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Does Explorify support better primary science teaching?

A report for the Wellcome Trust



For more information about this report please contact
Sarah Leonardi, Associate Director:

CFE Research, Phoenix Yard, Upper Brown Street, Leicester,
LE1 5TE

0116 229 3300 Sarah.Leonardi@cfe.org.uk
www.cfe.org.uk

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CONTENTS

Executive Summary	1
01. Introduction and methodology	8
02. Awareness and use of Explorify	14
03. The impact of Explorify	27
04. Science leadership and delivery in schools	42
05. Discussion and Conclusions	76
Appendix 1: Repondent characteristics	80
Appendix 2: Additional analysis	82



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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.

In 2017 research was undertaken by CFE and supported by 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. This research captured the baseline position from which the outcomes and impacts of the Primary Science Campaign will be determined, and was reported in the *State of the Nation* report of UK primary science education.²

This report presents data captured from schools using Explorify to explore the outcomes and impacts of the campaign on science delivery and compares science delivery to similar schools not using the resource.

Context

Science teaching varies throughout the UK. In England, the National Curriculum dictates the programmes of study for science year-by-year for Key stages 1 and 2³. However, schools can introduce additional content within the relevant key stage and can also extend it. The position in Wales is broadly comparable, although the Foundation Phase Framework covers Reception and Key Stage 1 with the National Curriculum for science in Wales adopted at Key Stage 2 (a new draft curriculum is currently in development). By contrast, the Curriculum for Excellence in Scotland comprises a broad general education from the early years to age 18. Increased emphasis is on inter-disciplinary or cross-curricular learning, skills development and encouraging personal achievement. The position in Northern Ireland is similar, with science forming part of the 'World Around Us' area of learning.

Approach

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

- A computer-assisted telephone interview of **706** Science Leaders (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

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 Excluding academies

applicable). The sample frame of Explorify schools was created using Wellcome 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. Science delivery methods across the four countries of the UK differ considerably requiring sample sizes to be large enough to undertake meaningful analysis. For this reason comparator schools were only selected from England as this is where Explorify schools are currently predominantly located. Throughout this report, findings from this survey are reported as the **science leadership survey**.

- An online survey of **713** 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.
- 36 semi-structured interviews with a range of school staff, including teachers and Science Leaders who have used Explorify in addition to Headteachers in some of the schools. These interviews explored science teaching; how interviewees use Explorify; and how it impacts on them, their pupils and their school more widely.
- Four case studies focused on schools where a Science Leader was interviewed and where Explorify was used across the school or by a significant number of teachers. Each case study included: up to three additional interviews with staff at the school, an observation of a science lesson and up to three group discussions with pupils.

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*.

The terminology used to refer to pupils' year groups differs throughout the UK. For consistency, we have adopted the English and Welsh terminology of year groups and key stages throughout the report. **Throughout the report all differences in the commentary are statistically significant.**

Key findings

Using Explorify

79% of respondents to both surveys who are aware of Explorify had undertaken Explorify activities with pupils in their school.

Initial **motivations to use the resource**, as described by interviewees, included it being **free, easy to use, high quality** and needing **minimal preparation time**. Science Leaders highlighted how it supports them in their leadership role especially for those with no science background.

Amongst respondents who are aware of Explorify and use it with pupils in their school, **only 4%** of classes taught by these teachers have not yet experienced Explorify (with the teacher using Explorify with other classes but not all). Across **50% of classes use Explorify at least once a week or fortnight**. A further 12% of classes use Explorify every month.

Explorify is often **used by teachers in science lessons** (reported by **88%** of respondents) but is also used at other times in the school day: **42%** use it at the **start of the day**, **38%** use it during **other lessons** and **36%** use it at **other times during the school day** (excluding breaks or lunch).

98% of respondents using Explorify **plan to continue using it**. Interviewees outlined the following reasons for their desire to continue using it:

- Content which links into the curriculum
- Visual nature of the content which appeals to pupils
- Easy to use website
- The impact it has had on them and their pupils

Pupils like Explorify for lots of reasons, with differences by activity type. Common reasons included it being **fun, working in teams**, the **‘surprises’** within certain activities and their being **no right or wrong answers**. Most would **like to use it more** in science and in other lessons.

86% of Science Leaders advocate Explorify’s use to teachers in their school, with most (91%) advocating it to all colleagues at their school. Where Science Leaders have not formally advocated it, most have recommended its use more informally with colleagues.

Amongst **teachers**, **62%** have **recommended Explorify to their colleagues** and most (who have not yet done so) are likely to recommend 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	55%	43%
Pupils ask more questions	45%	50%
Pupils enjoy science lessons more	22%	57%

All interviewees report an increased level of pupil engagement in discussions whilst using Explorify; whilst this is true amongst pupils of all abilities, **most interviewees highlight that it is often pupils who were previously apprehensive or those who were not**

interested in science who exhibit the most notable increase in engagement. This was also true of pupils with SEN (Special Educational Needs) or English as an additional language.

Almost all interviewees describe how Explorify allows children to **express thoughts and answer questions about science without fear of being wrong**, which helps to increasing their engagement in discussions.

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

	'Strongly agree'	'Agree'
Increased science vocabulary	27%	58%
Increased science knowledge	19%	65%
Increased confidence	17%	60%
Improved literacy skills	5%	35%

Almost all interviewees describe how Explorify **is positively influencing pupils in their science lessons through developing critical thinking skills** and aptitude for inquiry. It has helped to **improve science knowledge** whilst reinforcing the view that scientific enquiry involves the questioning of scientific concepts.

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	62%	33%
Encouraging pupils to predict what will happen when they do a science investigation more frequently	23%	54%
Enjoy teaching science more	33%	51%

Half (50%) of all teachers who use Explorify regularly state it has **increased the time they spend teaching science**, whilst the remaining 50% report no change.



Science Leadership in schools

93% of schools have a Science Leader. Larger schools (defined as having 100 or more pupils⁴) are more likely to have a Science Leader than smaller schools (those with less than 100 pupils).

56% of schools report that **science is included in their School Development Plan.**

Science Leaders

92%

Of Science Leaders are classroom teachers.

49%

Get **specific release time to lead science** in addition to planning their own lessons.

54%

Have **undertaken external Continuing Professional Development** lasting one day or more in the last year **to help them lead or develop science** throughout their school.

Importance of science

Respondents to both surveys indicate **how important** they think certain subjects are to the Senior Leadership Team of their school:

- **89%** think **maths** is ‘**very important**’ and 8% ‘important’
- **88%** think **English** is ‘**very important**’ and 9% ‘important’
- **32%** think **science** is ‘**very important**’ and 54% ‘important’

56% of Headteachers/Acting Headteachers/Deputy Headteachers or Assistant Headteachers state that **science** is ‘**very important**’ compared to **29% 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** (**55%**)
- **Coaching** or **mentoring** from their Science Leader (**45%**)
- **Science training** from their Science Leader (**41%**)

85% report they have **received** some form of **support** for **science teaching** from their school in the last 12 months. There are differences between groups:

⁴ A small school is defined by Ofsted as less than 100 pupils.

- **90%** of teachers **from a school where Explorify is used received support** compared to **69%** of teachers in schools **who do not use Explorify**.
- **95%** of teachers who state that science is **‘very important’** to the Senior Leadership Team received support compared to **81%** who stated it is **‘important’** and **73%** who stated it is **‘neither important or unimportant’**.
- **89%** of teachers report receiving support in schools where the **Science Leader has received CPD in the last 12 months** compared to **82%** who had a **Science Leader who has not received CPD**.

Confidence teaching science

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

- **47%** state **‘very confident’** and **46%** state **‘confident’** to **maths**
- **44%** state **‘very confident’** and **50%** state **‘confident’** to **English**
- **29%** state **‘very confident’** and **60%** state **‘confident’** to **science**

The characteristics that are associated with an increase in confidence are:

- Enjoying teaching science
- Being a Science Leader in a school compared to non-Science Leaders
- Holding a science A level⁵ or Advanced Higher
- Working in the teaching profession for a longer period of time
- Being in a school that currently has PSQM (Primary Science Quality Mark) or is in the process of applying for PSQM
- Viewing science as important to the school
- Using Explorify

Science resources

Respondents to the science leadership survey answered a series of statements about the suitability of science resources in their school.

55%

of schools have science equipment suitable for different ages

40%

of schools have a good range of science equipment to carry out hands-on science investigations

29%

of schools have appropriate budget for resources

Science delivery

89% of respondents to the science leadership survey report that in their school **classroom teachers deliver** most **science lessons**. **5%** of schools **have a dedicated science teacher** who takes science lessons whilst **6%** have a mix of the two.

⁵ This has been defined as holding a Biology, Chemistry or Physics A level or Advanced Higher.



Weekly science teaching

Science is taught weekly by most teachers who responded to the survey. Across classes this equated to **91% of classes**. **Standalone lessons** are more prevalent for older year groups. Younger pupils (especially Reception) are more likely to receive cross-curricular work (**60%** 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 1.5 hours** (1 hour and 30 minutes). Lower year groups receive fewer hours of weekly science lessons with the amount of science taught increasing for those in older age groups. Across year groups **on average 56% 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 (as reported in the science leadership survey). 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. Other methods used by schools are dedicated science weeks only, standalone methods (such as block teaching or fortnightly lessons) or a variety of methods (which are not weekly).

Across all of these methods science is taught on average for **1.8 hours** a week (1 hour and 48 minutes – as reported across both surveys). Lower year groups (with the exception of reception) receive, on average, slightly fewer hours. Across year groups, on average, **51% of classes are not receiving the equivalent of two hours of science per week**.

How science is taught

Across both the science leadership and teaching surveys, respondents report that different activities are undertaken with pupils when teaching science⁶:

	'Always'	'Frequently'
You arrange for pupils to design their own science investigations when applicable	14%	39%
You demonstrate science investigations to pupils when applicable	36%	38%
You arrange for pupils to record data or observations from science investigations	32%	50%
You encourage pupils to interpret their science data or observations	40%	43%
You teach science by encouraging pupils to do investigations	36%	53%

⁶ Response options to this survey question were 'always', 'frequently', 'occasionally', 'never', 'don't know' and 'not applicable'.

01. 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,⁷ 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 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.
- 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 UK education context

Science teaching varies throughout the UK. In England, the National Curriculum dictates the programmes of study year-by-year for Key stages 1 and 2.⁸ However, schools can introduce additional content within the relevant key stage and can also extend it. The National Curriculum for science aims to equip young people with: (i) scientific knowledge and conceptual understanding; (ii) an understanding of the nature, processes and methods

⁷ <https://explorify.wellcome.ac.uk/>

⁸ Excluding academies

of science; and (iii) the scientific knowledge required to understand the issues and implications of science.⁹ The Early Years Foundation Stage Framework¹⁰ outlines the requirements for Reception pupils with science being delivered through the *Knowledge and Understanding the World* programme on a cross-curricular basis.

The position in Wales is broadly comparable, although the Foundation Phase Framework¹¹ covers Reception and Key Stage 1 with the National Curriculum for science in Wales adopted at Key Stage 2.¹² This is supported by a non-statutory Skills Framework for 3–19 year olds in Wales to provide guidance and continuity throughout the various stages. In the Foundation Phase, science is similarly taught through *Knowledge and Understanding of the World* which equips children to embrace science. Pupils at Key Stage 2 are then given the opportunity to build on the skills, knowledge and understanding acquired to apply science in everyday life, including current issues. Activities should foster creativity and curiosity, and be interesting, enjoyable and relevant to young people. However, significant change is afoot. The new draft curriculum comprises six Areas of Learning and Experience to allow learners to explore different concepts across grouped subjects. The draft curriculum was published in April 2019 and teachers will have flexibility to develop the curriculum in their school to meet the needs of their pupils.¹³ This will be rolled out in schools from 2022, and replace the current curriculum described as “prescriptive, narrow and outdated” by the Welsh Government.¹⁴

By contrast, the Curriculum for Excellence in Scotland comprises a broad general education from the early years to age 18. It emphasises inter-disciplinary or cross-curricular learning, skills development and encouraging personal achievement. The curriculum is intended to develop four capacities in all young people: successful learners, confident individuals, responsible citizens and effective contributors.¹⁵

The position in Northern Ireland is similar, with science forming part of the *World Around Us* area of learning. The revised Northern Ireland Curriculum covers the Foundation Stage (Years 1 and 2), Key stage 1 (years 3 and 4) and Key Stage 2 (Years 5, 6 and 7), and is set out in six Areas of Learning with science as part of the ‘World Around Us’ area. There is an expectation that teachers integrate learning to make relevant connections for children. It is intended that the learning opportunities presented through the Northern Ireland Curriculum help young people to develop cross-curricular skills (which include communication, using maths and ICT) and thinking skills and personal capabilities. These

⁹ Department for Education (2015). *National curriculum in England: science programmes of study*. London: DfE.

