rest of the science lesson when used as a 'starter'.

A few interviewees believe that observational techniques are developed through engagement with the resource and nearly one-third comment on how pupils' reasoning and questioning skills are improved as it encourages them to expand on their initial answers and provide scientific reasoning in class discussions. These developing skills are transferrable and used in science lessons and other areas of the curriculum.

[12] Respondents who had completed nine or more Explorify activities with their pupils

"So, we'd be in a lesson and talking about something else and they would then use the skills that they've been using when we have our Explorify discussion; they would actually talk to each other in that way and the lesson would open up to a discussion that was relevant, moving children on and getting them to wonder."

Science leader

One interviewee describes how this increases pupil confidence sufficiently to then further contribute in class discussions in any lesson. A further key benefit cited by almost all interviewees is the way Explorify supports the generation of scientific enquiry, with more emphasis on supporting ideas with evidence in conversations in the classroom. This then helps to further the discussion, progressing beyond the initial question posed.

A few interviewees describe how Explorify enables pupils to gain science knowledge and have scientific experiences. For example, seeing animals close up or being able to witness experiments which are either impossible in a classroom or would be difficult due to health and safety restrictions.

"I can definitely see, maybe it's something that's not been experienced before, so if it's not something that's in everyday life, or even if it is something that was in everyday life, you know, not all pupils have the opportunity to see different birds, for example, or different types of animals, you know, they've not been to the zoo to see different types of animals."

Science leader

Oracy and numeracy

Due to Explorify encouraging pupils to engage in class discussions, one-third of interviewees highlight how it contributes to the development of pupils' oracy – often a strategic priority for the school.

"Because our key target's oracy, it is a brilliant resource for that, because it's killing two birds with one stone. You know, I'm getting my oracy done, which is the priority in our school, but I can do it while teaching science."

Science leader

A few interviewees describe how this has an even greater impact for those in younger year groups where language development is at a crucial stage.

"One of my little girls, even back in September term, said, 'I think it's the human,' and I thought, 'Wow, I didn't even know [she would] know the word human."

Science leader

Interviewees highlight how the quality of the content engages pupils and captures their imagination which, they believe, is central to facilitating their use of new and varied vocabulary. One interviewee notes that pupils who struggle in maths and English can excel in science when using the resource because they have the opportunity to share their ideas in a creative way, without the need to write anything down.

Engagement in discussions and the visual nature of the activities also has a significant impact on the oracy levels of pupils with SEN. It assists in developing their language skills and knowledge, as the images allow them to understand what is being discussed.

"Having the pictures and the videos and the different types of activities within them, really helps them understand the language behind that science topic. So I think for

them, it's particularly helpful because they can actually see it in real life and see what it means to them, as opposed to just the teacher or a peer telling them what it means"

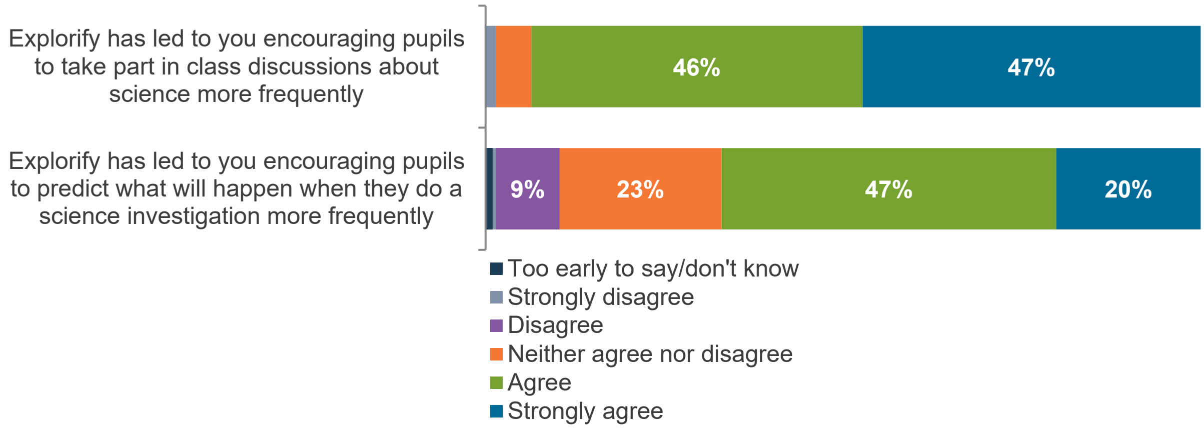
Science leader

While fewer interviewees spoke about the effect of Explorify on numeracy skills, one interviewee did note that both science and maths benefit from the development of questioning techniques and testing predictions.

3.3 Impact on teaching

Alongside having an impact on pupils, Explorify also has an impact on teaching practice. The vast majority (93%) of respondents[13] to both surveys 'agree' or 'strongly agree' that it has led to them more frequently encouraging pupils to take part in class discussions about science. Two-thirds (67%) also 'agree' or 'strongly agree' that it has led to them more frequently encouraging pupils to predict what will happen when they do a science investigation.

Figure 6: Extent of agreement about impact of Explorify on teaching practice as reported in the science leadership and teaching surveys. Base=203.



When asked to elaborate on how Explorify has had an impact on them as teachers, over two-thirds (69%) highlight how the interactive format of Explorify has improved the delivery of lessons. It is this which brings about impacts on pupils who become more 'engaged', 'challenges' pupils' existing knowledge or understanding of the world while 'stimulating' broader discussions. Overall, there is a general tone in the open responses that delivery is 'easier' for teachers but it also provides pupils with challenge while being 'fun' for teachers and pupils alike. Interviewees in one-third of schools describe that science teaching across the school has improved because it has increased teachers' enjoyment of teaching, improved teaching practice and increased pupil curiosity.

Under one-third (32%) of respondents highlight how Explorify supports science planning by providing 'fresh ideas', 'starting points' and 'hooks' for class discussions or topics:

"It has helped provide me with a wider range of open-ended questions to give the children. It is a fantastic topic-of-conversation starter and it also helps me spark their curiosity."

Science leader survey respondent

A small proportion (3%) highlight that Explorify has specifically reduced time in planning lessons and, for 4%, has increased their own scientific knowledge. These were all key themes highlighted throughout the interviews, as we describe in the sections below.

[13] Who had completed nine or more Explorify activities with their pupils

Encouraging group discussions and self-directed learning

Almost all interviewees use Explorify as a starter for their science lessons (and other subjects) because it encourages group discussion and raises enthusiasm and, as such, has made lessons more interactive. A few science leaders specifically highlight how Explorify encourages them and their colleagues to move away from focussing their lessons on only teaching 'content' to teaching pupils how to 'think scientifically' including engaging in discussions and sharing ideas.

> ***"When I took over as subject lead, the children were just learning sort of science from the factual side of things, rather than thinking more scientifically. And I think [Explorify] really gets children hyped up about science."***
>
> **Science leader**

Almost half of interviewees describe how Explorify helps teachers in their school plan lessons which are focussed on pupil-led learning. Explorify has given these interviewees' colleagues the confidence to take a step back and allow children the freedom to shape the lesson through their discussions. A few interviewees describe how allowing pupils to self-direct parts of lessons may be daunting for some teachers if they are less confident about teaching science, as there is less structure and they do not know what pupils will ask. Therefore, Explorify provides teachers with some background information to boost their confidence and allow them to balance structure with pupil discussion. One science leader spoke about observing one of their colleagues, and how that teacher used Explorify to combine structure with pupil engagement.

> ***"It was a 'Big Question' she used and because of the way she used it, she said actually it was one of the easiest lessons she'd planned. Which makes it quite strange when I thought it was the best lesson she'd taught... what she did, it just meant the children were actively enquiring... it was almost like it wasn't a lesson it was just a really informal group of children just exploring."***
>
> **Science leader**

Using Explorify to monitor and assess

Using Explorify at the start of a lesson allows teachers to assess pupils' knowledge about a topic or concept, to ensure they can tailor the lesson accordingly. Around two-thirds of interviewees use it in this way or use it at the end of a lesson to understand what has been learned. One interviewee highlights that Explorify is useful to quickly assess what pupils know, ensuring more progression is taking place and content is not repeated. It is also useful in allowing teachers to assess if pupils hold any misconceptions, which can then be addressed during the lesson:

> ***"I need to make sure that you don't have that misconception, so I'll steer you to the right answer,' and that's what I find Explorify does well, to start a lesson off with that open dialogue."***
>
> **Science leader**

At least half of interviewees describe using Explorify as a form of formative assessment throughout a topic to gauge pupils' progression and understanding between lessons. One science leader has even used the same activity twice to determine whether pupils' language or enquiry skills have improved.

> ***"I've used it in the past, as doing an activity twice. So they do something at the beginning of a topic and then do the same activity again, recording any changes in the vocabulary***

they use, or the questions that they ask, or their understanding of the questions that the activity comes with."

Science leader

Planning

Almost half of all science leaders and a few teachers interviewed use Explorify to support their planning of science lessons and extra-curricular activities (i.e. science clubs) by browsing content to find activities that link with the topic or an existing lesson plan.

"If I'm planning out a lesson and planning my resources, then I will generally click onto it and just see if there's anything that matches up closely to what I'm doing."

Science leader

A few interviewees also use Explorify prior to their lesson planning to get ideas for how they could teach a certain topic rather than trying to fit Explorify into an existing lesson. Explorify activities have links to other similar activities and content, and one science leader highlights how this helps teachers plan ahead and decide what they might want to cover in future lessons.

"It's made me and made the teachers here… think more about the journey of the topic that they're teaching. So how Explorify fits in with their lessons, how they are going to teach a scientific objective or working scientifically, where they're going to get to at the end…[Explorify] has enabled them to really think about how they're going to do it week by week and help them plan that better."

Science leader

Time spent teaching science

Two-fifths (40%) of all respondents to both surveys who completed nine or more Explorify activities with their pupils report the resource has increased the time they spend teaching science, while over half (58%) report no change and the remaining respondents are unsure.

Almost all interviewees describe how time constraints make it difficult to teach more science as it can conflict with the time needed for other subjects. Despite this, Explorify is used by almost all interviewees between lessons or in lessons other than science and can, therefore, lead to pupils being exposed to more science.

"At break time, when [pupils] are eating their snack, they're all looking at their [Explorify] activity and talking about science, when before they might have just been chatting. So yes, it's enabled us to make use of pockets of time that otherwise wouldn't have been given to science. And that's great."

Science leader

One-third of interviewees state that although Explorify has not had an impact on the amount of science they teach, it has had a positive impact on the quality of science they and others teach.

"I think the amount of curriculum time would be the same. We'd probably spend just the same two hours a week with extra here and there for special things. But the difference

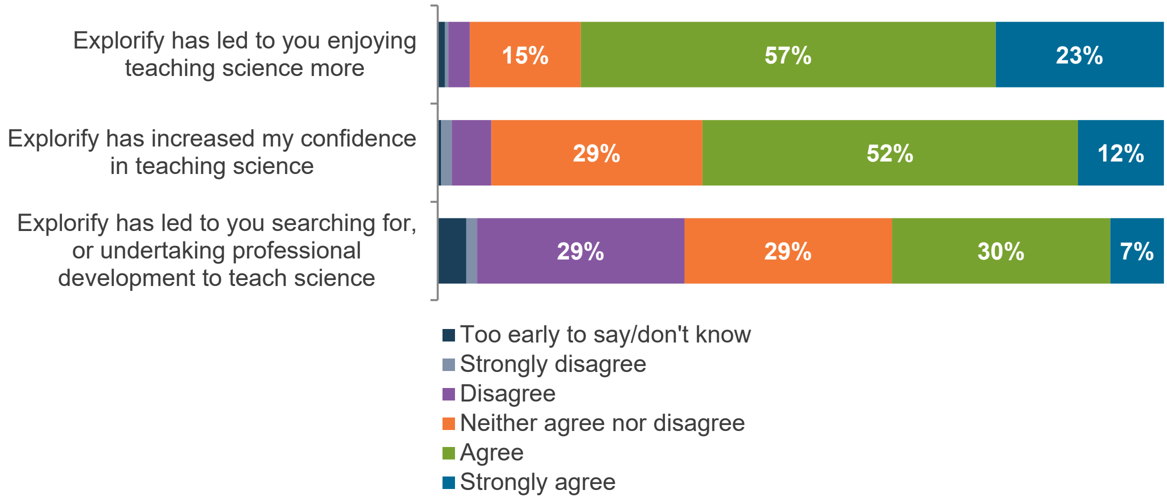
is, that two hours will be more useful and more meaningful because you're not going over things the children already know."