¹⁰ Department for Education (2017). *Statutory framework for the early years foundation stage*. London: DfE

¹¹ Welsh Assembly Government (2015). *Foundation Phase Framework*. Cardiff: Welsh Assembly Government.

¹² Welsh Assembly Government (2008). *Science in the National Curriculum for Wales Key Stages 2-4*. Cardiff: Welsh Assembly Government.

¹³ Welsh Government (2019). *Draft Curriculum for Wales 2022*. Cardiff: Welsh Assembly.

¹⁴ Kirsty Williams (Education Minister) at the launch of the draft curriculum at Olchfa School (Available from: <https://www.cscjes-cronfa.co.uk/news/articles/fob5c037-be43-4166-b9a9-5b778372a39d>)

¹⁵ Scottish Government: Curriculum for Excellence (Available from: <http://www.gov.scot/Topics/Education/Schools/curriculum>)

include: thinking, problem-solving and decision-making, self-management, working with others, and managing information.¹⁶

As of August 2014, teachers in Scotland have been mandated to engage in professional learning, self-evaluate the learning, and maintain a record of the learning by the General Teaching Council for Scotland as a condition of their registration.¹⁷ This is intended to help maintain and improve the quality of teachers in order to enhance the impact they have on pupils' learning, and provides teachers with a responsibility to consider their development needs and an entitlement to a system of supportive professional review and development. There is no such requirement for teachers in England, Wales and Scotland.

1.3 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.¹⁸

This report presents data captured from schools using Explorify 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 four methods, described below.

Science leadership survey

A computer-assisted telephone interview of **706** Science Leaders¹⁹ drawn from both Explorify schools and comparator schools asking a series of questions about the strategic direction of science, awareness of Explorify, and their experience of using it (where applicable). 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 data²⁰ 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

¹⁶ Council for the Curriculum Examinations and Assessment (2007). *The Northern Ireland Curriculum Primary*. Belfast: CCEA.

¹⁷ The General Teaching Council for Scotland (2014). *Professional Update Guidance Notes*. Edinburgh: GTC Scotland.

¹⁸ <https://wellcome.ac.uk/sites/default/files/state-of-the-nation-report-of-uk-science-education.pdf>

¹⁹ Or other senior leaders where there was no Science Leader in the school or they were unavailable at the time of interview.

²⁰ Wellcome Explorify usage data provides information about the level of engagement for each individual teacher who has signed up to Explorify.

activities and visited the site at least a year after signing up²¹. In total 1,770 schools met these criteria and schools were randomly selected to take part, focusing 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 time spent teaching science in Explorify and non-Explorify schools. Science delivery methods across the four countries of the UK differ considerably requiring large sample sizes to undertake meaningful country specific analysis. For this reason comparator schools were only selected from England as this is where Explorify schools are currently predominantly located. 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 in regard to key characteristics²². The surveys were undertaken between October 2018 and February 2019.

The overall sample initially comprised 406 Explorify schools and 300 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 use Explorify and Explorify schools reporting that they were not aware of and did not use Explorify. This resulted in 398 Explorify schools, 285 comparator schools and 23 whose status is inconclusive.

Teaching survey

An online survey of **713** 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 274 schools. The surveys were completed between January 2019 and May 2019. A minority of respondents indicated that they were Science Leaders (n=85) 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**.

²¹ Explorify was launched in September 2017.

²² School characteristics were school type and school size.

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)
- 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 36 semi-structured interviews were undertaken with staff drawn from 32 schools during the Spring and Summer terms of 2019. Throughout the interviewing period additional questions were added to the topic guide to explore emerging themes. The key characteristics of those responding are outlined and highlight a mix of different school roles. In four schools more than one interview was undertaken.

Role	Number of interviews
Headteacher	6
Science Leader	19
Classroom teacher	11

Case studies

Case studies focused on schools where a Science Leader was interviewed and where Explorify was used across the school or by a significant number of teachers. Four schools were selected in England and visited by the research team.

In addition to the Science Leader’s interview the case study research included:

- Up to three interviews with other staff who were able to provide feedback on using Explorify and/or the impact it has had on pupils and teachers in the school. This included: headteachers, Senior Leaders and teachers. These interviews were either undertaken on the day of the visit or by telephone.
- Observation of a science/topic lesson. This was designed to observe how the pupils are interacting in science lessons and understand the types of activities they are undertaking in science and not to make any judgements about teaching.

- Up to three small group discussions with pupils (4-5 per group) from any year group between Year 3 and Year 6. These lasted approximately 30 minutes.

Data collected from the case studies was analysed alongside the 36 qualitative depth interviews. Visit our [report page](#) to read the case studies.

1.4 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.²³ 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 have not quantified the number of responses to a particular theme. To aid the reader we have provided an assessment as to the proportion of interviewees who have 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** explores the leadership and delivery of science in respondents' schools. **Chapter 4** examines the impact that Explorify has on teachers and pupils and **Chapter 5** summarises the key conclusions emerging.

²³ Please note that some graphs contain statistically insignificant findings. Please refer to the text for statistically significant differences.

02. 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 have been 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, 64% are aware of the Explorify resource (this is partially a result of purposively selecting schools and individuals who are currently using Explorify). The majority of respondents (86%) from Explorify schools (where one or more teacher uses Explorify) are aware of the Explorify resource²⁴, compared with 14% from comparator schools.

Almost all Science Leaders interviewed discovered Explorify through a science training course or conference, such as conferences with links to Wellcome or courses provided by STEM Learning. Most of the signposting by these training providers presented Explorify as a suggested science teaching resource alongside other resources. A small number of interviewees highlight how their provider actively encouraged them to use Explorify, and occasionally they were provided with the opportunity to use the resource during the training session.

Almost all teachers without science leadership responsibilities found out about Explorify through a colleague (usually their Science Leader or a member of the senior leadership team) who had encountered the resource through a training provider. One-third of teachers without science leadership responsibilities stated a colleague had formally presented it to them as part of a staff meeting or internal training session.

“[The Science Leader] arranged a staff meeting and showed us, I think she’d recently been on a course, lots of different websites and apps and things that could be used and how they could be used, I think some people had picked up on a few bits and pieces, some people haven’t. Explorify was one of the ones that I used.”

— Teacher

Around a quarter of teachers said their Science Leader referred them to Explorify through a school-wide email. One headteacher, however, highlights that a Newly Qualified Teacher

²⁴ Not all teachers at a school use Explorify, and therefore may not be aware of the resource.

(NQT) was the source of their schools' introduction to Explorify. The few remaining interviewees either cite social media and/or search engines as a source of discovery or are uncertain where they had first encountered Explorify.

Nearly four-fifths (79%) of respondents to the science leadership and teaching surveys who are aware of Explorify had undertaken activities with pupils in their school. Only 8% have not used Explorify, whilst the remaining 13% have undertaken activities but not with pupils in their current school. Within Explorify schools, 85% of those who were aware of it have undertaken activities with pupils in their current school. Across the schools, respondents to the science leadership survey report that Explorify was used on average by 6 teachers (including themselves where applicable).

Initial motivations

The majority of interviewees describe how Explorify is easy to use, and say that this encouraged them to use it for the first time. With teachers reporting they have limited time, they appreciate how quickly and easily the resource can be set up with minimal preparation.

“You don't have to prepare anything, it's done. So, if the video clip takes 1 minute 33 seconds you can watch that on your phone before using that clip. So, it's a quick thing, it's little input and maximum output.”

— Science Leader

Headteachers, in particular, highlight how Explorify being free was influential in their decision to use it in the school. Almost all Senior Leaders also cite this as an initial motivation to use it in their school. One Science Leader highlights how they did not want to “waste” budget on unsustainable resources, which led them to favour Explorify as a resource.

A few Science Leaders had spent time looking for a high-quality resource and explained that before they encountered Explorify they had been largely unsuccessful. The fact that Explorify filled a gap in the market heavily influenced their enthusiasm for the resource.

“Because teachers are always looking for something which is going to engage the children, and if I'm being honest, with minimal preparation wherever possible, there are not that many resources out there where you can literally pick it up and have a quick fix and think ‘That is really up to date.’”

— Science Leader

Around half of Science Leaders interviewed explained their decision to use Explorify was influenced by how it would support them in their leadership role, as they believe it would be a valuable way for them to support their colleagues to teach science. They highlight that it would be especially useful for colleagues who had no scientific background, as it offers the capacity to encourage them to teach science more often and with greater confidence.

“I thought it was very supportive for teachers who were non-specialists, because at our school we’ve got two teachers with a science background from their degrees and everybody else not, and so sometimes people shy away from not wanting to look at a certain topic in science, because they don’t feel their own subject knowledge perhaps is as strong and don’t feel able to answer the questions that children might throw up.”

— Science Leader

“For me one of the things that came up in the audits was that a lot of the teachers didn’t really have any clue about scientific inquiry or starting with a question and then exploring that further. So, Explorify was a good opportunity to do that simply”

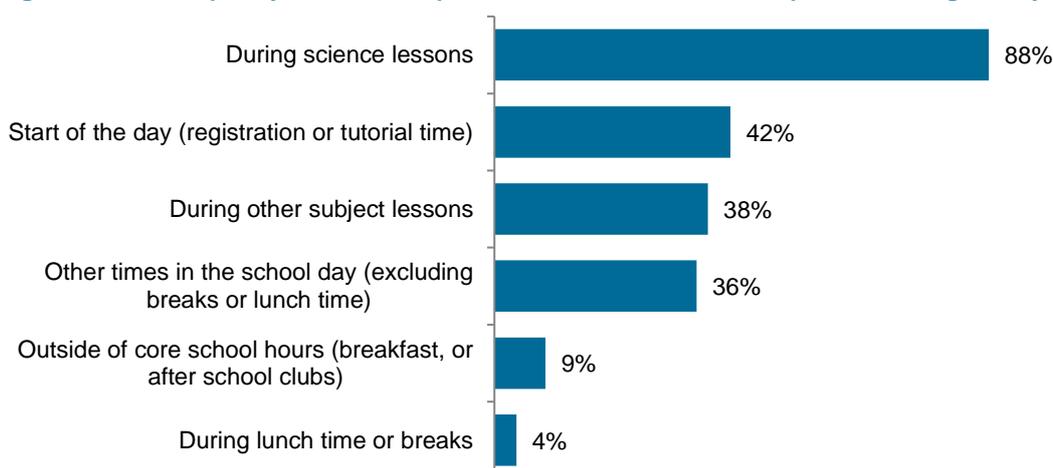
— Science Leader

2.2 How Explorify is used

Across both surveys the majority of respondents (88%) who use Explorify report they use the resource during science lessons (Figure 1). Over one-third (38%) use Explorify during other subject lessons. Over two-fifths (42%) use Explorify at the start of the day prior to lessons commencing, whilst just over one-third (36%) use Explorify at other times during the day (excluding breaks and lunch time).

The majority (88%) of respondents to both surveys *only* use Explorify during the school day (excluding lunch time or breaks and outside of core school hours). Less than 1% use it *only* during lunch times or breaks and outside of core hours. The remaining 12% use a blended approach using Explorify both during the school day and during lunch time or breaks, or outside of school score hours.

Figure 1: When Explorify is used as reported in the science leadership and teaching surveys. Base=650.



Interviewees described how they value the way that Explorify encourages pupils to engage in discussions, which they find useful as a way to supplement their teaching and as a bridge between lessons (either at the beginning or the end). Explorify was also described as an effective method of summarising and reviewing learning from a lesson. Interviewees described how they use Explorify during science lessons, other topic lessons or as a stand-alone activity before a lesson starts. Most use it as a short exercise and only a small

number use the longer activities. The brevity of exercises was described by one interviewee as a key reason for the resource’s success, as it maintains pupils’ interest and enthusiasm.

In addition to regular use during lesson times, a few participants highlighted how they use Explorify during assemblies or as a replacement for an assembly (if it is cancelled). One interviewee described how it could be used in a number of different scenarios:

“We’ve used [Explorify] throughout lessons. We’ve used it during special weeks like British Science Week. I’ve used it during the reading evening where we had 400 visitors after school.”