Science leader

3.4 Wider impact on teachers

As well as supporting teachers to change their teaching practice, Explorify also has an impact on respondents'[14] enjoyment when teaching science (80% 'agree' or 'strongly agree'), increased their confidence (64%) and, for a smaller proportion (37%), searching for, or undertaking, professional development to teach science.

Figure 7: Extent of agreement about wider impact of Explorify on respondents as reported in the science leadership and teaching surveys. Base=203.



Confidence

As highlighted in the survey findings above, confidence was also repeatedly mentioned during the interviews as a key impact of using Explorify. Around one-third of interviewees describe the positive impact it has had on their own confidence when teaching science. A few describe how they felt confident knowing Explorify was there if they needed to quickly use a new activity and could have confidence in the quality of the resource.

"I think it makes me more confident when I've got Explorify to back me up, and also if you're flailing a little bit at the front of the class... you've got Explorify to fall back on. It has made me more confident."

Teacher

The step-by-step guides as part of activities are described as invaluable for planning, while providing flexibility to deliver lessons in a style that teachers feel confident with. Due to Explorify instigating discussion among pupils, this boosts teachers' confidence in their ability to deliver high-quality lessons and to take a step back and allow children the freedom to shape the lesson through their discussions.

Two-thirds of interviewees describe how Explorify has boosted the confidence of other teachers in their school and frequently report this for new or recently qualified teachers (N/RQTs) or those who are less confident in teaching science. Confidence in these cases is again reinforced by the background information provided within the activities.

[14] Who completed nine or more Explorify activities with their pupils

> ***"Certainly we are a huge fan at the school. I mean the NQT (Newly Qualified Teacher) who doesn't have the science background, it is contributing to boosting his confidence and I know that he relies on that background information heavily."***
>
> **Science leader**

> ***"I think it's been really good for teachers maybe that weren't quite so confident at using scientific language beforehand, because it's all there for you. And it tells you everything in quick easy steps and it's not frightening… I think it's really helped other staff be more confident in their science teaching as well."***
>
> **Science leader**

The activities in Explorify are described by interviewees as highly practical, with clear and concise guidance included. While this helps improve teachers' confidence, it also supports teachers to undertake better investigations and be more confident in doing so. A few science leaders said that Explorify has enabled them to add more breadth to their science lessons. Through using Explorify resources, they have developed a clearer view of their end goal and what they are supposed to be achieving. This enables them to extend the scope and quality of their lessons, with less focus on simply following a pre-determined plan.

Science-related CPD

Taking part in Explorify has motivated two interviewees to undertake further science-related CPD. One science leader is also considering pursuing PSQM for the school:

> ***"I think having resources like Explorify, which makes science easier to teach, makes it more interesting. Yes, makes me want to further my knowledge within the science topics, it wants me to try and achieve more things for my school… [we're] currently looking into going for the Primary Science Quality Mark, looking at perhaps doing that in the future."***
>
> **Science leader**

Teachers interviewed describe how it is the science leader in their school who goes on science-related CPD; therefore, although it has inspired a few to want to learn more, they state that access to external science-related CPD is not possible.

3.5 Wider impact across the school

Many interviewees' schools prioritised science before using Explorify but describe how the resource contributes towards increasing the science profile in their school, often alongside the work of the science leader.

> ***"I think that the status of science has definitely increased in our school and that is down to the hard work of our subject leader. She took over the subject about two years ago and part of her whipping up that, kind of, enthusiasm for science has been to encourage people to develop their practice by using websites like Explorify… I think it's down to the person who as part of her work has introduced us to it."***
>
> **Senior leader**

At least half of all interviewees state that the profile of science within their school has not changed since introducing Explorify, either due to the already high profile of science in their school or due to the importance placed on other subjects (primarily English and Maths).

"Science has always been a big subject in our school because we've got the lab, you know, science was heavily pushed even before Explorify came in. So, I don't think I would say it's... made us teach science any more, it's just added to what we already do."
Science leader

4. Science leadership and delivery in schools

This section explores how science is delivered in schools and examines any differences between schools and teachers who use Explorify and those who do not.

4.1 Science leadership in the school

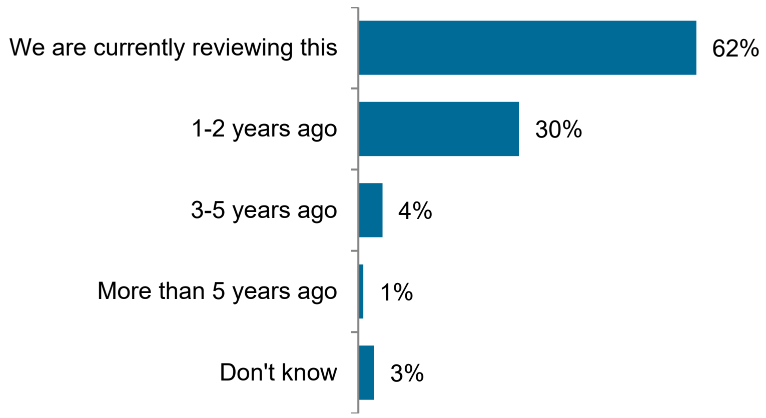
Almost all respondents (98%) to the science leadership survey report that there is a dedicated science leader at their school. Science leaders are responsible for leading science development and teaching in schools, either as an individual subject or as a cross-curricular topic area. A slightly higher proportion of larger schools (schools having a pupil cohort of 200-299 or 300 plus) have a science leader (100% and 99%, respectively) when compared with small schools (defined as less than 100 pupils), at 91%.

The majority of science leaders who responded to both surveys are classroom teachers (95%) and nearly two-thirds (61%) do not hold a science A level[15] or Advanced Higher. One-quarter of science leaders (25%) hold one A level or Advanced Higher, while the remaining 14% hold two or more.

Just under two-thirds (62%) responding to the science leadership survey report that science is included in their School Development Plan for the 2019/20 academic year. This is more common for schools who are currently applying for the PSQM award (91%) compared to those who already hold the award (66%) or those that do not have it (60%). Schools that give their science leader specific release time to lead science (67%) are also more likely to have science on their School Development Plan compared with those who do not (53%).

Nearly two-thirds of schools report they are currently reviewing the way science is taught across the school (as reported in the science leadership survey). A further 30% reviewed this within the last 2 years and 5% reviewed it 3 or more years ago.

Figure 8: When the school last reviewed how science was taught across the school as reported in the science leadership survey. Base=853

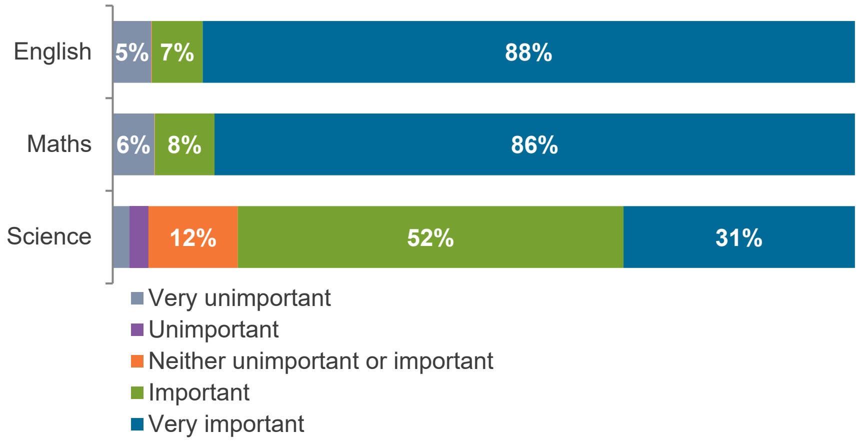


[15] This has been defined as holding a Biology, Chemistry or Physics A level or Advanced Higher.

The importance of science

The majority of respondents to both surveys state that both English (95%) and maths (94%) are 'very important' or 'important' to their school, while a smaller proportion (83%) state their school views science the same way. When the answer 'very important' is examined, science is much lower at 31% compared with 88% for English and 86% for maths; while a further 12% state that science is 'neither important nor unimportant'. These findings are similar to those in the baseline report.

Figure 9: The perceived importance of subjects in school as reported in the science leadership and teaching surveys. Base=1268-1270.



The role that someone holds in a school influences their perceived importance of science, with a much higher proportion (67%) of senior leaders stating that science is 'very important', compared with only 28% of those in other roles. Over one-in-ten respondents (13%) who are not senior leaders state science is 'neither important nor unimportant', compared with only 2% of senior leaders.

Further differences are found by:

— **school size:** 53% of respondents from small schools (those with 99 pupils or less) state that science is 'very important', compared with 30% of respondents from larger schools with 100 or more pupils; and

— **science on the School Development Plan:** 35% of respondents from schools who have science on their School Development Plan state 'very important', compared with 26% of respondents from schools who do not have science on their development plan.

— **science leaders:** 27% of science leaders state 'very important', compared with non-science leaders (38%).

Release time for science leaders

Nearly two-thirds (61%) of science leaders get specific meaningful release time to lead science in their school, in addition to time to plan their own lessons. This is higher than reported in the baseline report when 52% of science leaders in England received release time. A higher proportion of science leaders from the largest schools (300-plus pupils) receive release time (69%) compared with science leaders from schools with between 200-299 pupils (59%), 100-199 pupils (52%) and those with fewer than 100 pupils (32%). A higher proportion of science leaders from schools who already hold, or are currently applying for, the PSQM award (69%) receive release time compared with those who do not hold the award (59%).

Analysis[16] was undertaken to explore the best combination of individual and school-level characteristics that are associated with a science leader receiving release time. The final model was significant and indicates that school characteristics are the only factors that are associated with this. In order of importance these are:

— Larger schools

— Having science included on the School Development Plan

— Viewing science as important to the school

Among those who receive it, the amount of release time taken by science leaders varies. Most report taking release time either every term (29%) or every half term (29%) with only one-quarter (25%) taking regular release time every one or two weeks.

Table 2: Frequency of release time for science leaders as reported in the science leadership survey

Frequency of release time	Proportion
Approximately every week	17%
Approximately every two weeks	8%
Approximately every month	8%
Approximately every half term	29%
Approximately every term	29%
Other	9%
Base	*458*

The amount of release time taken by all Science leaders across a year is variable, with two-fifths (39%) receiving no release time, just over one-tenth (15%) taking just 10 hours or less a year and a further 17% taking between 11 and 20 hours. Only 5% of Science leaders take 41 hours or more across the year, equating to an average of around one hour per week. This is, however, an improvement on the findings in the baseline report where almost half of science leaders (48%) received no release time.

Table 3: Number of hours of release time taken by science leaders as reported in the science leadership survey

Number of hours of release taken each year	Proportion	Proportion at baseline[17]
No release time	39%	48%
10 hours or less	15%	16%
11-20 hours	17%	16%
21-30 hours	4%	4%
31-40 hours	6%	9%
41 hours or more	5%	6%
Unsure of time/it differs	13%	1%
Base	*757*	*435*

[16] Logistic regression. Variables added into the models but no association found for: percentage Free School Meals (FSM), whether school holds/does not hold PSQM, gender, whether Head/SLT or non-management, number years in teaching, full/part time worker, whether hold a science A Level/Advanced Higher, Explorify/comparator school. (Base = 666)

[17] Proportion based on responses from English schools only for comparative purposes.

Around half of those interviewed receive release time for their science leadership duties and a few find that they sometimes have conflicting responsibilities, meaning that release time has to be spent preparing lessons and any other leadership or management responsibilities they have. Those who do not receive any release time describe undertaking their role during evenings and weekends; or they are part-timers and use their days off to make up for time lost. Interviewees who do not receive release time highlight how this inhibits their ability to fulfil the role.

> ***"I get fifteen minutes when my class are doing music on a Wednesday each week, but no, effectively, I don't really get any. [I do it] in the evenings and at the weekends."***
>
> **Science leader**

Science leaders use their release time to carry out lesson observations, plan lessons, mentor colleagues and, where the school is working towards it, prepare for PSQM. Almost all science leader interviewees who receive release time say it is sufficient and they appreciate the time they are given, taking into consideration that many science leaders and teachers do not have any release time at all. However, almost all agreed that more time would be welcome.