— Science Leader

Survey respondents were asked to report how regularly they use Explorify activities with each class they teach and the number of activities they complete during these intervals. Table 1 (below) displays how regularly survey respondents use Explorify activities with their respective classes. Respondents most commonly report using Explorify on a weekly or two-weekly basis. Analysis was undertaken to work out the number of Explorify activities that were undertaken with each class as a weekly equivalent. On average, across all year groups, respondents report they use Explorify activities 0.9 times a week over the course of the academic year; therefore on average respondents complete one Explorify activity a week with their pupils. Only small differences exist between respondents teaching different year groups. Further analysis reveals that 89%²⁵ of respondents who use Explorify activities with more than one year group use the resource across all classes for the same amount of time.

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

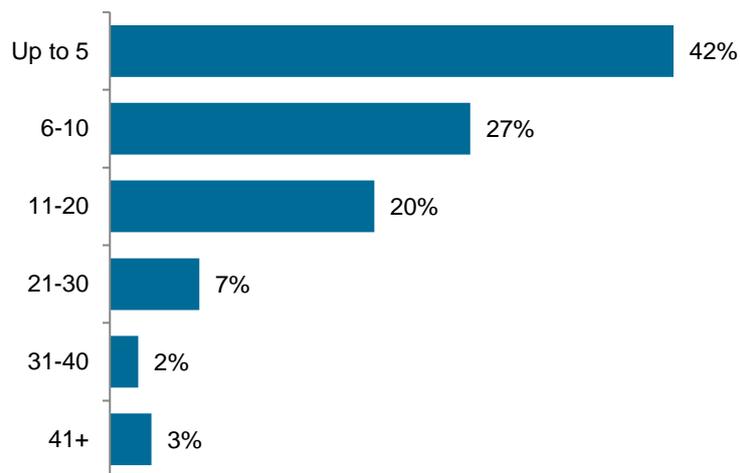
How regularly Explorify activities are used with classes taught	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Special school	Across all years
Base	77	128	161	171	179	179	170	6	1,071
I haven't used it yet	9%	3%	3%	3%	2%	4%	4%	0%	4%
I do not use Explorify regularly	8%	9%	8%	5%	8%	7%	7%	17%	7%
Approximately every week	30%	30%	29%	25%	31%	27%	28%	17%	28%
Approximately every two weeks	17%	24%	26%	20%	21%	22%	20%	17%	22%
Approximately every month	20%	20%	20%	27%	20%	18%	20%	33%	21%
Approximately every half term	12%	10%	9%	14%	14%	16%	10%	0%	12%
Approximately every term	4%	2%	4%	5%	5%	6%	10%	17%	5%
Other	1%	2%	1%	1%	0%	0%	1%	0%	1%
Mean activities per week	0.9	1.0	0.8	0.9	1.0	0.8	0.8	1.0	0.9

²⁵ Base=151

On average, Science Leaders report using Explorify activities with their classes once a week, compared with non-Science Leaders who report using Explorify activities 0.7 times a week.

On average survey respondents report that they have used Explorify activities 12 times in total with each class. Over two thirds (69%) of respondents have completed up to 10 activities, a fifth (20%) have completed between 11 and 20, and just over a tenth (12%) have completely 21 or more activities with each class they teach (Figure 2).

Figure 2: Breakdown of the average number of Explorify activities each respondent has completed per class. Base=617.



2.3 Continuing to use Explorify

Almost all respondents (98%) using Explorify in their current school plan to continue using activities with their pupils. The remainder stated they were either unsure or would not use them.

Content

Explorify is routinely updated with new content and activities, making it a dynamic and interactive resource which always seeks to remain relevant. Almost all interviewees report that Explorify has content that ties in with their curriculum and describe how the inclusion of additional activities on the website is a key factor in their decision to keep using the resource. Increasing the amount of content is considered important as this leads to the resource becoming more applicable to different topics and lessons. The regular content renewals are also cited by a few interviewees as important for the relevance of the resource, because this ensures it remains topical and fresh.

“Really relevant, and quite creative as well... they’re all linked to what the children are learning, but they’re not always the most obvious ones. So it makes you think outside the box a little bit, which is really good I think.”

— **Science Leader**

Whilst relevance to the curriculum is evident within Explorify, a small number of interviewees do not believe that it is always necessary for the content to directly correlate to a lesson plan, especially when used as a standalone or lesson-starter activity.

Interviewees liked the visual nature of the resource. Around half of participants believed that using images and videos helped Explorify to become one of the most engaging resources they use with pupils. The up to date appearance and content was seen as something which distinguished Explorify from other resources.

“It’s very visual, so, for younger children, they can see the concepts that you’re talking about. I think it’s really good at encouraging thinking and getting discussions.”

— **Headteacher**

Website

All interviewees are happy with the way in which Explorify is set out, and praise the accessibility of the content within the website. Many interviewees find it easy to browse and access activities specific to a certain topic or subject area.

“One of the best things about it, is that the menus when you open into Explorify, the menus do lead you very comfortably. If there’s an area we’re doing, we can usually find an activity to fit that topic straight away. So, yes, they do work well.”

— **Science Leader**

Almost half of interviewees reported that the website, specifically its organisation of content and the search function, is easier to navigate following recent updates and this encourages them to continue using the site. The improved search function on the site also makes the addition of more activities less problematic.

“The search facility is better now, that wasn’t the quickest or most accurate at the start, but now includes search engine. The look of the site is better as well”

— **Science Leader**

The function which enables users to indicate which activities they have completed is useful either to avoid repeating activities or to revisit activities.

“One of the practical activities that we do quite regularly is making the butter, so, the children really love that so we do that a couple of times a year. But, some of the odd-one-out ones, if we haven’t looked at them for a while then we’ll revisit them. The

‘what’s going on’ one, so we did the swimming ones quite a while ago now and then some of the year six children went for swimming lessons, so we revisited that as well.”

— Science Leader

Around a quarter of interviewees also express an appreciation of the option to give feedback on Explorify through a range of mechanisms including surveys and via email, and highlight that when there are difficulties with the resource, they are often resolved quickly.

Pupils views of Explorify

Overall, pupils enjoy the various activities they have used and think Explorify is “fun”. Many pupils say that Explorify brings life to their science lessons and has had an effect on how interested they are in science lessons. For example, one pupil described how using the resource at the start of a lesson helps to stimulate their interest:

“It gets you more intrigued for the rest of the lesson, start off with something, like, stupid fun, and then you can go into the next part being happy.”

— Pupil

A pupil at the same school reported how Explorify has affected how they view science – they now look forward to science lessons:

“I think science is so much better than it was before we had Explorify...I remember in year three I used to think science was so boring and now it’s my favourite lesson.”

— Pupil

Pupils in almost all focus groups highlight they would like to do more Explorify activities in their science lessons, and across other lessons.

Zoom In Zoom Out

The favourite Explorify activity amongst pupils is Zoom In Zoom Out. Pupils in all focus groups had used Zoom In Zoom Out and almost all groups chose it as their favourite activity. In almost all instances, pupils reported how they like the “surprise” which often happens when the final image is revealed and they find it interesting to see how others, and themselves, change their opinions.

“When we zoom in and zoom out sometimes it’s fun to see whose opinions change. Because I think we did one with the dog noses and someone thought it was a ladder of shoes... it’s just fun to watch the opinions change and contribute yourself and your opinions change as well.”

— Pupils

There is also an element of humour to Zoom In Zoom Out, as pupils say their guesses can often be so far from what the final image turns out to be, but as long as their predictions are justified their opinion is valued and no-one is ridiculed for being ‘wrong’.

“People guess things totally far, as [classmate] said they guess a door and then it turns out it’s a fox. Then, like, somebody finally gets it...people just keep on guessing, getting it wrong, until it’s actually there, and then somebody gets it right.”

— Pupil

At least half of pupils reported they like this activity because of the discussion it incites, allowing pupils to debate their differing opinions calmly and respectfully. It also allows everyone to be involved and doesn’t involve writing – a task some pupils mentioned wasn’t their favourite in science lessons as a whole.

“You don’t need to write a lot and everyone joins in...you don’t necessarily have to be the smartest one in your class to join in.”

— Pupil

As much as Zoom In Zoom Out is the firm favourite, some pupils say they aren’t always keen on the content of the images – if they are insects, for example. Another pupil thought it was not very practical (in comparison to undertaking an investigation). These were however both isolated cases where the pupils were justifying why the activity isn’t their favourite rather than not liking it.

Odd One Out

The Odd One Out activities are the second favourite with pupils. Pupils from all groups reported they have done this activity at least once. The primary reason for liking this activity is that there is no right or wrong answer, again allowing pupils to justify their opinion. One pupil stated that this has helped them feel more confident to speak out in class, without fear of being wrong.

“If there was just one answer, then I’d be a bit scared because then I might get the answer really wrong...everyone hates getting a question wrong.”

— Pupil

There being no right or wrong answer was echoed as being attractive by almost all pupils, and another pupil thinks that the process of determining who might have the best argument is especially fun and helps them to think ‘outside the box’.

‘What If...’

Perhaps the activity most widely used by teachers but least favoured by pupils is ‘What If’, which is seen as the favourite by only one of ten focus groups. Some pupils do like the ‘What If’ exercises and find the often bizarre nature of the questions funny and eye-opening. As with other exercises, pupils say that in classes the activity can get pupils talking and helps discussion.

However, a few pupils say the obscure nature of the questions puts some children off taking part as they may know very little about the topic and therefore feel they are going to slip up as described by one pupil:

“I don’t necessarily like them because not everyone can contribute. As if someone says something and they know more about that particular thing, like why are my bones bendy. So, someone that knows a lot about bones will be contributing through the entire thing and the other people that don’t know much about bones wouldn’t really be able to contribute and so on and so forth.”

— Pupil

One pupil observes that the questions can be so strange that they are difficult to comprehend and visualise. A few pupils suggested that the subject could focus on an area of science everyone enjoys and can relate to – such as animals to prevent this. A few pupils also highlighted that pupils don’t always understand the question and another suggested using images to explain the concept presented.

Video – What’s Going On?

The video activities which ask pupils to describe what’s going on are used across all focus groups. Pupils widely like the videos and are especially fond of those which depict the natural world. Pupils from one school were particularly moved by the videos they had seen which related to the environment and climate change.

“It helped us to think that what we’re doing right now with energy and everything else, wasting everything - it’s destroying an animals’ environment that could become extinct...The ones with the polar bears we watched recently. About the polar bears and it got us thinking about how we could also save the polar bears and stuff.”

— Pupils

Pupils in a few of the focus groups spoke about the suspense sometimes being difficult to handle, but not knowing what is going to happen next keeps them interested. They also like the fact that they can often go and carry out what they have seen on the screen, if it is an investigation.

The impression from some of the pupils is that these can often go under the radar somewhat, and don’t have the ‘wow’ factor that the Zoom In Zoom Out perhaps does. Teachers were vocal about how much discussion they incite, something which children may not have noticed. Since they are also likely to be used as a precursor to a practical investigation, they may be overshadowed a little by the following experiment.

2.4 Recommending Explorify

The majority (86%) of respondents to the science leadership survey who were aware of and use Explorify report that they formally advocate its use by teachers in their school, with a further 8% stating they do so ‘to some extent’. Respondents who have undertaken CPD in the last 12 months are more likely to advocate the use of Explorify than those who had not (90% compared with 77%). The majority of respondents (91%) who advocate the use of Explorify have done so to ‘all’ colleagues at their school. The remaining 9% advocate it to

selected groups and/or individuals – these most commonly include year and phase leaders who can cascade the message to their respective colleagues – and teachers within the same year group or phase as the Science Leader themselves.

Of the 22 respondents to the science leadership survey who had not advocated the use of Explorify to teachers in their school, 15 report they have recommended it to their colleagues more informally. Therefore, 98% of respondents to the science leadership survey who were aware of Explorify either advocate or recommend Explorify to their colleagues.

Respondents to the teaching survey who were aware of Explorify were also asked whether they had recommended Explorify to any of their colleagues. Just under two-thirds (62%) have recommended Explorify to their colleagues and have done so to an average of 6.2 colleagues. Half (50%) of those who have not recommended it to their colleagues are ‘likely’ to do so in the future and a further fifth (17%) stated they are ‘very likely’.