CPD for Science Leaders

In the last 12 months, just over half (57%) of all science leaders have undertaken external CPD lasting one day or more to help them lead or develop science throughout their school, similar to the levels reported in the baseline report. Those in smaller schools are less likely to report this, with only 22% of science leaders from schools with less than 100 pupils compared with those from larger schools with 100 or more pupils (59%). Higher proportions of science leaders from schools who hold the PSQM award (73%) and those applying for the PSQM award (74%) report undertaking CPD when compared to schools who do not hold PSQM (53%), which is not surprising given that participation in CPD is necessary to achieve the award. Nearly two-thirds (66%) of science leaders who are from a school where one or more teachers are using Explorify state they receive CPD, compared with 41% of those who are not.

Analysis[18] was undertaken to consider the range of individual and school-level characteristics that are associated with a science leader receiving or participating in CPD during the last 12 months. The final model was significant and only two school characteristics are associated with this:

- Explorify schools
- Schools that hold the PSQM

On average, science leaders who took part in external CPD did so for 3 days. Over one quarter (29%) undertook one day of external CPD, just over one-quarter (26%) undertook up to two days, one-fifth (20%) undertook between two and three days, and the remainder (25%) undertook more than three days of CPD.

Almost all those interviewed had been on a science leadership course since beginning their role (but not necessarily within the last 12 months). Just over one-quarter attended a course at the STEM Centre in York and learnt about science leadership, different ways to teach science and methods of scientific enquiry. A few interviewees attended courses by The Ogden Trust, universities and Wellcome, focussing on primary science teaching. They found the courses useful in introducing them to different methods for teaching science and for leadership training. Networking opportunities were seen as invaluable by almost all interviewees who took part in external CPD, particularly via science leader network meetings and conferences. These courses and CPD events also allowed them to share best practice with other science leaders.

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[18] Logistic regression. Variables added into the model but no association found for: school size, FSM, gender, whether Head/SLT or non-management, number of years in teaching, full/part time worker, whether hold a science A Level/Advanced Higher, school has science on School Development Plan. (Base = 666)

> *"It was really useful. Very, very practical, very hands-on, hundreds of examples, but then also theory and strategy behind it, so that you've got things that you can then present back to your own teachers, things that you can try out yourself."*
>
> **Science leader**

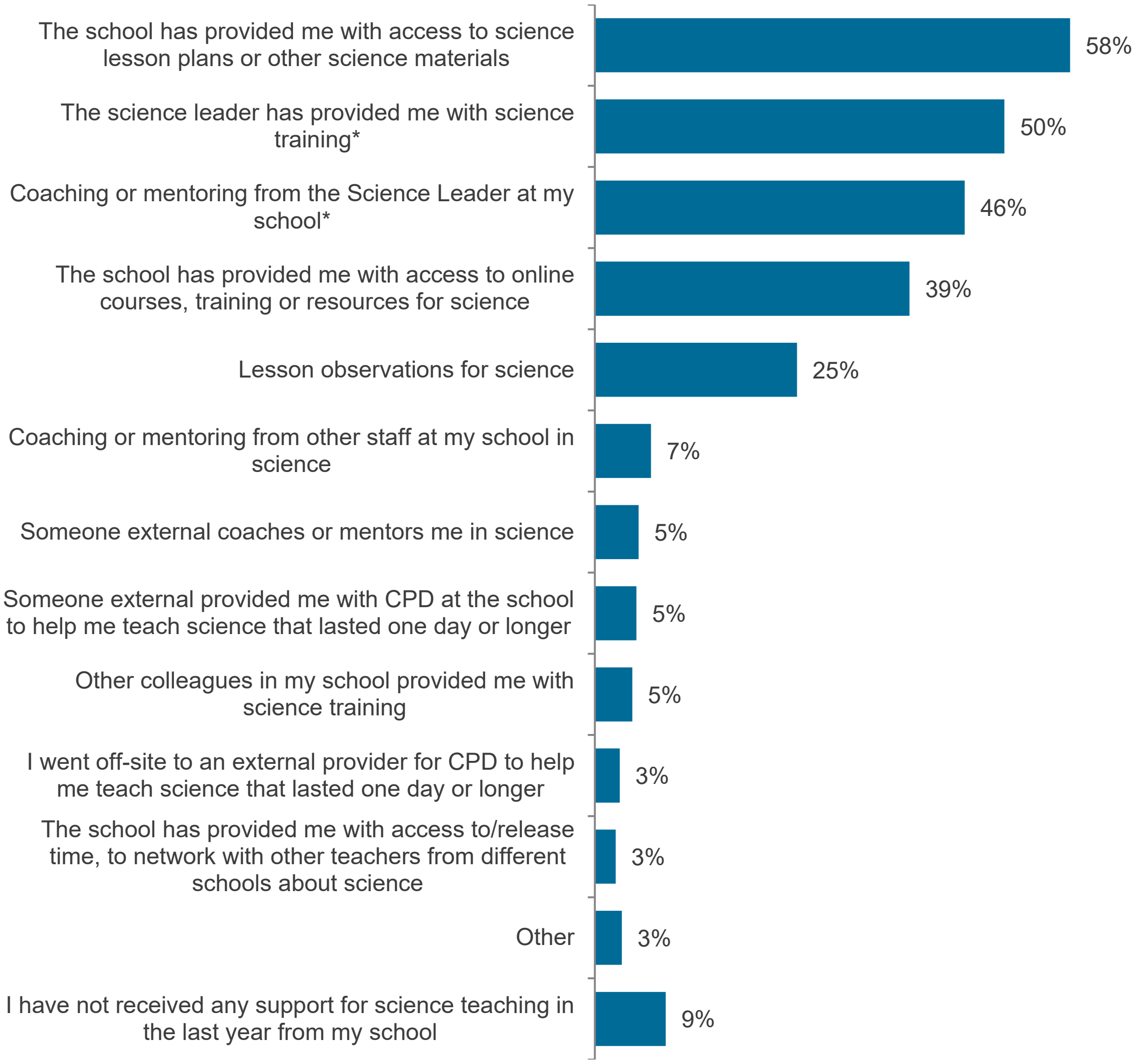
Alongside CPD, around one-quarter of science leaders are working towards, or had been recently awarded, PSQM, which is a CPD programme that allows schools to demonstrate how effective science leadership has a positive impact on science teaching and learning. Interviewees describe how the PSQM has increased the profile of science in their school and pushed them to collaborate with other schools.

Only a few science leaders who had recently taken on the role had not received science leadership CPD and were learning 'on the job'. They also sourced online CPD, undertook their own research and gained support via colleagues and informal networking. However, they would value training in the future.

4.2 Science support and CPD for teachers

Respondents to the teaching survey (excluding science leaders) were asked to state what support their school had given them to improve their science teaching in the last 12 months. Providing access to lesson plans and materials (58%); training from their science leader (50%); coaching or mentoring from their science leader (46%); and the school providing them with access to online courses, training or resources (39%) were most frequently reported. The majority of respondents received some kind of support, with less than one in ten (9%) not receiving any support. This is lower than reported in the baseline study (at 30%) partly due to those teachers who are at a school that is using Explorify reporting higher support levels than the comparator sample (see Table 4).

Figure 10: Support received to improve science teaching in the last 12 months as reported in the teaching survey (excluding science leaders). Base=390, those with a * Base=389.



Higher levels of support were found between schools using Explorify and those who are not in four areas as shown in Table 4 below. Overall, just 2% of teachers from Explorify schools did not receive any support, compared to just over one-fifth (22%) from comparator schools.

Table 4: Support received to improve science teaching in the last 12 months by Explorify schools as reported in the teaching survey (excluding science leaders).

	Respondents from an Explorify school	**Respondents from a Comparator school**
The school has provided me with access to science lesson plans or other science materials	65%	42%
The science leader has provided me with science training	58%	35%
Coaching or mentoring from the science leader at my school	54%	29%
The school has provided me with access to online courses, training or resources for science	48%	19%
I have not received any support	2%	22%
Base	268-269	113

A number of other factors influence the likelihood of a teacher receiving support to teach science. These include:

— **holding or applying for the PSQM award:** 99% of respondents from schools that hold, or are applying for, the PSQM award receive support, compared with 89% of respondents from schools who do not hold PSQM;

— **science leader receiving CPD** (in schools with a science leader): a slightly higher proportion of respondents (96%) whose science leader had received CPD in the last 12 months receive support compared with 86% of respondents whose science leader had not received CPD in the last 12 months.

— **science leader release time** (in schools with a Science Leader): a slightly higher proportion of teachers (95%) who have a science leader who receives release time for their role receive support compared with 87% of teachers from schools where their science leaders does not receive release time.

During interviews, teachers describe they are less likely to participate in external CPD which relates to science compared to science leaders. Science leaders typically pass on learning from external CPD they have attended to teachers in their school. More recently, delivering internal CPD has become challenging due to the pandemic and science leaders have responded by using online software to deliver individual and/or group CPD. A few teachers interviewed have found their own CPD; often reliant on online resources which provide advice on delivering specific aspects of science. This was described as even more important for teachers during the lockdown.

Although there is a general acceptance that there is little time for teachers to take part in external science CPD, a few teachers would like to undertake this and one reported undertaking this themselves.

> ***"I knew it would be beneficial for my teaching, and I knew it would help and I wanted to do it, so I just arranged it off my own back."***
>
> **Teacher**

A few teachers said they had received CPD from their science leader over the last year through meetings or individual support. Science leaders describe how they use a combination of school-wide and individual support to ensure the level of guidance is sufficient for each staff member.

> ***"I always do an audit just to see what people's skills are because they're often quite happy to say on paper what they can and can't do... We have CPD every term and we moderate every term and we catch up and chat. We have more informal book looks, communal book looks where we're just saying 'This is what we've done,' and somebody might say, 'Oh, that's a good idea,' or, 'Oh, you could do that,' and so often that happens as well. So, it's a very sharing situation."***
>
> **Science leader**

Science leaders describe how they undertake lesson observations to monitor the delivery of science teaching in their school and give feedback on what they have observed. A few teachers also reported watching their science leader teaching to observe best practice. To try and provide additional opportunities for teachers, a few science leaders also use 'team teaching' where teachers work together to plan lessons, observe each other and collaborate. This approach is viewed as favourable by teachers.

4.3 Science teaching in the school

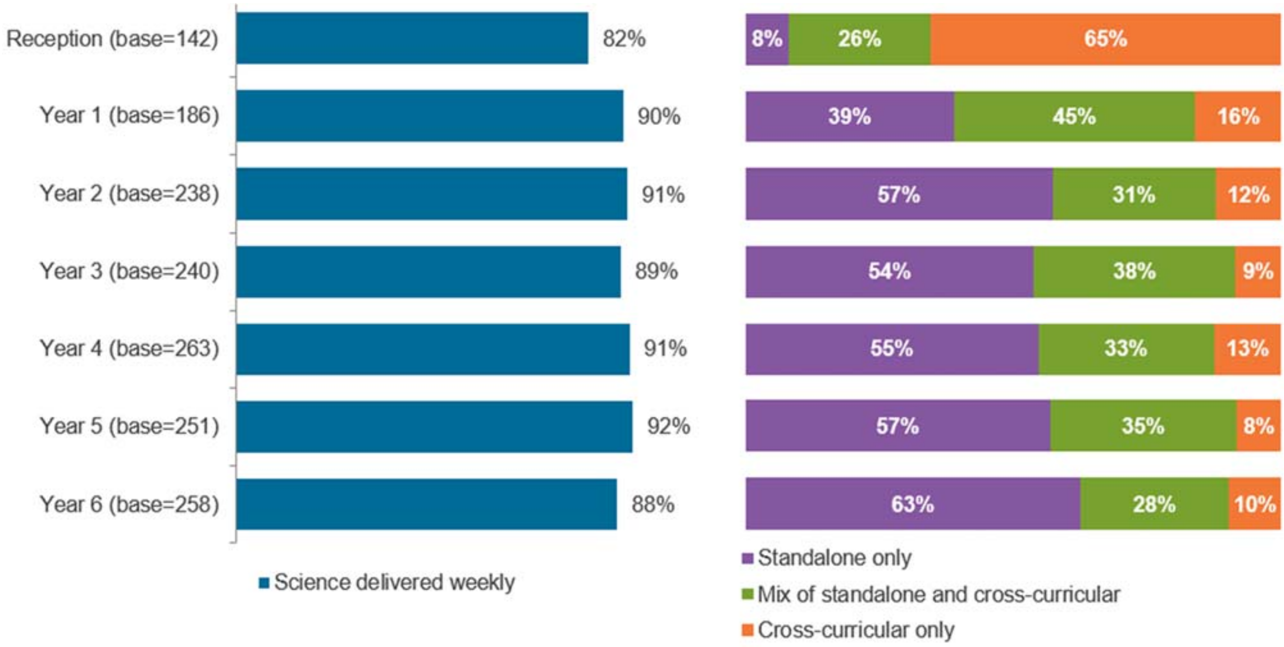
Classroom teachers deliver most science lessons in the vast majority (92%) of schools. Just 4% of schools have a science teacher who takes science lessons, 4% have a mix of the two and just two schools use other staff to deliver science. A higher proportion of small schools (those with less than 100 pupils) have a specific science teacher (13%), compared with 3% of all other schools.