All Science Leaders interviewed have recommended Explorify to their colleagues, with most introducing the resource for suggested use, rather than as an obligation. Their reasoning for this was to allow colleagues to decide themselves whether to use the resource and let it “speak for itself”. A few Science Leaders report running a training session for staff to show them how to use Explorify.

“I’ve verbally encouraged it, I’ve emailed it, I’ve got everybody to sign up to it, I’ve encouraged them in the planning meetings. I’ve said ‘you can Explorify for that’. ‘Have you thought about this for your opener?’ I’ve done a CPD meeting after school where I showed everyone how to get on it and how to use it.”

— Science Leader

Science Leaders who more formally advocate the use of Explorify in their school are able to keep track of whether their colleagues were using the resource or not. This interviewee asks teachers to make sure pupils put a sticker in their book when they have used Explorify.

“We just decided as a school that everybody’s going to use [Explorify]. So, I helped everybody to be able to engage with it, then I’m checking with people, I look at the books, make sure it’s part of my book look. When I’m looking in the books one of the ticks on the list, is that I can see there’s Explorify stickers in the books.”

— Science Leader

There are also a few interviewees who have recommended to others, including colleagues outside of their own school.

At least half of all Science Leaders who advocate the use of Explorify to their colleagues do so because they have used it successfully themselves. They describe it as a resource that other teachers can use easily that is applicable to all primary pupils.

“I work with some of the youngest children in the school and it worked for them that was a big indicator that actually it would be accessible. Also, the materials are quite well designed so they can be used with multiple age groups.”

— Science Leader

A small number of interviewees also state their school specifically wants to improve pupils’ oracy and cite that Explorify is a useful tool for doing this as it promotes discussion amongst pupils. The lower importance of science in a school compared to English and maths also led to them recommending the Explorify resource as a way to ensure children are exposed to more high-quality science teaching in the limited time available.

“It really matters to me that I’m not the only teacher teaching science well in school. I want the whole school to be teaching it well so that all children in the school are enjoying science and are passionate about science.”

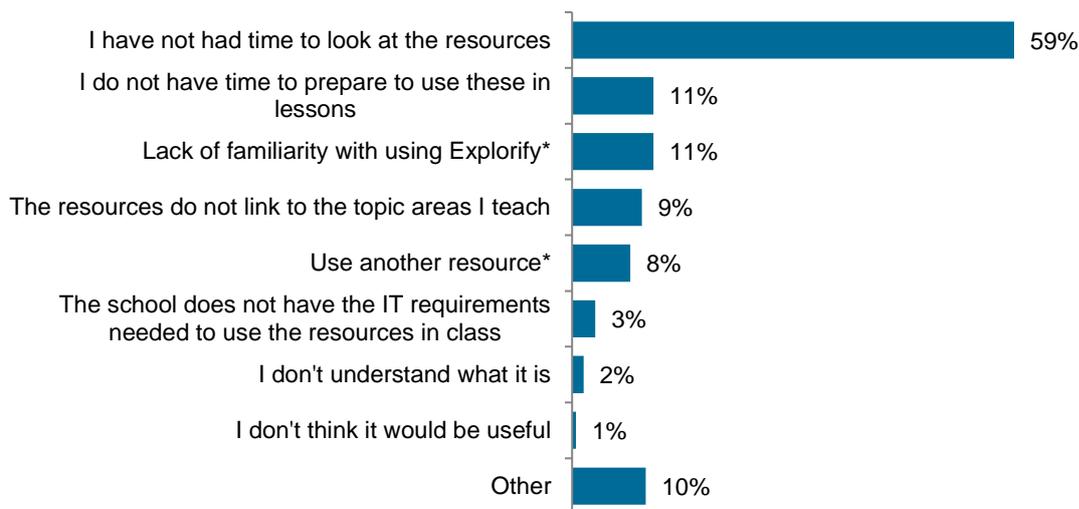
— Science Leader

A few teachers also echo the sentiment of many Science Leaders, explaining that they had recommended Explorify to colleagues, especially to those who are not confident teaching science. Over half of interviewees report that the majority of those who they had recommended Explorify to are now using it.

2.5 Barriers to using Explorify

The 194 respondents to the science leadership and teaching surveys who indicated they had not undertaken Explorify activities with pupils in their school were asked to state the reason/s why they have not used the resource with their current classes. The majority (59%) report they do not have time to look at the Explorify resource, whilst just over one in ten (11%) report a lack of familiarity with the resource and therefore did not use it. 11% state they do not have time to prepare to use Explorify in lessons. 10% of respondents state an ‘other’ reason which includes: a greater importance being given to other subjects such as maths and English, respondents not being involved in the decision making process for science resources, and not teaching science regularly enough to use Explorify. Very few respondents who have not used Explorify say that this is because it would not 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=194. Those with a * were back coded from 'other' therefore were not asked to all respondents.



A small number of interviewees described how their use of Explorify has reduced in recent months. One of the reasons for this is a lack of encouragement or reminders from outside sources. The importance of spreading awareness of Explorify, even amongst teachers who have already been exposed to the resource, is seen as important.

“I guess every subject has got their own resources and websites and things to use and I think if you’re not using them regularly, it’s easy to forget about them. So, I guess that’s the kind of curriculum leader’s role to make sure people remember that it’s there.”

— Teacher

One teacher notes that it is especially important to ensure that those responsible for passing on training and resources to colleagues in their school are made aware of Explorify, since it could be difficult to reach non-subject specific teachers otherwise.

“I think it’s quite rare for teachers to get out and get CPD themselves for science. I guess the most effective way of getting the message [about Explorify] is to get Science Leaders excited about it and, kind of, enthused and then hope that they take that back.”

— Teacher

Around a quarter of interviewees mention that lack of time to explore its content makes them less likely to use Explorify as often as they would like. There was concern that if more activity types and content was added it could become overwhelming. Interviewees report that their continued use of Explorify is dependent on new content and activities being added without making the website more complicated. One Science Leader states that Explorify is easy to use due to its simplicity and accessibility to all.

“I think the beauty of it is almost its simplicity and it isn’t too in depth, it isn’t too complicated. I think if they try and add much more detailed content, like really detailed lesson plans and things like that, I think that could almost move it away from what made it a success in the first place. So, I think they need just to keep updating the content, keep putting on the, the videos and things, but don’t try and get too, I don’t know too

deep, I suppose... that might actually put some teachers off it if they had to wade through lots of long action plans.”

— **Science Leader**

Although most interviewees report that Explorify topics link to their science curriculum, a few say it does not always obviously link to all areas. Whilst Explorify does release and signpost users to new content which is relevant to topical science related events, a few interviewees commented that they were unaware of this.

“If new material was on [Explorify] that was relevant, or themed to a particular science event happening in the year, or something that just has a bit of a wow factor, but that’s seasonal, I think I’d be more likely to use it ... I would highly recommend that, I think it would get children’s engagement, because children are acutely aware now of things that are happening all around them.”

— **Science Leader**

A few interviewees spoke about how they often forget to use Explorify as it can easily slip out of mind and not be used. Whilst some teachers report receiving reminder emails and updates on new content, not all interviewees received such messages or report being too busy to read them all.

“We just have too many emails for us to check all of the lovely things that are sent to us. We do get so many companies trying to promote their things to us, and maybe if your email said ‘free’ in big letters at the beginning.”

— **Teacher**

This is especially important as headteachers particularly value the fact that the resource is free. One interviewee described how it is useful to ensure that schools are aware that the resource will be free “forever”, as there may be the expectation that it is only free for a set time. Being free is a key characteristic which distinguishes Explorify from many other online resources.

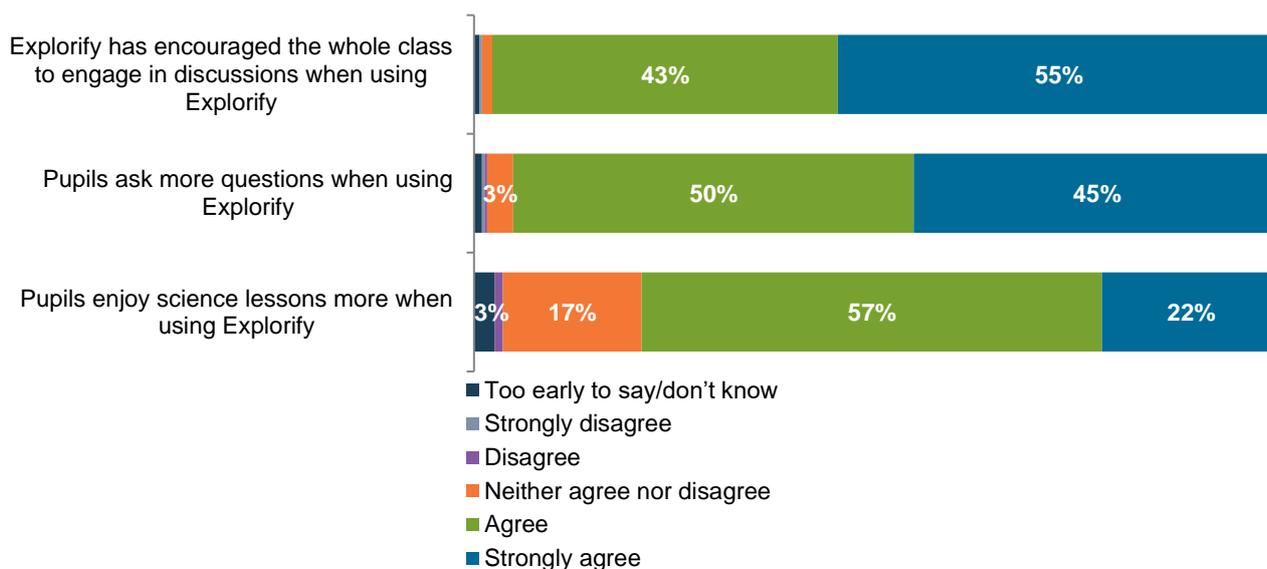
03. THE IMPACT OF EXPLORIFY

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

3.1 Impact on pupils when using Explorify

Respondents to both the teaching and leadership surveys who had completed nine or more Explorify activities with their pupils were asked to what extent they agreed with statements regarding the impact of Explorify on pupils. Almost all (98%) respondents ‘agree’ or ‘strongly agree’ that using Explorify has encouraged the whole class to engage in discussions, with a similar proportion (95%) reporting that pupils now ask more questions. Nearly four-fifths (79%) 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=308.



Furthermore, when survey respondents were asked to outline any additional impacts on their pupils, approximately half of respondents (46%) say that the use of Explorify increases discussions between pupils and engagement in science lessons. Respondents elaborated that Explorify promotes ‘curiosity’ amongst pupils by encouraging them to ‘ask questions’ and stimulating ‘pupil led discussions’. Just under a third (31%) of respondents also explained how Explorify impacts on their pupils enjoyment of science, describing how Explorify ‘creates excitement’ and ‘enthusiasm’ for pupils to learn about science.

Engaging in group discussions

Evidence from the interviews supports these findings, with almost all interviewees agreeing that Explorify has led to increased engagement in discussions by pupils. During lesson observations pupils were regularly engaged in group discussions. One Science Leader describes how Explorify encourages pupils to engage in meaningful discussion whilst taking part in the activities:

“It’s good for [pupils’] metacognitive skills and their communication. They’re sharing their ideas about things and respecting each other’s opinions and just growing up and developing.”

— Science Leader

The inclusivity of Explorify is regularly highlighted by interviewees, who describe how the resource brings the class together and allows children to debate a topic with very little facilitation by teachers. One interviewee in particular expresses how universally applicable it is to children from all backgrounds:

“Using Explorify is an excellent way of getting children to work collaboratively and develop their questioning and answering skills... when we’re using it in class it’s not ability-specific so the whole class can join in.”

— Science Leader

Whilst all interviewees report that increased engagement during use of Explorify is true amongst pupils of all abilities, around half observe that it is often the previously-uninterested or apprehensive pupils who exhibit the most notable increase in engagement.

“Sometimes it gets the ones who you don’t expect to talk, talk, which is a great result. It certainly can generate a little bit of excitement and interest...It starts off with laughter [where funny videos are used], and then you put in a question and it starts to get interesting. And the kids know way more than you think they will.”

— Science Leader

This is further evidenced by interviewees who regularly work with children with SEN and pupils learning English as an additional language (EAL). One interviewee who works exclusively with SEN pupils described Explorify as a valuable resource for children because it can be tailored to their needs. Interviewees believed the difficulties some may have in particular learning areas are less significant when using Explorify because of its visual and inclusive nature.

“I’ve recently done a tally of the number of comments children have made in my class, just to see who speaks most and whether there’s anyone that gets overlooked. And, actually, often it’s the children who have autism or who have special needs who seem to

really enjoy it and who seem to have said the most in my class. So I think it's just that sort of there's no right or wrong, and they feel safe, they feel like that can contribute."

— Teacher

Less fear of being wrong

One of the most frequently-cited benefits of Explorify, described by almost all interviewees as instrumental to its success, is that it allows children to express thoughts and answer questions about science without fear of being wrong. This may explain why it reportedly helps to increase pupils' engagement and oracy skills. A number of pupils also described how they like Explorify due to there being no right or wrong answers in some activities. Most interviewees agree that it is the nature of certain activities that reinforce the fact that there is no wrong answer, and that all answers can be supported and/or challenged.

"It's good because they get to question each other and... go against each other but in a controlled and a polite way. So they're challenging each other's views knowing that neither of them are right, neither of them are wrong. It's quite good for discussion, really good for discussion, and getting all of them to talk, not just the same children all the time."

— Teacher

"I think the thing that I've noticed is children that don't often talk very much or don't have very many ideas or feel a bit inhibited [because] they think they're going to get something wrong, or they don't know quite what the answer is, or quite what the question really means. But [when using Explorify] they're always willing to put up their hand and say something."

— Science Leader

One Science Leader describes how Explorify has impacted on their pupils' ability to express ideas and engage in discussion, comparing their class with another which has not been using Explorify. They observed that more children from the Explorify class were willing to vocalise opinions during a discussion that involved both classes.

"I ran a kind of little test last year where I was using Explorify with my Year 2 class and invited the Year 5 class down to participate in an Explorify activity... My Year 2 class sat there and their hands were going up with loads of ideas and two of the Year 5s put their hands up to give ideas and thoughts... They had loads of ideas, they knew they could answer and it wasn't going to be wrong."

— Science Leader

Enjoying science

Explorify having an element of fun is recognised as important because it encourages children to engage with an activity that they may not see as 'educational'. A few interviewees recognise how Explorify enables implicit learning, allowing children to work out how to respond to scientific questions without needing to be taught directly. Whilst

activities are fun, one teacher also highlights that the learning aspect of Explorify is still prevalent, and the resource retains the structure necessary to keep children on topic when used correctly by teachers in their work.

“It’s just one of the key things about learning when you don’t really realise that you’re learning. They’re learning all these things and they’re practicing their observational skills or discussing, in sometimes quite a deep way their thoughts and feelings about things and sharing and listening, but they just think it’s a fun activity.”

— Science Leader

At least half of interviewees describe the relevance of Explorify content and activities to pupils’ everyday lives as that which makes science attractive and accessible to all children.

“It’s nice that it’s all relevant, so it’s using real life examples or it’s using things that children can see around them.”

— Science Leader

Access to new learning opportunities

A few interviewees say they use activities that are labelled for older age groups with younger pupil. These teachers explain that their pupils benefit from exposure to subject knowledge not planned for their year group as described by one Science Leader:

“You may get children in Year One, Year Two, Nursery, Reception looking at things that maybe would be taught in Year Five, Six, but because it’s such a simple system and because the videos are so watchable, you get the children exposed to stuff very much earlier and actually generated their curiosity earlier. So, when they finally get through to Year Five and Six and you look at things like evolution, they’ve probably learnt a little bit about it because the teachers will have shown them the videos and the pictures and things at an earlier age.”

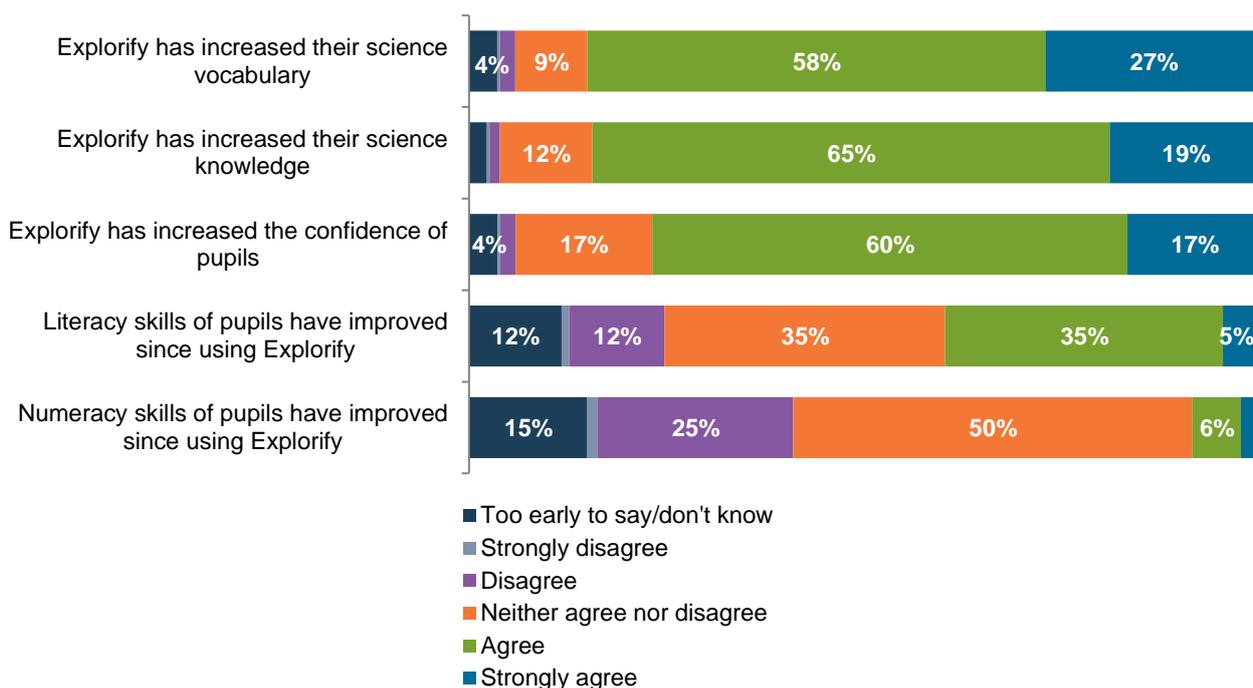
— Science Leader

One interviewee reported that pupils have grown more accustomed to cross-curricular teaching styles since the introduction of Explorify in lessons. Others report that cross-curricular teaching is an increasingly common approach, so familiarity with these techniques is important.

3.2 Impact on pupils in science and other lessons

A high proportion of those responding to the teaching and leadership surveys agree that Explorify has a positive impact on pupil’s science vocabulary (85%) and their science knowledge (84%). 60% ‘agree’ and 17% ‘strongly agree’ that it has benefitted pupils’ confidence. Two-fifths (40%) report wider impacts on the literacy skills of pupils, and 9% on numeracy skills.

Figure 5: Extent of agreement about wider impact of Explorify on pupils as reported in the science leadership and teaching surveys. Base=308.



Further analysis reveals that a higher proportion of respondents who have completed, on average, 21 or more Explorify activities with each of their classes ‘strongly agree’ that Explorify has increased pupils’ scientific knowledge (33%) and vocabulary (43%) compared with those who have completed up to 10 activities (11% and 19%, respectively). Therefore, this suggests that the perceived impact of Explorify on pupils increases with the number of times that it is used.

Survey respondents also describe how Explorify impacts their pupils in other ways. Approximately a fifth (19%) of respondents say Explorify has a positive impact on science outcomes for their pupils. They explain that Explorify improves their pupils’ scientific vocabulary and helps them to understand how ‘science permeates their everyday experience’, allowing them to ‘think more scientifically’ and leading to them being better able to ‘predict what will happen’ when doing investigations.

A quarter of respondents (25%) also say Explorify has wider impacts on their pupils. Respondents believe that Explorify improves pupils’ ‘observation skills’ and ‘critical thinking’, which impacts on their ‘comprehension’, ‘reasoning’ and how they ‘explain their thinking’ in other lessons. Other respondents also report that Explorify helps to improve pupils’ ‘speaking and listening skills’ and their ‘literacy’.

Almost all interviewees think that Explorify positively influences pupils in their science lessons. Interviewees believe that the critical thinking skills and aptitude for enquiry that Explorify helps to instil are influencing them during investigations. Others describe how

the enthusiasm they observed in science lessons is carried through to others subject being taught:

“I think what happens is if they’re doing science experiments (I know it happened in one of the year groups when they were doing rocks), they said ‘This is the same thing; this is what we did on the television.’ So they associated things that they are doing now and it’s almost like they’re copying the scientists who are on Explorify.”

— Science Leader

Interviewees state that Explorify has helped to increase pupils’ scientific knowledge whilst also encouraging them to question scientific concepts. The resource also helps to develop pupils’ knowledge and use of scientific vocabulary.

“It then seeps in because quite often we’ll have a discussion, children sat on the carpet and we’ll talk about the difference between results and a conclusion or the difference between fair testing and validity. I might push them to use the language then and also just to share their ideas then. It definitely feeds into other parts and into their writing when they’re writing an explanation of something as well”

— Science Leader

The improvements in pupils’ vocabulary have been apparent when teachers ask them to make observations about what they are seeing, on the screen during use of Explorify and during science investigations. The more Explorify is used, the greater the impact teachers believe it has.

“Their observational skills are better. They can observe a lot closer than they could before...but now their vocab, and that understanding because we’ve done it quite a few times...their technical vocab around topics is better because we have to make sure that they’re using it.”

— Teacher

Literacy and numeracy

A few interviewees report that Explorify is having a knock-on effect not only on pupils’ scientific vocabulary, but also on their wider ability to express themselves using language that is not science-specific.

“I think for children of lower ability, having that opportunity to vocalise what they have thought, is quite empowering for them, and develops their language skills as well... Everybody who uses [Explorify] thinks it’s made an impact on the children’s language, which I think, for us, is really, really important.”

— Teacher

A few interviewees also believe that the positive effect that Explorify has on improving language skills is particularly prevalent amongst pupils who typically struggle with their oracy skills. A headteacher spoke about how the vocabulary and scientific knowledge learned during the use of Explorify influences pupils’ writing in other lessons.

“[Explorify gives] that little boost through science. Sometimes that comes out in [pupils’] writing, which is quite funny. They’ll use those facts in something, they’ll just, kind of, weave its way into their stories, or some non-fiction writing that we’re doing or something.”

— **Headteacher**

A few interviewees report using Explorify as part of English lessons after realising that many of the activities are applicable to non-science subjects, especially when teaching new vocabulary.

“I think one of the things that has been really helpful is that [Explorify] actually has more than one use, so, it’s helped develop our language quite a lot. So, they’re actually quite similar to the activities that some of the speech and language therapists will do with children, so it’s also improving their speaking and listening skills as well, which is kind of an unintended by-product.”

— **Science Leader**

Whilst fewer interviewees spoke about the effect of Explorify on numeracy skills (which reflects the survey findings), there are examples where interviewees recognise the wider cognitive abilities developed whilst using the resource, and that this has extended into numeracy.

“I certainly think it’s encouraged their scientific talk...[it has increased] their reasoning skills, which then if you’re doing guided reasoning in your questions, that then have a knock on effect to your reasoning in Maths.”

— **Science Leader**

Almost all interviewees think that Explorify also improves pupils’ observational skills, which one teacher believes has extended into their ability to identify mathematical patterns.

“I think their observation skills probably have impacted on other things, because they can notice things. Patterns and things like that, because you do patterns in maths, so I can see that.”