Regularity of science teaching

Teaching science weekly

Across schools, a high proportion of year groups are taught science weekly either as an individual subject or as part of cross-curricular work. Stand-alone science lessons are more prevalent for older year groups while Reception pupils are more likely to receive cross-curricular lessons only, reflecting the baseline findings.

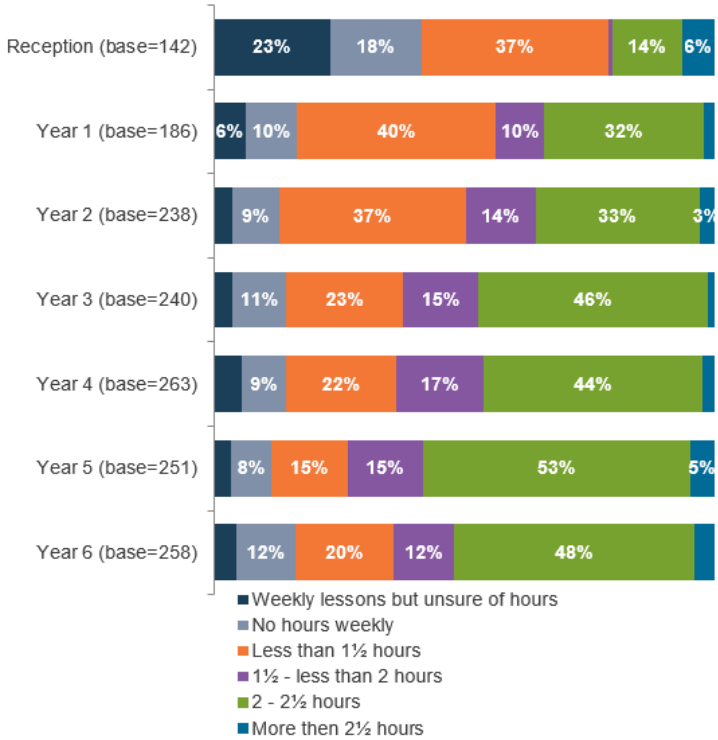
Figure 11: Weekly science delivery by year group and mode of delivery as reported in the science leadership and teaching surveys



On average, science is taught weekly for 1.4 hours a week (1 hour and 24 minutes) and 55% of classes receive less than 2 hours a week (excluding those who were unsure about the time but including those who teach no science weekly). On average, younger year groups receive fewer hours of weekly lessons, with the amount of science taught increasing slightly as pupils get older, reflecting the baseline findings.

Just under one-quarter (23%) of those teaching Reception pupils are unable to estimate the amount of time they spend teaching science. For the remaining year groups, the proportion who could not indicate the number of hours spent teaching science is much lower.

Figure 12: Hours of weekly science delivery by year group as reported in the science leadership and teaching surveys[19]



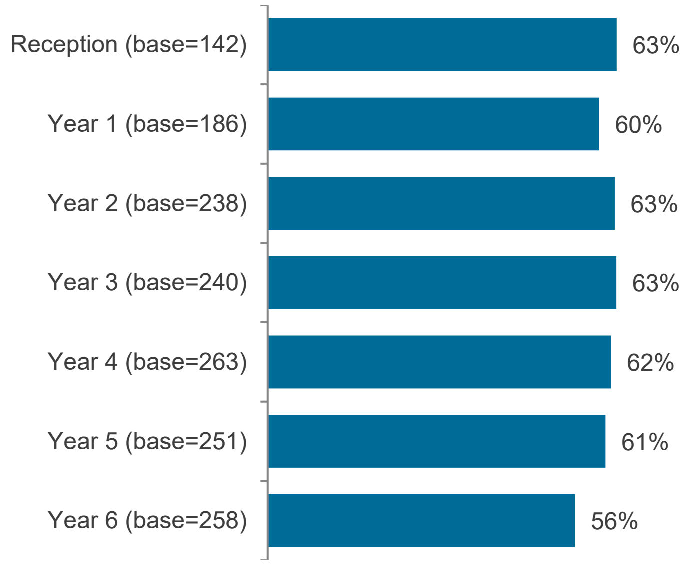
	Proportion less than 2 hours *(excluding unsure)*	Mean weekly hours	
		Trimmed	Untrimmed
Reception	73%	1.0 hours	1.3 hours
Year 1	64%	1.3 hours	1.3 hours
Year 2	63%	1.4 hours	1.4 hours
Year 3	51%	1.5 hours	1.5 hours
Year 4	51%	1.5 hours	1.5 hours
Year 5	40%	1.7 hours	1.7 hours
Year 6	46%	1.5 hours	1.5 hours
Average	**55%**	**1.4 hours**	**1.5 hours**

Dedicated science weeks

Just over two-fifths (43%) of those who teach science deliver it through dedicated science weeks. For most teachers, (see Figure 15 later in this chapter), this is an additional activity that complements other delivery methods rather than being a stand-alone approach. For the majority (88%) of teachers, science weeks are delivered once a year. Only a small minority delivered two or more science weeks a year (See Appendix 2 for a full breakdown by year group).

[19] A trimmed mean at 5% was used to calculate these figures. This excludes 5% of responses in the sample (2.5% of cases from the lower end of the scale and 2.5% from the higher end of the scale) to prevent the mean being skewed by schools with extremely high or low figures. This ensures that the mean more accurately reflects the majority of schools in the sample.

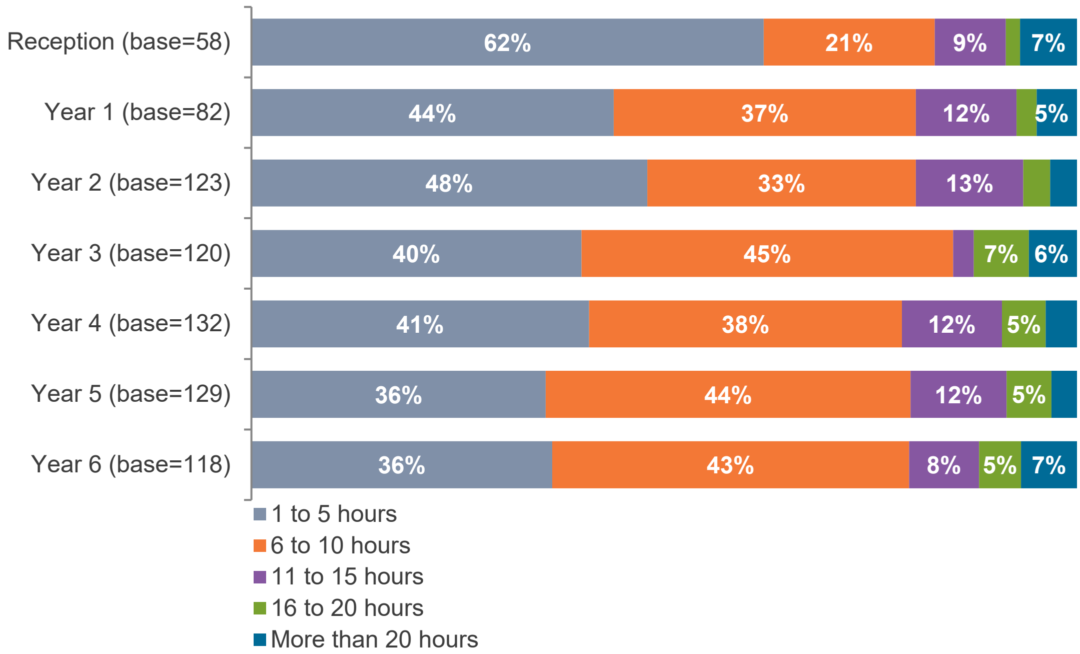
Figure 13: Dedicated science week delivery by year group as reported in the science leadership and teaching surveys.



Dedicated science week hours of delivery

In each science week, most teachers typically teach science for up to 10 hours for each class, with an average of between 7 and 9 hours across the week (Figure 14).

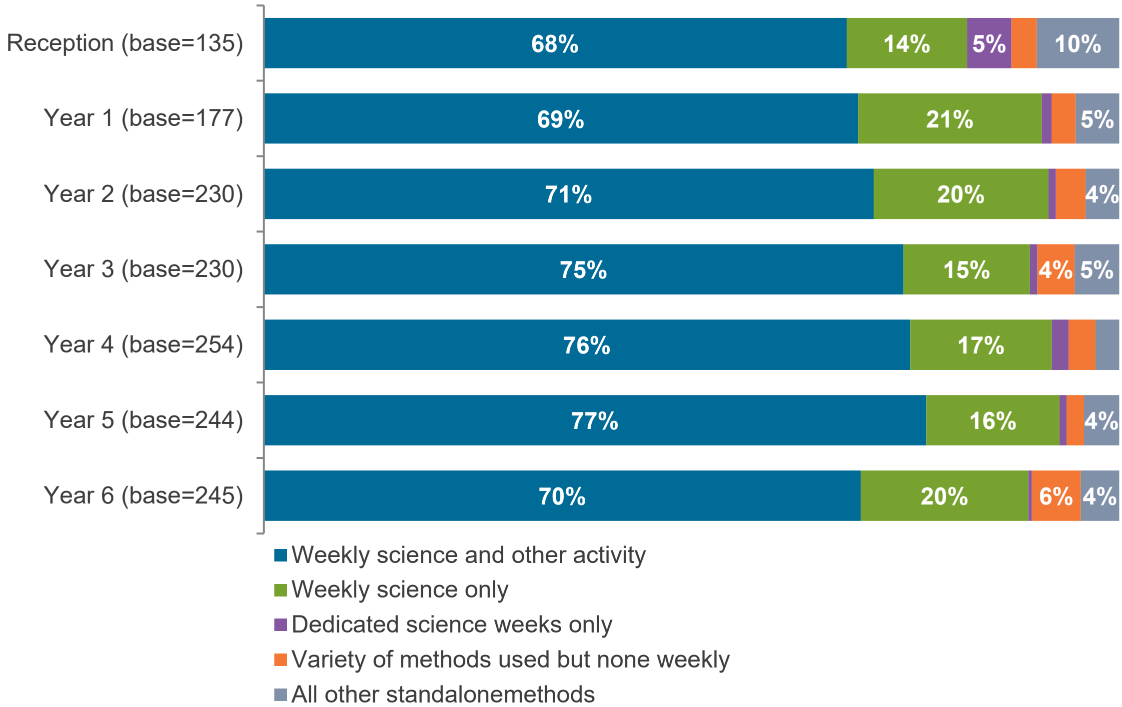
Figure 14: Total number of hours delivered through each science week in the school year as reported in the science leadership and teaching surveys



Main delivery methods

Science is not only taught through weekly lessons or science weeks but in a wide variety of ways. While the majority of respondents teach some form of science weekly, most combine this with other types of activity such as dedicated science weeks, science days and visits, which all increase the amount of science taught to pupils. Only a small proportion (up to 5%) teach science through dedicated science weeks only. Under 6% of respondents teach science through a variety of methods (more than one method used but none undertaken weekly) and 3%–10% through a stand-alone method (such as block teaching or fortnightly lessons). These are similar findings to those in the baseline report.

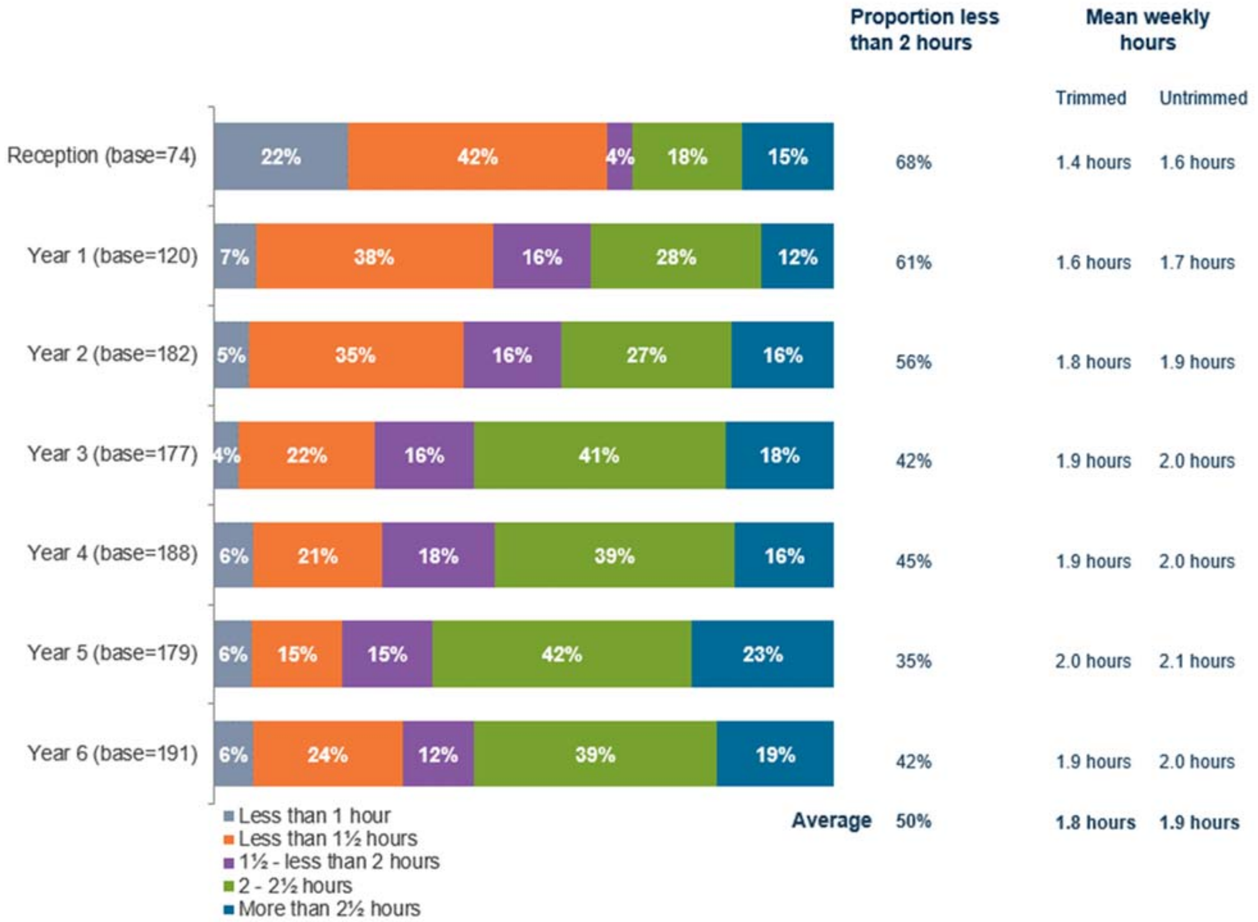
Figure 15: Overall delivery method by year group as reported in the science leadership and teaching surveys



Total hours of delivery

Across the various methods used by teachers, the number of hours of teaching was combined to calculate a total number of hours taught in a year. This was then averaged across 39 weeks of the school year to calculate a weekly average. On average, science is taught for 1.8 hours a week (1 hour and 48 minutes a week). The proportion of year groups receiving *less than 2 hours of science teaching* a week decreases by age from 68% in Reception to 42% in Year 6.

Figure 16: Average number of hours of science delivery per week by year group as reported in the science leadership and teaching surveys



Deciding how many hours to teach science

Almost all interviewees report that the amount of time spent teaching science is decided by senior leaders in the school. Science leaders (if not a senior leader) have limited input into how much time is specified, as English and maths are often prioritised. Around half of all interviewees report they would like to teach more science but that it is not possible.

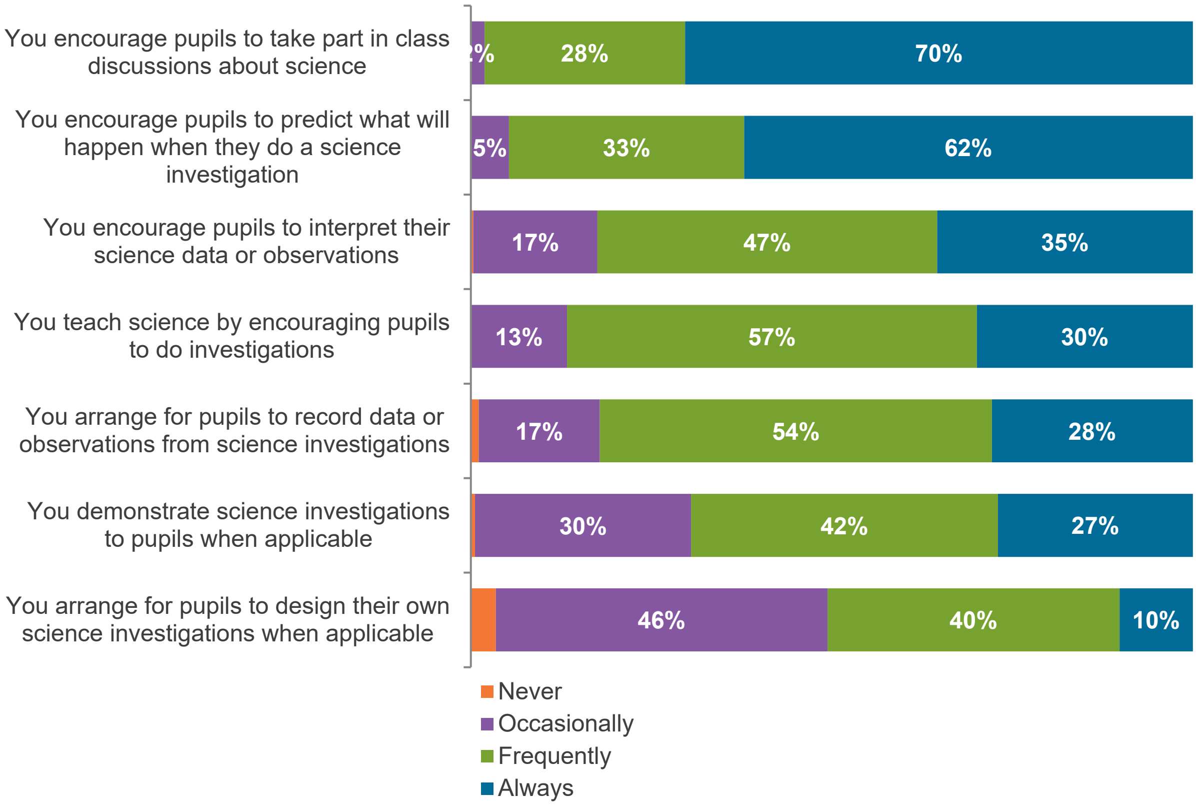
> *"I would always campaign for way more science. Science has sort of dropped down the priority list in most primary schools, which I don't like and don't agree with, but that's the way it is. So, timetabling in terms of that comes from a higher level. The big focus recently has been on reading, so that has kind of squeezed any extra time out of the timetable really."*
>
> **Science leader**

A few interviewees from schools with religious affiliations report that stipulations to teach Religious Education for a certain number of hours also inhibits their capacity to teach more science.

Teaching methods

Improving the quality of science teaching is a key objective of the primary science campaign, encouraging pupils to take part in class discussions, predict what will happen when doing investigations and undertaking their own investigations. A majority of respondents 'always' or 'frequently' encourage pupils to take part in class discussions and encourage pupils to predict what will happen when they do science investigations. A much lower proportion state they ‘always’ or ‘frequently’ arrange for pupils to design their own science investigations.

Figure 17: Frequency of science delivery methods used in lessons as reported in the science leadership and teaching surveys. Base=1,182–1,196.



Differences are found by whether or not someone is an Explorify user:

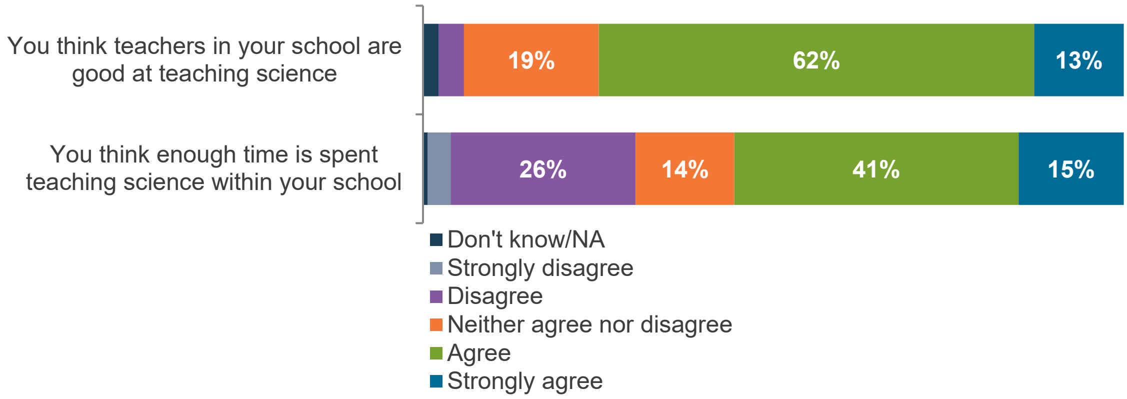
— **you encourage pupils to take part in class discussions about science:** 73% of Explorify users state ‘always’, compared with 67% non-Explorify users; and

— **you arrange for pupils to design their own science investigations when applicable:** 44% of Explorify users state ‘frequently’, compared with 37% non-Explorify users.

4.4 Attitudes towards teaching of science

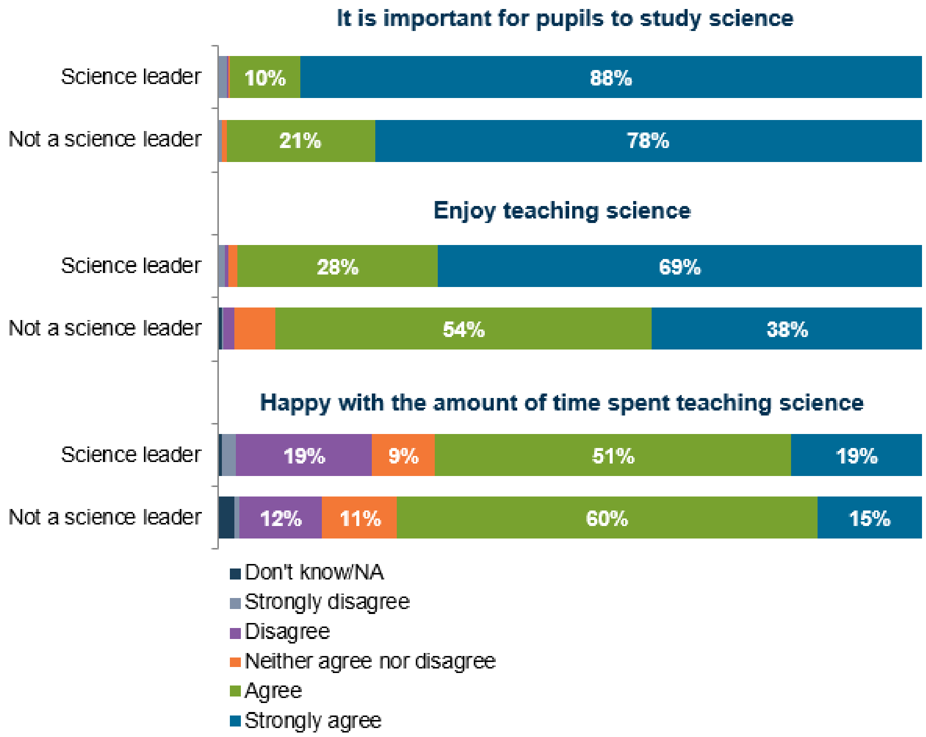
Three-quarters of respondents to the science leadership survey (75%) ‘strongly agree’ or ‘agree’ that teachers in their school are good at teaching science. However, a much lower proportion (56%) think that enough time is spent teaching science in their school, which reflects the baseline findings.