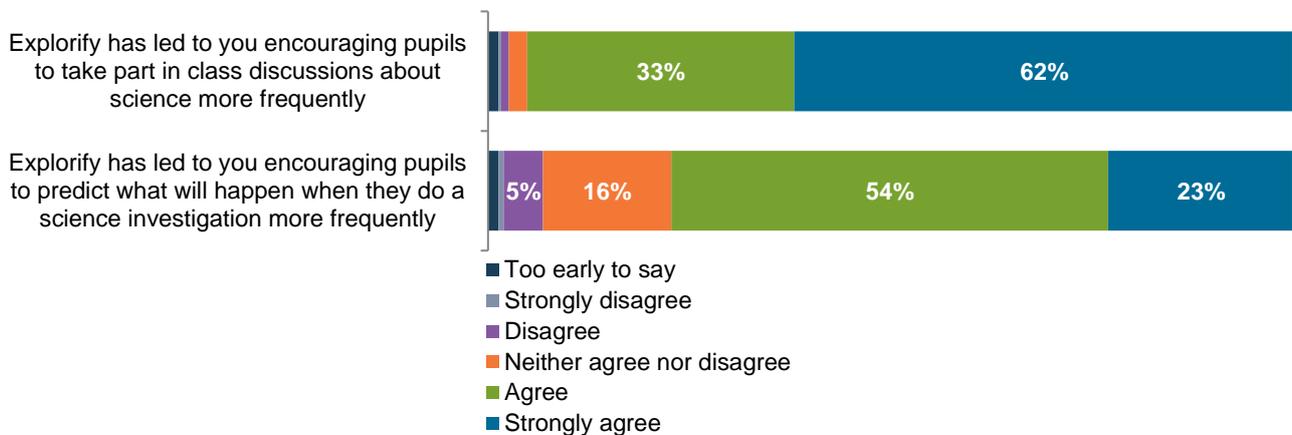
— **Teacher**

3.3 Impact on teaching

Respondents to both the teaching and leadership surveys who had completed nine or more activities were asked to what extent they agreed with statements about the impact of Explorify on their own teaching. The majority (95%) ‘agree’ or ‘strongly agree’ that it has led to them more frequently encouraging pupils to take part in class discussions about science, with 62% strongly agreeing. Just over three-quarters (77%) ‘agree’ or ‘strongly

agree' 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=308.



Further analysis reveals that a higher proportion of respondents who have, on average, completed Explorify activities with each class a total of 21 or more times (76%) or between 11 and 20 times (71%) 'strongly agree' that Explorify has led to them encouraging pupils to take part in class discussions about science more frequently compared with those who have undertaken a total of up to 10 activities with each class (45%). This suggests that repeated use of Explorify activities increases the likelihood that a teacher encourages class discussions about science.

In addition, when asked to outline how Explorify had impacted their teaching in other ways, over a third (34%) of survey respondents further reported that Explorify helps to stimulate discussions between teachers and pupils. Respondents explained how it provides 'interesting', ways in which to teach science and helps teachers to think about how to 'question' their pupils. They also elaborated on how the resource helps them to encourage pupils to 'predict' what will happen, which leads to pupils 'explaining and discussing' their thoughts more. A further tenth (10%) of respondents highlight that Explorify helps to make teaching more interactive as it provides them with 'visual stimuli' that 'illustrate' scientific processes and 'bring science to life'.

Encouraging group discussions

Almost all interviewees say Explorify has helped them make lessons more interactive. The resource has allowed them to create lessons that encourage pupils to talk to each other more and develop their communication skills through debate and discussion. This was regularly observed during the lesson observations.

“[Explorify is] providing more opportunities to talk, which maybe I didn’t build in as many as those times before.”

— **Teacher**

One Science Leader explained that facilitating discussion between pupils allows pupils to experiment with scientific concepts, and teachers can then identify which areas they are struggling in and adjust their focus accordingly. One interviewee describes how, when they use Explorify, it is more engaging for teachers and pupils than resources that were typically used before:

“It’s making it more interesting, more exciting, something a bit different. I think when you’ve been teaching for a while, the danger is that you can pull out the same old resources and it gets boring for the teacher and it gets boring for the children...It makes it much easier to provide really good quality resources for your lesson and there isn’t really an excuse then for printing off a boring old worksheet, I don’t think.”

— **Science Leader**

Using Explorify to monitor and assess

In addition, a few interviewees report using Explorify to undertake ongoing observations to monitor pupils’ development and enable assessment. Interviewees and lesson observations also highlight how it is also being used to reinforce children’s learning throughout or at the end of a lesson to consolidate learning:

“I think the greatest impact is as a teacher is using it for, like, plenary style questions. I think it’s really powerful because obviously you can’t always get that snapshot at the end of the lesson of everyone in the class, you can see how a few children have touched it, but you can’t get it from everyone, and it’s a nice way to do a quick final question; It gives them a chance to use that vocabulary and apply what they’ve learnt.”

— **Teacher**

During the lesson observations there were also examples of teachers encouraging pupils to link their learning to previous lessons. Another interviewee reports that Explorify has altered the way they think about assessment and that, since using the resource, they are now more concerned with exposing children to experiences rather than merely marking them based on their writing ability.

“[Explorify has] made me a lot more confident in thinking that I don’t need to be obsessed with necessarily having huge amounts of written work as part of the evidence. My Assessment for Learning has improved because I’m looking for children’s ability to give reasoned answers rather than saying, ‘Yes, they’ve managed to answer a question’

on a worksheet.' We've really moved away from that worksheet type of learning where children are just filling things in without experiencing something."

— Science Leader

Encouraging pupil-led discussions

Explorify breaks down the barriers between teacher and pupil in other ways. A few interviewees spoke about how Explorify allows children to direct their own learning. This self-led approach to teaching and learning is something that one interviewee observed as being more engaging for children:

"Rather than me just churning out facts, 'Oh, this, this, this, this' they're all growing a bit more and we question things a bit more. And they'll say something, and I'll say, 'Why do you think that?'"

— Teacher

A few other teachers also observe that allowing children to have more control over their own learning is not only beneficial for them, but also gives them the opportunity to take a step back and watch their pupils and assess their knowledge. This lets them determine how they might further pupils' learning further.

"I'll let one of my more able readers stand at the front and read what I am meant to be doing and the kids will literally run it themselves and yes, it makes it so much easier to make it child-led...I didn't see that properly until I put on Explorify and you get chance to sit back and see how they're doing."

— Teacher

The same teacher elaborates how this open style to teaching that Explorify facilitates also helps to develop learners' scientific curiosity and expertise.

"It's actually benefiting me, because I see children thinking differently, and asking questions that I wouldn't necessarily know about. But also enriching my knowledge as well, because I will go off, and I will try to gain information on why something might happen, or what if this didn't happen? What would happen? So it does support me, and gives me ideas, as well, for in my science lessons, sometimes."

— Teacher

The methods of teaching delivery which Explorify facilitates can also be used in subjects other than science. One interviewee described how what they have learnt from Explorify has helped them employ similar techniques in maths lessons and more.

"Each [Explorify] lesson, it has like a certain teaching pedagogy behind that. So, for example, you know, the odd one out...they are very, very transferable, you know, particularly in Maths. So, I might go, 'Do you know children, three different numbers,

which is the odd one out and why,' and again there's no correct answer. So, those type of teaching strategies I have used in other subjects, absolutely."

— **Headteacher**

Planning

In addition to the changes teachers make during their lessons, around half of interviewees say that Explorify has benefitted their lesson-planning. One Science Leader describes how vital Explorify has become to their planning process, largely due to the wide array of activities and topics within the resource.

"Whenever I'm doing my planning, I've always got an Explorify link open... I don't plan now without having that tab open because there's always going to be something there that's going to help me with it."

— **Science Leader**

Interviewees suggest that Explorify reduces the time needed to plan a science lesson due to the guidance included alongside the activity. One interviewee describes how it makes them less content-focused which also reduces planning time:

"I could go in by different type of activity, I could go in by the topic or the year group and I know there'll be something there which I'd be able to use as a stimulus... That means that releases me with a bit more time to think about the actual lesson itself and what I'll be doing during it. So, it's definitely a real time-saver for me."

— **Science Leader**

Time spent teaching science

Respondents to both the teaching and leadership surveys who had completed nine or more Explorify activities with their pupils were asked whether they had increased the amount of time they spent teaching science to classes as a result of using Explorify. Half (50%) of all respondents state it has increased the time they spend teaching science, whilst the remaining 50% report no change. Further analysis reveals that a higher proportion of respondents who had, on average, completed a total of 21 or more (67%) and between 11 and 20 (52%) Explorify activities with each of their classes had increased the amount of time they spent teaching science compared with those who had completed up to five Explorify activities (16%). This suggests that the more Explorify is used, the more likely teachers are to increase the amount of time spent teaching science.

This finding is supported by interviewees, with half saying that they spend more time teaching science, largely due to using Explorify outside of science lessons. Interviewees report that the short Explorify activities are easy to use between or before lessons, therefore using time that otherwise may have been wasted.

"If suddenly assembly has been cancelled, if it's raining outside and it's wet they might have their drink and their fruit but they're watching a science clip and talking about it."

— Science Leader

One teacher observed that their improved confidence in teaching science, as a result of using Explorify, means that they have increased the amount of science they teach, often without realising.

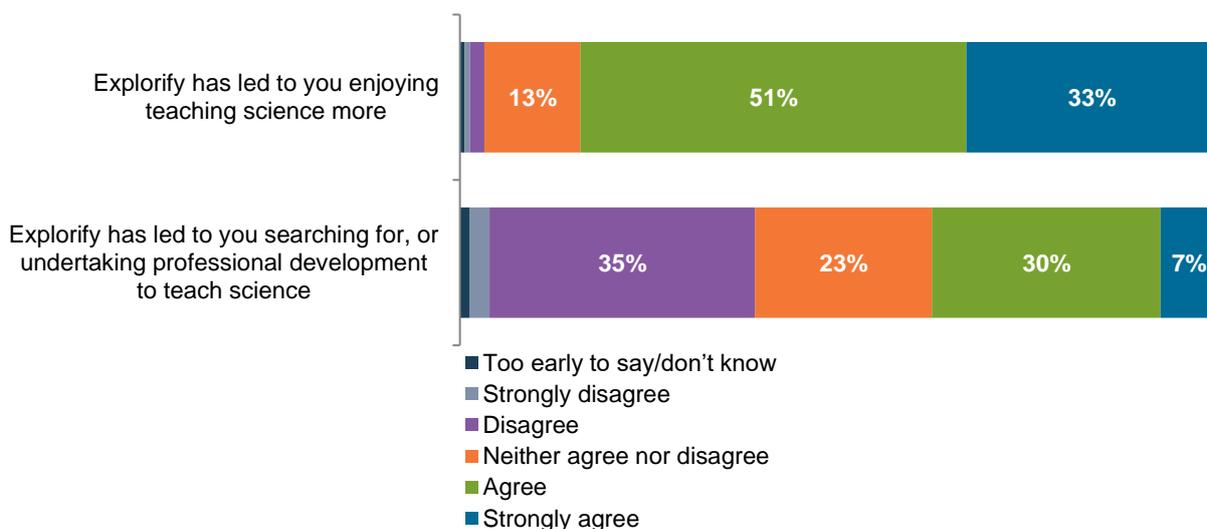
"During the Explorify chunk that I do, sometimes it goes on longer than I plan it to, probably because I'm enjoying it with them because of the confidence... if you're confident in something you spend more time on it."

— Teacher

3.4 Wider impact on teachers

Just over four-fifths (84%) of respondents to both the science leadership and teaching surveys agree that Explorify has increased their enjoyment in teaching science. In addition, just over one-third (38%) 'strongly agree' or 'agree' that it has led to them 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=308.



Almost two fifths (38%) of survey respondents also highlighted that Explorify was a useful resource for them when asked to outline how it had impacted on their teaching practice. They explained how Explorify provides them with 'well thought out activities' to use in class and also helps them to generate ideas and plan their lessons.

Confidence

Teacher confidence is described by interviewees as integral to the quality of science teaching. Whilst around half of interviewees say that they are already relatively confident, around one third say that using Explorify increases their confidence in teaching. The

mantra that no answer or response is considered necessarily ‘wrong’ in science has also extended to teachers in other subjects. One Science Leader observed that teachers’ ability to admit that they do not know the answer to everything has also helped teachers feel more confident teaching science. This, in turn, has allowed pupils to apply the same principles during discussions.

A few Science Leaders also describe how Explorify has boosted the confidence of colleagues whilst teaching science.

“I can think of two people in particular who’ve come and said that [Explorify has made them more confident teaching science], but I would say that if I asked everybody, I’m sure they would say yes.”

— Science Leader

“I think it’s given the teachers who use it regularly, I think it’s given them some tools and given them a bit more confidence and essentially improved their questioning as well, really improved their questioning skills and the feedback they’re getting from the children.”

— Science Leader

Alongside general confidence in teaching science, confidence in the resource and the information available is also regarded as beneficial. One headteacher said that because they know that everything they need for a lesson would be available on Explorify, the resource made them feel better prepared and more confident that they could deliver a high-quality lesson. For a small number of interviewees this affects their overall confidence. One Science Leader reports that the content within Explorify can be trusted and that this gives them confidence in what they are teaching:

“I feel like I can rely on it, I can trust it, it’s going to give me something, an activity... So, that’s definitely helped my teaching and I like that there’s the subject knowledge there behind, so I feel that upskills me a little bit as well.”

— Science Leader

Most interviewees report that Explorify facilitates a lesson which is less structured which some teachers are not used to, which some said can be daunting for those who are apprehensive of teaching science. One teacher believes that regularly using Explorify helps them feel more confident in teaching.

“Because I’ve been using it now, I’m quite confident in actually asking children questions, and I don’t use the print-out format so much. But when I first did it, I would print it out and look at it and read it all.”

— Teacher

Almost all interviewees described how having subject knowledge is a significant influencer on their confidence when teaching science. The ability to find out more information about

a topic area through the links on the Explorify website has also helped teachers feel more confident in their own scientific knowledge, which in turn positively impacts their confidence in teaching science.

“Any background knowledge that you need is there as well, so, again subject knowledge, you’re having to know an awful lot about different things and that information is there for you, so, it does make you feel confident in that you’ll be able to read up on exactly what you need to know.”

— **Headteacher**

Whilst Explorify helps teachers’ confidence levels by providing them with information about areas of science – which can help them improve their subject knowledge – it also helps teachers reconsider what they need to know in order to be confident. The recurring concept of ‘no right or wrong’ is incredibly valuable to teachers who fear being wrong.

A few interviewees who feel particularly confident teaching science say that they do not fear having less structure in their lessons, and don’t mind when things go ‘wrong’. One teacher recognises that Explorify reinforces their confidence by providing them with knowledge, *but* they still know they don’t need to know everything.

“[Explorify has] given me that kind of clear routine of science, but it’s also helped my subject knowledge as well, massively. Because there’s such a diverse range of topics on there sometimes I look at one and go, ‘I’m not sure about that one’ and then we talk about it and then I consult my friend ‘Doctor Google’ and we have a look at it together. It shows the kids that I’m learning as well at the same time, on the job.”

— **Teacher**

Science-related CPD

A few interviewees report that Explorify has motivated them to pursue further science related CPD. One interviewee expresses intentions to engage in CPD that Explorify itself has directed users to and notes how this resource has made such training more accessible.

“I think it offers some online CPD training which I’ve spoken to two members of staff about, so, I would say that, yes, it has encouraged me to look at science and CPD because I think again it makes it easier for people to be able to access that, so, I haven’t done it yet, but yes.”

— **Headteacher**

Within almost all interviewees’ schools, science-related CPD is structured so that Science Leaders receive external CPD, which they then pass on to their colleagues. Because of this, around half of teachers report that, although they would like to be involved in more training, external science related CPD is not typically something they have access to. One Science Leader is aware of how beneficial science CPD has been for them personally and believes that after using Explorify their colleagues may be more inclined to take part in science training. Reasons why some interviewees feel unable to take part in further science

related CPD include lack of time, insufficient funds, and the prioritisation of other subjects over science.

3.5 Wider impact across the school

Around half of all interviewees agree that Explorify has improved the quality of science teaching at their school and as a result has raised the importance of the subject in school. One Science Leader reports that their ability to monitor children's progression shows the importance of science on improving teaching and learning.

“So, through observations, through feedback provided by children and through my own work with the children, I found out that, yes, it has enhanced science teaching at our school, no doubt... It has made a huge impact on improving the profile of science and, in terms of improving learning and teaching.”

— Science Leader

Another Science Leader concurs with the above statement, observing that Explorify has helped to close the ‘importance gap’ between science and other subjects that are given higher credence in school.

“It gives us another option and it means that we’re not always just focusing on English and maths, so it has put a bit of the spotlight back onto science.”

— Science Leader

Most respondents who believe that Explorify has increased the importance and/or teaching of science often find it difficult to distinguish between the impact of Explorify and that of other resources or activities, such as PSQM. The common belief is that Explorify contributes to this increase in importance alongside other changes happening in the school.

04. 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

Respondents to the science leadership survey were asked if there is a Science Leader in their school. Science Leaders are responsible for leading science development and teaching in schools, either as an individual subject or a cross-curricular topic area. Across all respondents, just over nine out of ten (93%) schools report having a Science Leader (similar to reported in the baseline report). Schools with 100 or more pupils have a higher proportion of Science Leaders (95%) than small schools (defined as less than 100 pupils), at 79%. English schools that have one or more Explorify users have a slightly higher proportion (97%) of Science Leaders compared with those that have none (90%).

Just over half (56%) of all respondents to the science leadership survey report that science is included in their School Development Plan for the 2018/19 academic year. A higher proportion of schools who currently hold the Primary Science Quality Mark (PSQM) award (70%) or are applying for the PSQM award (89%) have science on their School Development Plan compared with other schools (52%). A higher proportion (64%) of schools that have one or more Explorify users also have science on their School Development Plan compared with those that have none (49%).

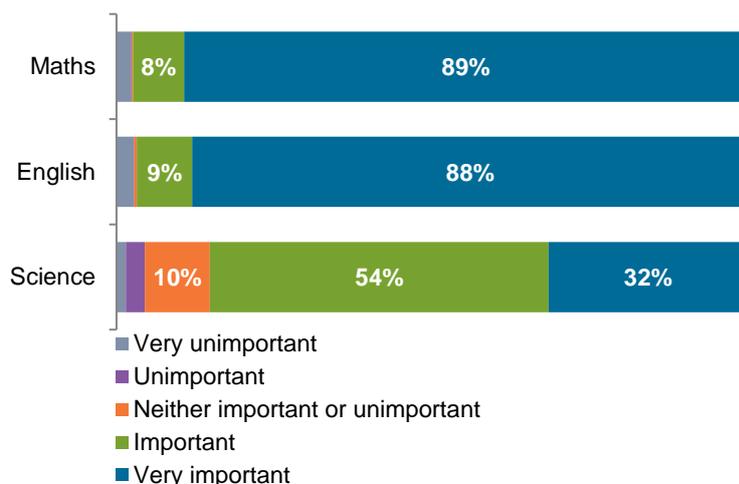
The majority of Science Leaders who responded to both the science leadership and teaching surveys are classroom teachers (92%). Nearly three-fifths (57%) of Science leaders do not hold a science A level²⁶ or Advanced Higher, 23% hold one A level or Advanced Higher, whilst the remaining 19% hold two or more.

The importance of science

Respondents to both the science leadership and teaching surveys were asked to state how important they think certain subjects are to the Senior Leadership Team of their school. The majority (97%) state that both English and maths are ‘very important’ or ‘important’, whilst 85% state that their school views science in the same way. Alongside this, only one-third (32%) think science is ‘very important’, compared with 89% for maths and 88% for English. A further 10% state that science is ‘neither important nor unimportant’. These findings are similar to those reported in the baseline report.

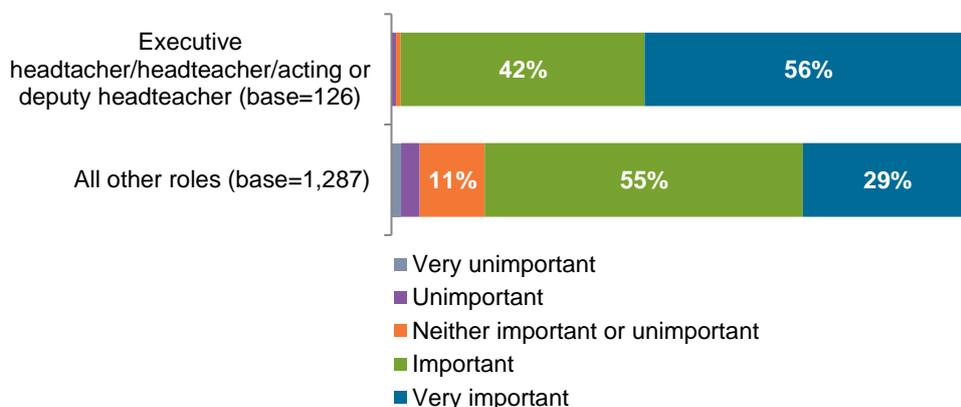
²⁶ This has been defined as holding a Biology, Chemistry or Physics A level or Advanced Higher.

Figure 8: The perceived importance of subjects in school as reported in the science leadership and teaching surveys. Base=1,412–1,416.



The role that someone holds in a school influences their perceived importance of science in a school. A much higher proportion of respondents in a senior leadership position state that science is ‘very important’ (56%), compared with 29% of those in all other roles. Just over one-in-ten respondents (11%) who are not senior leaders state science is ‘neither important nor unimportant’, compared with only 1% of senior leaders. Alongside this, a slightly lower proportion (28%) of Science Leaders state that it is ‘very important’ to the school, compared with 35% of respondents not in this role.

Figure 9: The perceived importance of science in school by role as reported in the science leadership and teaching surveys.



Further differences are found by:

- **School size:** 42% of respondents from small schools (those with 99 pupils or less) state that science is ‘very important’, compared with 31% of respondents from larger schools.
- **Holding the PSQM award:** 39% of respondents from schools who currently hold the PSQM award state ‘very important’, compared with 29% of respondents from schools who do not hold PSQM.

- **Science on the School Development Plan:** 36% of respondents from schools who have science on their School Development Plan state ‘very important’, compared with 25% of respondents from schools who do not have science on their development plan.

Release time for Science Leaders

Just under half (49%) of all Science Leaders get specific release time to lead science in their school in addition to time to plan their own lessons, reflecting the baseline report findings. Almost all (92%) Science Leaders are classroom teachers and being a member of the Senior Leadership Team (SLT) does not significantly influence whether or not release time is given. A higher proportion of Science Leaders from larger schools receive release time than those in smaller schools, with 30% of Science Leaders in schools with less than 100 pupils receiving it compared with 53% in schools with 200 pupils or more. A higher proportion of Science Leaders (73%) from schools who are currently applying for the PSQM award state they receive release time compared with those who hold the award (47%) or those who do not hold the award (47%).

The amount of release time taken by Science Leaders who receive it varies across schools. Most respondents report taking release time either every term (27%) or every half term (29%). Just over one-quarter (28%) take 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	19%
Approximately every two weeks	9%
Approximately every month	8%
Approximately every half term	29%
Approximately every term	27%
Other	9%
Base	283

One-third (30%) of Science Leaders in receipt of release time take 10 hours or less a year, with only a slightly higher proportion (36%) taking between 11 and 20 hours. Just one in ten Science Leaders take 41 hours or more which equates to at least one hour per week.

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
10 hours or less	30%
11-20 hours	36%
21-30 hours	5%
31-40 hours	18%
41 hours or more	10%
Base	269

Only a small number of Science Leaders interviewees report receiving release time that is specifically allocated to them for responsibilities associated with the Science Leader role.

They highlight how the time is limited, although on occasions they can ask for additional time. Despite there being very little release time for most Science Leaders, those who receive it say it is sufficient for their needs.

“I think any [subject] leadership could probably have more time generally speaking because you have such a lot to do and I just think as a teacher you’re always going to do work at home. But, when I look at it with what I know about school, I think we’re given quite a generous amount of subject leader time compared to most places I’ve either worked at or I know of.”

— Science Leader

Almost all Science Leaders interviewees (with release time) have additional roles and/or are Senior Leaders in the school, so they are provided with release time to perform these duties. Within this time, they are expected to undertake activities related to their Science Leader role and to other leadership responsibilities. One interviewee reports how they only started to receive release time to carry out leadership duties once they became a member of the senior leadership team. Another interviewee describes how this limits the amount time they can focus on their Science Leader role:

“I’m also deputy head and do get release time. I get a day a week for that. Which does enable me to do that, but it’s not specific for science [...] if I had some regular non-contact time, then obviously I could do a lot more, but we can’t facilitate that. So, you just have to be a bit creative.”

— Science Leader

Approximately half of all Science Leaders interviewees did not receive release time, and they say this constrains them in their role. Because of the lack of time, a small number of interviewees report using their own free time to work on tasks associated with science leadership, alongside their regular workload.

“I’m finding I’m putting more and more of my own time into it that I’m not being paid for. So, I’m not entirely happy about that, to be honest.”