Figure 18: Extent of agreement about time spent teaching science and how good teachers are at teaching science as reported in the science leadership survey. Base=853.



Nearly all survey respondents (99%) 'strongly agree' or 'agree' that 'it is important for pupils to study science', while 95% enjoy teaching science. Only 71% of respondents 'agree' or 'strongly agree' that they are happy with the amount of time they spend teaching science.

Figure 19: Extent of agreement about science views by role as reported in the science leadership and teaching surveys. Base: science leader=786, Non-science leader=488.



Respondents from the teacher survey were asked to state the first three words which came to mind when describing science. Figure 20 provides an overview of the most common words reported.

Figure 20: Word cloud representation of the most common words teachers think of when describing science

Three-fifths (60%) of all 1,263 words provided were of a technical or scientific nature relating to the process of undertaking scientific experiments or investigations (see Figure 25) with, for example, the words 'Investigation, 'Experiment', 'Practical' often cited. A smaller proportion (6%) of responses related to the wider application of science, for example 'Knowledge', 'Understanding' and 'World'; with 3% linked to school topic areas such as 'Space', 'Environment', 'Nature' or to the science disciplines 'Biology', 'Physics' and 'Chemistry'.

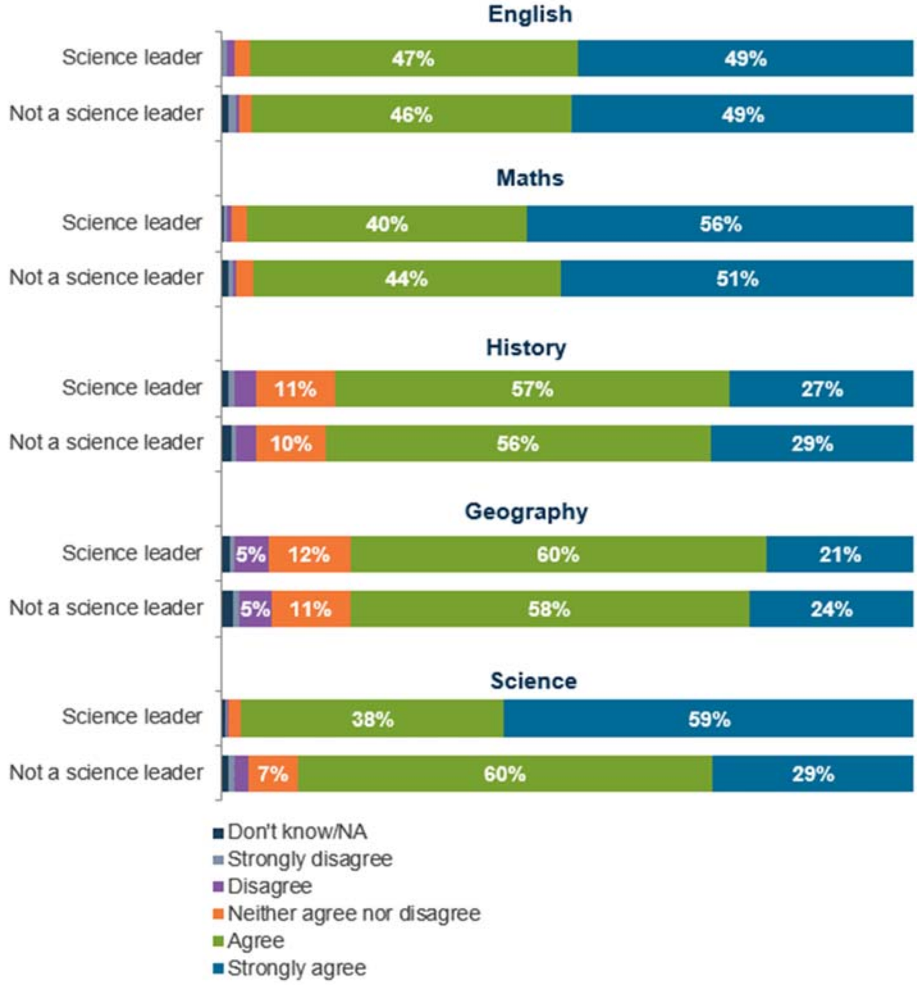
One-quarter (24%) of responses were related to positive emotions – expressing the positive aspects of learning or teaching science – using words, for example, including 'Fun', 'Exciting' or 'Interesting'. Negative emotions were less frequent and equated to 2% of responses, such as 'Daunting' or 'Jargon', or linking to the complexity of science, with responses including 'Puzzling', 'Challenging' or 'Complex'.

Figure 21: Word cloud representations of words relating to the process of undertaking scientific experiments or investigations (blue); positive emotions about science (green); and negative emotions and the challenges of science (orange).

4.5 Confidence teaching subjects

Levels of confidence in teaching maths, science and English are similar, with most respondents stating they ‘agree’ or ‘strongly agree’ (see Appendix 2). While there is very little difference between science leaders and non-science leaders’ confidence in teaching English and maths, confidence in teaching science is much higher among science leaders (59% ‘strongly agree’ compared with 29% of non-science leaders) indicating it is specific to science.

Figure 22: Extent of agreement about confidence teaching subjects by role as reported in the science leadership and teaching surveys. Base: science leader=785 – 786, Non-science leader=487 – 488.

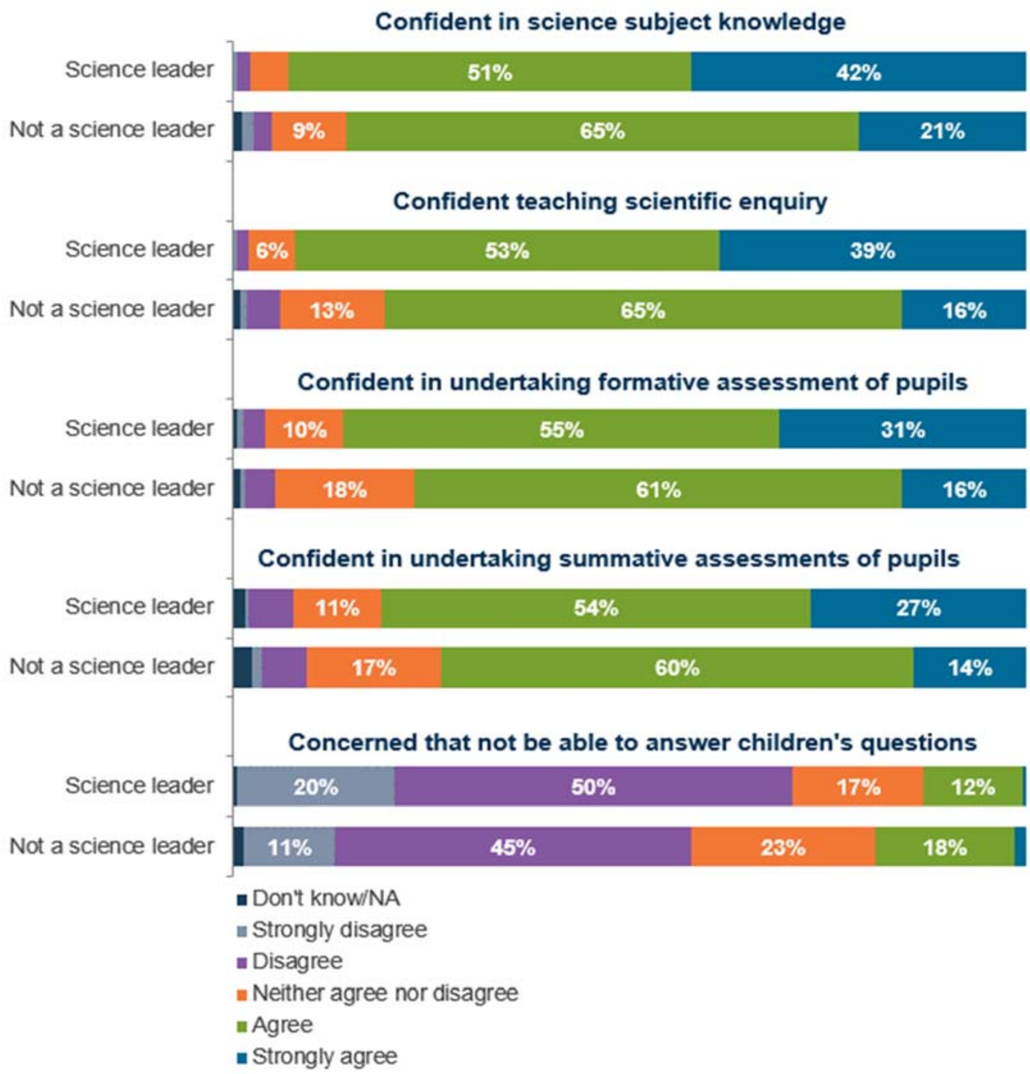


While confidence levels among science leaders is higher, a higher proportion who receive release time state ‘strongly agree’ (64%) compared with those who did not (52%).

Different aspects of science confidence were explored. Just over one-third (34%) of respondents ‘strongly agree’ they are confident in their subject knowledge, with a slightly lower proportion (30%) stating they feel confident teaching scientific enquiry. While overall confidence levels are relatively high, 15% of respondents ‘strongly agree’ or ‘agree’ that they are concerned they might not be able to answer children’s questions about science. In addition, 19% state they ‘neither agree nor disagree’ (see Appendix 2).

As with overall confidence, science leaders are more confident about different aspects of teaching science than those not in that role. One-in-five (20%) of science leaders ‘strongly disagree’ that they are concerned that they may not be able to answer children’s questions about science, compared with just 11% of non-science leaders.

Figure 23: Extent of agreement about confidence teaching science by role as reported in the science leadership and teaching surveys. Base: science leader=785 – 786; Not a science leader=487 – 488.



Analysis was undertaken to explore which individual and school-level characteristics have most influence over different aspects of confidence when teaching science.[20] All models were significant accounting for between 13% and 39% of the variance in confidence, with other factors which have not been measured through the study accounting for the unexplained variance. The common characteristics that have the most influence across different aspects of confidence when teaching science are:

— Enjoying teaching science

— Being a science leader in a school compared to non-science leaders

— Viewing science as important to the school

— Holding a science A Level[21] or Advanced Higher qualification

[20] Multiple regression. Variables added into the models but no association found for: school size, percentage FSM, number of years working in the teaching profession, full/part time worker, Explorify/comparator school, school has science on School Development Plan, number of Explorify activities used, mean number of hours teaching science per week.
[21] This is defined as holding a Biology, Chemistry or Physics A Level or Advanced Higher.

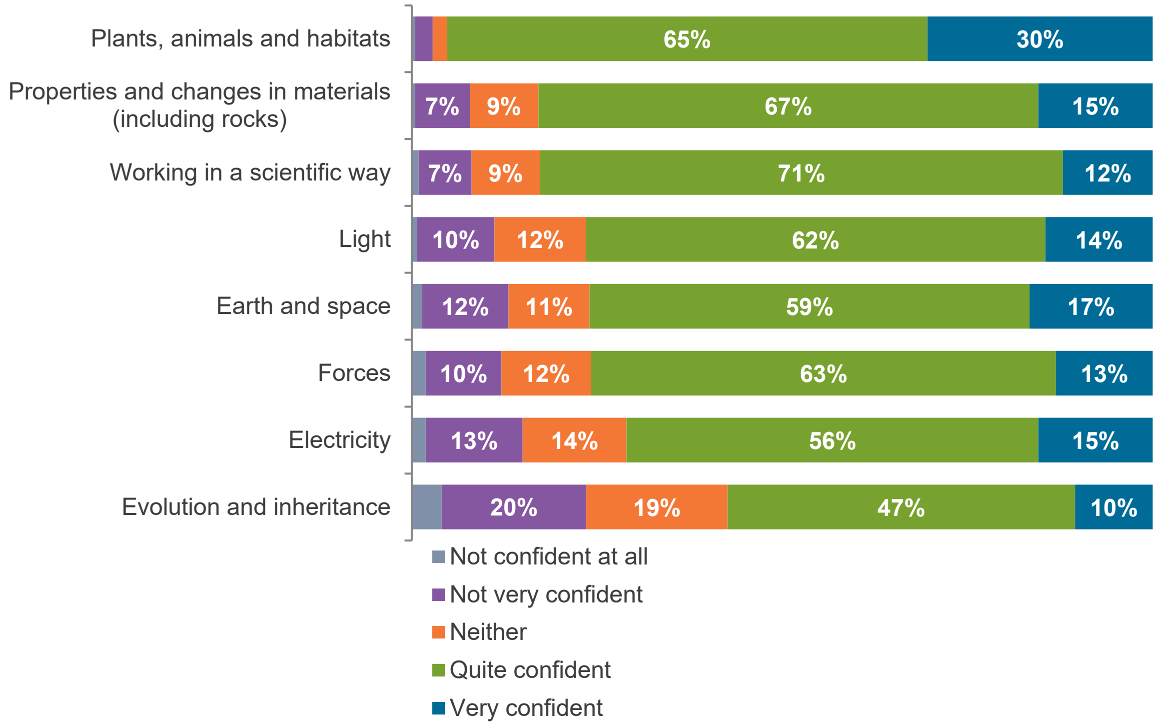
A more detailed breakdown of the characteristics that influence different aspects of confidence when teaching science is shown in Table 5. Whilst this analysis found that the number of Explorify activities a respondent has undertaken with their classes does not influence their confidence in teaching science, 'enjoying teaching science' does and taking part in Explorify increases teachers' enjoyment of teaching science, as outlined in the previous chapter.

Table 5: Rank order of variables affecting each question through multiple regression for confidence teaching science as reported in the science leadership and teaching surveys (bases = 620-625)

	Rank linear regression for influences				
	Confident teaching science (39% of variance explained)	**Confident in science subject knowledge** (33% of variance explained)	**Confident teaching scientific enquiry** (31% of variance explained)	**Confident in undertaking formative assessment of pupils** (20% of variance explained)	**Confident in undertaking summative assessment of pupils** (13% of variance explained)
Enjoyment teaching science	1	1	1	1	1
Person is a Science leader	2	4	2	4	3
Holding a science A Level of Advanced Higher	3	2	4	3	5
School holds the Primary Science Quality Mark (PSQM)	4				
School views science as important	5	5	3	2	2
Males		3	5		
Head Teachers/Senior Leaders					4

Respondents to the teaching survey were asked how confident they are in teaching the various aspects of science shown in Figure 24. A higher proportion state they are 'very confident' or 'quite confident' at teaching 'plants, animals and habitats' (95%), followed by 'properties and changes in materials' (83%), 'working in a scientific way' (83%) and 'earth and space' (76%). Only 57% are as confident in teaching 'evolution and inheritance'.

Figure 24: Confidence teaching aspects of science as reported in the teaching survey. Base=420 – 481.



Further analysis was carried out to explore which individual and school-level characteristics have most influence over the confidence of teaching various aspects of science[22]. Associations were found, accounting for between 12% (confident teaching forces) and 29% (confident working in a scientific way) of the variance, with other factors which have not been measured through the study accounting for the unexplained variance. The common characteristics associated with higher levels of confidence in teaching different aspects of science are:

— Enjoying teaching science

— Viewing science as important to the school

— Training being provided by Science Leaders

— Being male

— Holding a science A Level[23] or Advanced Higher qualification

[22] Multiple regression. Variables added into the model but no association found for: school size, percentage FSM, being a Science Leader as opposed to non-Science Leader, whether school holds/does not hold PSQM, Explorify/comparator school, school has science on School Development Plan, mean number of hours teaching science per week, Head Teacher/SLT vs. non-management role, school has provided access to science lesson plans or other science materials, the school has provided access to online courses, training or resources for science, lesson observations for science, not received any support for science teaching in the last year from school.

[23] This is defined as holding a Biology, Chemistry or Physics A Level or Advanced Higher.

A more detailed breakdown of the characteristics that influence confidence in teaching different science topics is provided in Table 6. Higher use of Explorify activities was associated with higher confidence levels in teaching science topics about 'light', but was not found to influence any other aspects of science teaching. However, enjoying teaching science continues to be a main influencer which Explorify has a positive impact on.

Table 6: Rank order of variables affecting each question through multiple regression for higher confidence levels teaching various aspects of science as reported by teachers in the teacher survey[24] (bases = 180-181)

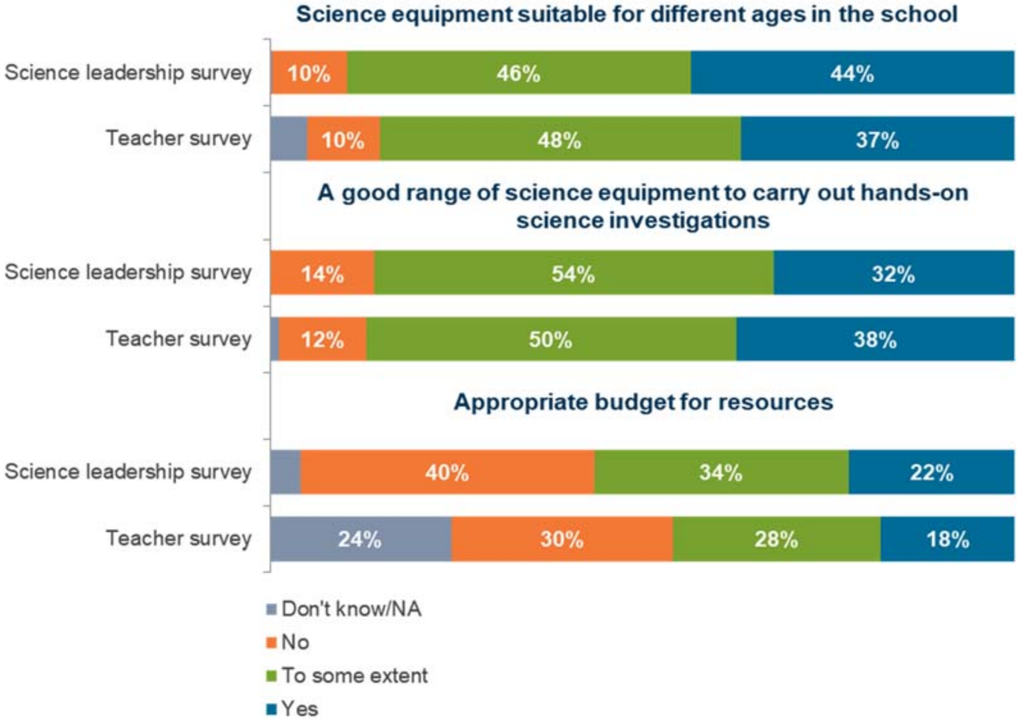
	Rank linear regression for influences					
	Working in a scientific way (29% of variance explained)	**Properties and changes (including rocks)** (23% of variance explained)	**Electricity** (23% of variance explained)	**Plants, animals and habitats** (21% of variance explained)	**Light** (18% of variance explained)	**Forces** (12% of variance explained)
Enjoyment teaching science	1	1	1	1	2	1
Holding a science A Level of Advanced Higher			4	4		2
School views science as important	2	3		2		
Males		4	3		1	
Science leader has provided science training	3	2		3		
Part-time worker						3
Higher use of Explorify activities					4	
Working in teaching profession for a longer period of time			2			
Not receiving coaching/mentoring					3	

4.6 Science resources in the school

Less than half (44%) of all respondents to the science leadership survey consider that the science equipment in their school is suitable for different ages compared with just over one-third of respondents to the teaching survey. Approximately one-third completing the science leadership (32%) and teaching surveys (38%) state that their school has a good range of equipment to enable children to carry out hands-on science investigations. Less than one-quarter (22%) of science leadership respondents state that their school has the appropriate budget for science resources, and 40% state that their school does not have the appropriate resources – compared with 30% of those completing the teaching survey.

[24] The multiple regression models for confidence levels in teaching science topics about evolution and inheritance and topics about earth and space were non-significant.

Figure 25: Extent of agreement about the suitability of science resources in schools as reported in the science leadership and teaching survey. Base: science leadership survey=850; teaching survey=420 – 421.



Teachers' views of the suitability of resources for different ages are associated with the perceived importance of science in the school, with a higher proportion of teachers who perceive science as 'very important' to their school stating 'yes' (50%) compared with those who perceive it as 'important' (33%) and 'neither important or unimportant' (21%).

Three-quarters of science leaders interviewed report they are responsible for monitoring and replenishing science resources and equipment within their school. A few science leaders have complete autonomy over what they decide to buy (within an allocated budget) while most need any spending agreed by a senior leader – especially where there is not a specified budget.

> ***"I would approach my head and say we need this and then it would be budget that would decide or dictate whether we could afford it [there's] no budget allocated to subjects."***
>
> **Science leader**

The most challenging aspect of resourcing was the replacement of single-use items and often interviewees used their own money to buy things such as vinegar or baking soda for lessons or would try and adapt their lesson to avoid using resources that are difficult to source or too expensive. To maximise available budgets science leaders describe gaining access to external grants from charities or scientific organisations (i.e. the Physics Society); gaining resources from CPD providers who "throw in" certain consumables; borrowing or pooling resources with other local schools; and also asking parents or guardians to supply resources such as household items for specific lessons.

Almost all interviewees have observed a decrease in their science budget over recent years. Despite this, over half thought the budget they had for science was sufficient.

> ***"If I was running low on budget, and there was something that I thought would be beneficial, as long as I could, sort of, tell [the headteacher] why it's beneficial and why I need it, there's a bit of movement management-wise that we could probably find the resources."***
>
> **Science leader**

5. Conclusions

This section summarises the key conclusions emerging in relation the use of Explorify in schools, the early impacts of Explorify and the leadership and delivery of science in schools.

The use of Explorify

Most science leaders continue to find out about Explorify through external science CPD they have attended. They pass this knowledge and experience on to teachers in their school who, in turn, spread the word among their colleagues. Most science leaders either formally advocate the use of Explorify or have recommended it to colleagues informally. This highlights the importance of science leaders and the role they play in encouraging others to use resources in their school but presents challenges in engaging those who do not attend CPD. Lack of time continues to be the primary reason why teachers have not yet used the resource or have not used all aspects of Explorify, such as newsletters or blogs. This lack of time highlights the difficulties in promoting the resource through targeted emails or newsletters as these are often not read even when engaged with.

The resource being free is critical to encouraging teachers to use it alongside the fact that it has high-quality visuals and is easy to use. This continues to motivate teachers to use the resource alongside the wealth of activities, the links to the curriculum and ultimately the impact it has on teachers and pupils.

On average, respondents use Explorify once a week with pupils in their class, although this varies greatly between teachers. Explorify is frequently used during science lessons, although many use it during other lessons and at various times throughout the school day. The activities are easy to use and many are short which enables teachers to use the resource with little planning allowing them to fit extra science in at the end of, or between, lessons. There are examples of where teachers use Explorify for the whole lesson, but it is most frequently used as a short exercise at the start or end of a lesson to introduce or consolidate learning, or to assess knowledge.

The impact of Explorify

Those who use Explorify describe the wide range of impacts the resource has on pupils and teachers. The nature of Explorify activities ensures pupils of all abilities are able to take part in class discussions and stimulates curiosity encouraging pupils to ask questions. A key factor in encouraging pupils to engage in class discussions is that strong literacy skills are not needed and there is less fear of being wrong and it is, therefore, important for SEN pupils or those from a disadvantaged background. Pupils enjoy science lessons more and Explorify helps to break down stereotypes of science as ‘boring or scary’, which motivates pupils as they do not start lessons with a negative attitude. Pupils not only increase their science knowledge through Explorify but also develop critical skills including scientific reasoning and observation techniques. Explorify also supports pupils to develop their oracy skills (sometimes a strategic priority within schools), with an even greater impact on those who are SEN, struggle with literacy or are in early years’ classes.

Using Explorify not only has an impact on pupils but also has a range of positive impacts on teachers and their teaching practice. Almost all respondents agree that Explorify has led to them more frequently encouraging pupils to take part in class discussions and, as a result, there has been an increase in pupil-led learning. Teachers use Explorify when planning their lessons and regularly use it to assess pupils’ knowledge either before or after lessons. Two-fifths of teachers describe how using Explorify has increased the amount of time they spend teaching science. All interviewees describe how time constraints make it difficult to teach more science as it can conflict with the time needed for other subjects. Despite this, Explorify is used between lessons or in lessons other than science and can, therefore, lead to pupils being exposed to more science. Although the time spent teaching science has not always increased, teachers report the quality of their/colleagues teaching has improved. Alongside influencing teaching practice, Explorify has led to teachers enjoying teaching science more, improving their confidence and, for a minority, has motivated them to undertake CPD.

Strategic issues relating to science delivery

Most schools have a dedicated staff member responsible for leading science development and teaching across their school. Nearly two-thirds of science leaders get specific release time to lead science in their school, in addition to time to plan their own lessons, which is slightly higher than reported in the baseline report although, for most, only a relatively small amount of time is taken throughout the year, with their role often undertaken during evenings or weekends. Science leaders in larger schools, where science is included on the School Development Plan and is viewed as important are more likely to receive release time.

While respondents believe science is important to their school, a much lower proportion believe it is very important when compared to English and maths. Just under two-thirds of schools have science included in their School Development Plan for the 2019/20 academic year and nearly two-thirds are currently reviewing the way science is taught across the school.

Just over half of all science leaders have undertaken external CPD in the last year to help them lead or develop science throughout their school. Science leaders in schools who use Explorify or hold PSQM are more likely to have received CPD in the last year which suggests the school views the development of science leadership as important. This learning is then passed down to teachers, with teachers being unlikely to receive external CPD themselves. Teachers at schools where Explorify is used are more likely to report they receive support from their school to teach science, compared with those in schools not using Explorify. They are also more likely to receive support if the science leader receives release time and/or CPD. That support most frequently consists of receiving lesson plans, coaching or mentoring from a science leader; being provided with science training; or gaining access to online courses, training or resources.

The delivery of science

Teachers mostly report teaching science weekly either as a stand-alone subject or through cross-curricular lessons. Younger pupils typically receive cross-curricular science teaching rather than stand-alone lessons and for fewer hours. On average, science is taught weekly for 1.5 hours (1 hour and 30 minutes) and 55% of classes do not receive 2 hours of science a week or more.

Weekly lessons are often supplemented with other methods such as science weeks, science visits or other methods. When combined with the number of hours taught on a weekly basis, the total amount of science delivered throughout the academic year, on average, still equates to less than two hours per week across all year groups. On average, classes are taught science for the equivalent of 1.9 hours a week (1 hours and 54 minutes) in total and 50% of classes receive less than 2 hours a week (similar to the times reported last year).

Teachers often encourage pupils to take part in class discussions and encourage pupils to predict what will happen when they do science investigations. However, there is less opportunity for pupils to design their own science investigations.

Perceptions of science

Overall, respondents are positive towards science and think it is important for pupils to study the subject. However, many believe that not enough time is spent teaching science in their school. Within the teacher survey, respondents were asked to state the first three words which came to mind when describing science. A high proportion of the responses relate to the process of undertaking scientific experiments or investigations with words such as 'Investigation, 'Experiment', 'Practical' cited. Approximately one-quarter of the responses are associated with positive emotions; conversely, around 2% of responses link to negative emotions or those which relate to science being 'Complicated'.

Respondents are broadly confident in their ability to teach science, although they rate this lower than their confidence to teach English and maths with the exception of those in the science leader role. Enjoying teaching science is a key predictor of an individual's confidence levels alongside being a science leader, viewing science as important to the school or holding a science a level. Higher use of Explorify activities was only associated with higher confidence levels in teaching the science topic 'light', but was not found to be a predictor for any other aspects of science teaching. However, enjoying teaching science continues to be associated with higher confidence which Explorify has an impact on. For teachers, receiving training from their science leader also was associated with higher levels of confidence.

APPENDIX 1: RESPONDENT CHARACTERISTICS

Characteristics of those responding to the Science Leader survey

School size

	Number	Percentage
99 or less pupils	54	6%
100 - 199 pupils	140	17%
200 - 299 pupils	258	31%
300 or more pupils	381	46%

School role

	Number	Percentage
Classroom teacher	754	88%
Deputy/Assistant Headteacher	38	4%
Acting Headteacher	5	<1%
Headteacher	45	5%
Other role	10	1%

Years working in the teaching profession

	Number	Percentage
5 years or less	215	26%
10 years or less (more than 5)	223	27%
20 years or less (more than 10)	246	29%
30 years or less (more than 20)	134	16%
More than 30 years	18	2%
Mean	12 years	
Range	0 – 41 years	

Full time or part time status

	Number	Percentage
Full time	668	79%
Part time	182	21%

Gender

	Number	Percentage
Female	701	82%
Male	149	18%

Class responsibility

	Percentage
Reception	12%
Year 1	15%
Year 2	23%
Year 3	22%
Year 4	25%
Year 5	25%
Year 6	25%
Our school does not have specified school years due to offering special/alternative provision	<1%
None	12%

Characteristics of those responding to the teacher survey

School size

	Number	Percentage
99 or less pupils	10	2%
100 - 199 pupils	42	10%
200 - 299 pupils	103	26%
300 or more pupils	246	61%

School role

	Number	Percentage
Classroom teacher	413	98%
Deputy/Assistant Headteacher	5	1%
Other role	3	1%

Years working in the teaching profession

	Number	Percentage
5 years or less	131	33%
10 years or less (more than 5)	92	23%
20 years or less (more than 10)	111	28%
30 years or less (more than 20)	57	14%
More than 30 years	6	2%
Mean	11 years	
Range	0 – 40 years	

Full time or part time status

	Number	Percentage
Full time	346	83%
Part time	72	17%

Gender

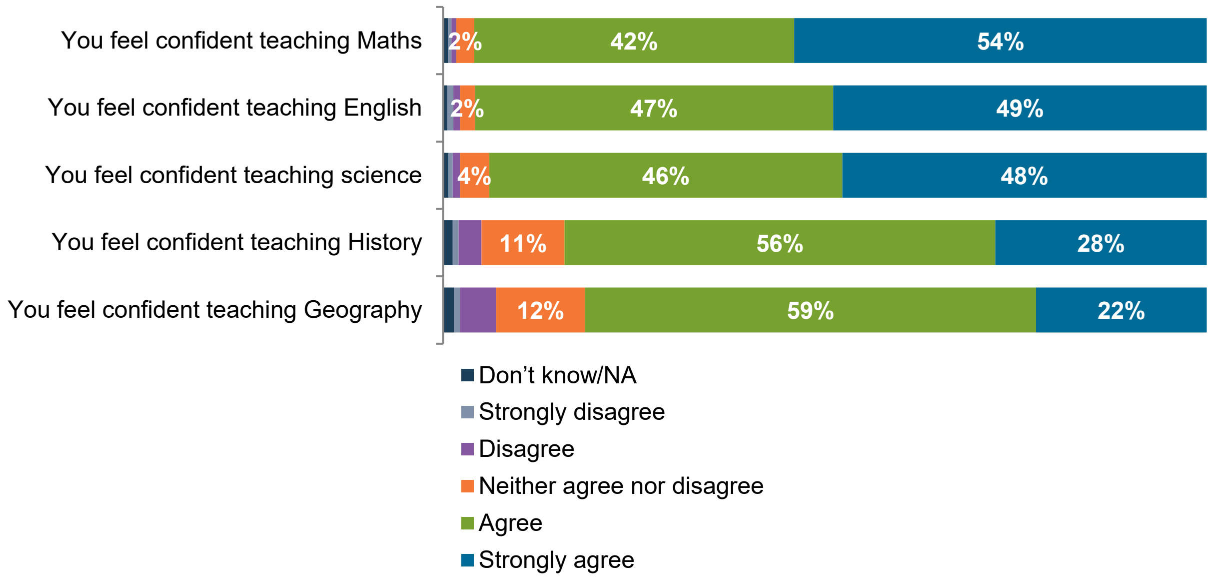
	Number	Percentage
Female	371	89%
Male	47	11%

APPENDIX 2: ADDITIONAL ANALYSIS

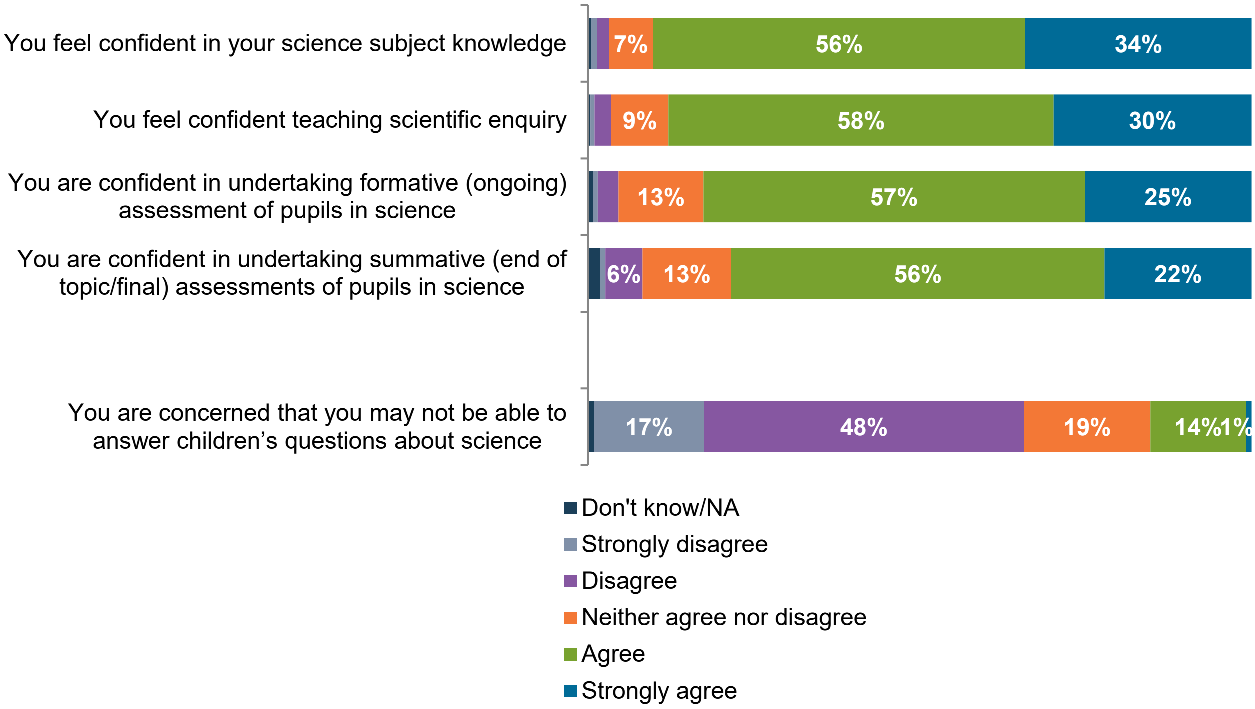
Number of weeks and hours dedicated science weeks are delivered as reported in the science leadership and teaching surveys

	1 week	2 weeks	3 weeks or more		Mean hours delivered each week
Reception (base=79)	80%	11%	9%		7 (base=58)
Year 1 (base=99)	88%	9%	3%		8 (base=82)
Year 2 (base=141)	88%	7%	5%		8 (base=124)
Year 3 (base=145)	90%	3%	6%		8 (base=121)
Year 4 (base=153)	88%	7%	5%		8 (base=132)
Year 5 (base=143)	92%	6%	2%		9 (base=129)
Year 6 (base=139)	88%	9%	4%		9 (base=118)

Extent of agreement about confidence teaching science as reported in the science leadership and teaching surveys. Base=1,271 – 1,273



Extent of agreement about confidence teaching science as reported in the science leadership and teaching surveys. Base=1,273 – 1,274



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