— Science Leader

CPD for Science Leaders

In the last 12 months just over half (54%) of all Science Leaders state that they have undertaken external Continuing Professional Development (CPD) lasting one day or more to help them lead or develop science throughout their school, similar to that reported in the baseline report. Where science is included on the School Development Plan a higher proportion of Science Leaders (61%) receive CPD compared with those where it is not (44%). Higher proportions of Science Leaders from schools who hold the PSQM award (86%) and those applying for the PSQM award (78%) report undertaking CPD when compared to schools who do not hold PSQM (46%), which is not surprising given that participation in CPD is necessary to achieve the award. Nearly two-thirds (65%) of Science Leaders who are from a school where one or more teachers are using Explorify state that

they receive CPD, compared with 32% of those who are not. A higher proportion of Science Leaders who personally use Explorify (67%) report receiving CPD, compared with 35% who do not use this resource.

Science Leaders who took part in external CPD lasting one day or longer in the last 12 months, undertook 3 days of CPD on average. One-third (32%) undertook one day, 19% undertook two days, 23% undertook three days and the remaining 26% undertook four or more days.

All Science Leaders who were interviewed had been on a Science Leadership course since beginning their role (not necessarily within the last 12 months). The content of the CPD is considered useful by all interviewees, who highlight how it helped them to pass on resources and scientific knowledge to their colleagues in the form of internal training at their school.

“I did a year-long subject leaders course based at [the National Science Learning Centre] York, so there were three residential stays there for a couple of days each where I learnt about the role of the coordinator [...] I learnt how to do things like pupil surveys, to find out what pupils thought about Science, improve my subject knowledge. I learnt about activities that would be useful for Science teaching.”

— Science Leader

Around a third of Science Leaders (and a few teachers/headteachers) interviewed have recently applied for or been awarded PSQM. PSQM is a CPD programme which allows schools to demonstrate how effective science leadership has a positive impact on science teaching and learning. Interviewees describe the PSQM as helpful for increasing their awareness of how their school is currently leading science, and how they could improve it.

“[PSQM] was really brilliant, because it really helped me to understand where we were with science. I had just come into it and it really gave me a lot of guidance about where to take science and the right direction for it [...] I feel more of a Science Lead now rather than just a coordinator.”

— Science Leader

Despite almost all Science Leaders reporting that they been on useful science leadership courses, a small number highlight how CPD specific to science leadership is not as comprehensive as CPD for maths and English, due to it being deemed less important.

“I just wish there was more of it. So, it was good, but I would say that it wasn't as high quality as some of the other training I've been on for other things in the past. I don't think there's as much information out there for science, as say for English and maths. I

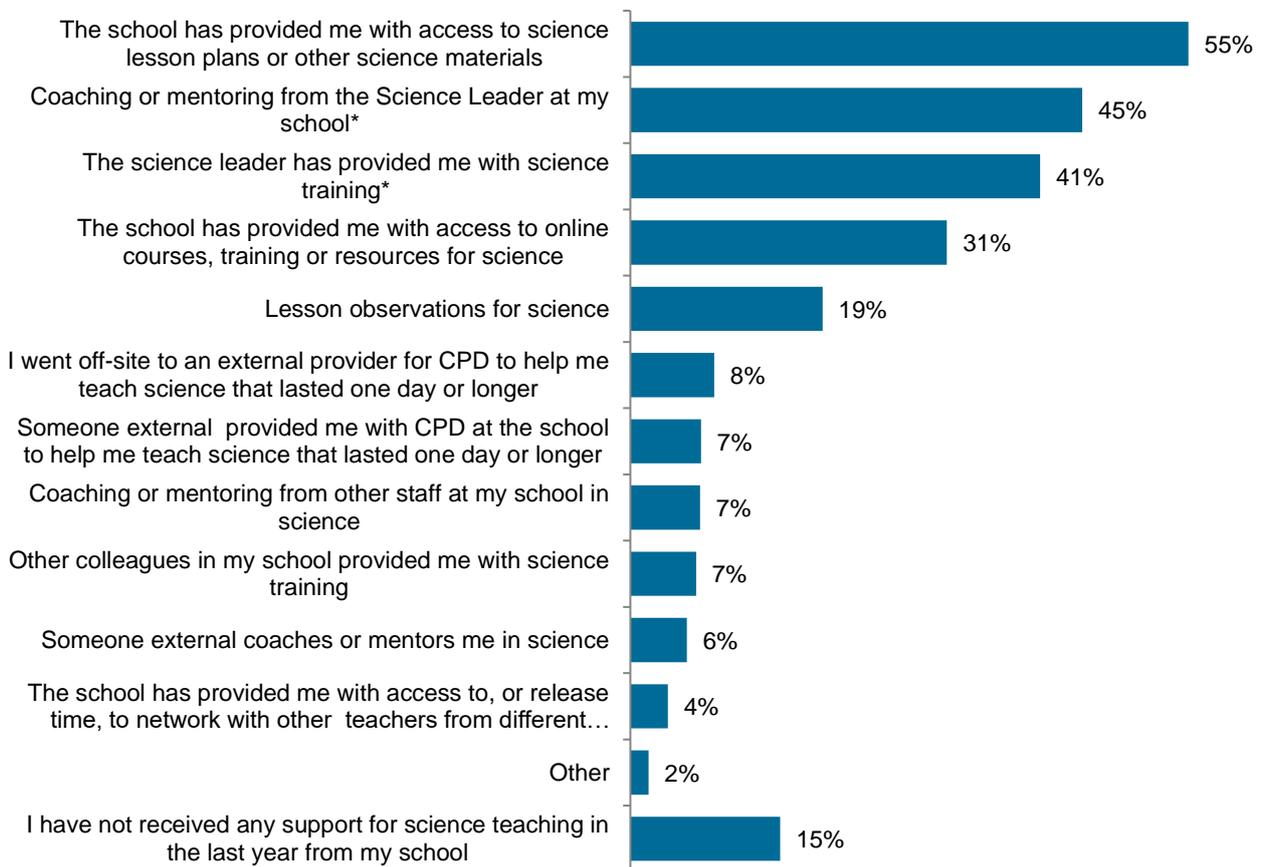
think it is the poorer of the core subjects, I don't think it gets anywhere near as much time invested in it."

— Science Leader

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. The most frequently reported methods are the school providing access to lesson plans and materials (55%), coaching or mentoring from their Science Leader (45%), science training from their Science Leader (41%) and the school providing them with access to online courses, training or resources (31%). The majority of respondents received some kind of support, with just under one-fifth (15%) not receiving any support.

Figure 10: Support received to improve science teaching in the last 12 months as reported in the teaching survey (excluding Science Leaders). Base=628, those with a * base=596.



This is different to that reported in the baseline study (at 30%) primarily due to those teachers who are at a school that is using Explorify reporting higher support levels than the comparator sample (see Table 4 overleaf). When comparing respondents from schools in England that are using Explorify with those who are not, the main differences in the type of support received are:

Table 4: Support received to improve science teaching in the last 12 months by Explorify school as reported in the teaching survey (excluding Science Leaders). Base=628.

	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	59%	43%
Coaching or mentoring from the Science Leader at my school	50%	18%
The Science Leader has provided me with science training	47%	15%
The school has provided me with access to online courses, training or resources for science	36%	13%
Lesson observations for science	22%	9%
I have not received any support	10%	31%

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

- **Perceived importance of science to the school:** 95% of respondents who state that science is ‘very important’ to their school receive support, compared with 81% who perceive it is ‘important’ and 73% who state it is ‘neither important or unimportant’
- **School size:** 89% of respondents from schools with 200 or more pupils receive support compared with 69% at schools with 100–199 pupils.
- **Holding the PSQM award:** 95% of respondents from schools that hold the PSQM award and 98% of respondents from schools that are currently applying for the PSQM award receive support, compared with 81% of respondents from schools who do not hold PSQM.
- **Science Leader in the school:** 86% of respondents from schools with a Science Leader receive support compared with 74% of respondents from schools without a Science Leader.
- **Science Leader receiving CPD:** (in schools with a Science Leader) a slightly higher proportion of respondents (89%) whose Science Leader had received CPD in the last 12 months receive support compared with 82% of respondents whose Science Leader did not receive CPD.

Only two of the teachers interviewed reported receiving external training to help them teach science. A few more teachers stated they can request to attend science related training but have not done so yet. Interviewees recognise the difficulties associated with sending teachers on external training due to the ability to arrange (and fund) supply cover for classes. One Science Leader observes that the cost of the training itself makes it unfeasible to send multiple teachers.

“Nobody’s been on any particular courses for the reason that we don’t have enough money to send all of the teachers on any courses, but myself and the other teacher that



leads science, we have been on courses and then brought that back and delivered that in staff meeting.”

— **Science Leader**

Teacher interviewees predominantly report they have been provided with in-school training led by their Science Leader. One headteacher describes how their Science Leader addresses teaching needs through individual support or as part of a larger training session:

“We try and get the Science Leader to take the role in looking at where science is [...] if we did find that there was a specific need, we would try and address that through training either putting on an in-house staff meeting if it was something that a few staff members would benefit from or if it’s a specific member of staff we’d maybe look for a more, sort of, tailored course. But also, we would get the Science Leader to work with them to look at what some of the issues might be and to, sort of, spend a bit of time discussing those and how we can move things forward.”

— **Headteacher**

Science Leaders describe several other ways in which they support colleagues in their school to teach science. All Science Leader interviewees say they passed on resources and guidance that they thought would benefit classroom teachers in their school via internal CPD and guidance. This took the form of newsletters, emails, announcements in staff meetings or specifically arranged training sessions.

“I try to put ideas out to them for where they can find extra stuff. For instance, when I did the Explorify course, I came back and then I did a quick, sort of, fifteen, twenty minutes with all the teachers to show them how that could be used.”

— **Science Leader**

A few Science Leaders report that they allow teachers to observe them teaching science, so they can see how to structure the lesson. They also mentor teachers who find teaching science particularly difficult, including NQTs, alongside more formal means of assistance.

Not all teachers agree that the amount of support provided by their Science Leader is sufficient, and one interviewee received no support:

“I don’t think we really do get very much support... You don’t really hear or see anything from them, so I don’t really quite know what he’s done.”

— **Teacher**

Another teacher has no Science Leader at their school, and as a result they receive support to teach science from a Science Leader at another school within their trust, but this is insufficient for their needs and they lack confidence teaching the subject.

4.3 Science teaching in the school

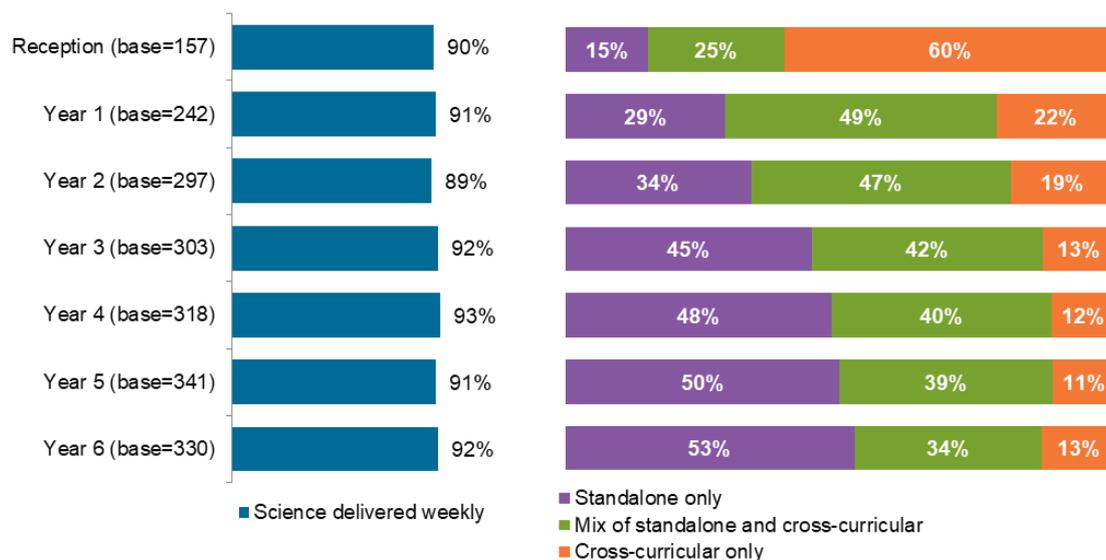
In the majority (89%) of schools, classroom teachers deliver most science lessons. Just 5% of schools have a science teacher who takes science lessons, 6% have a mix of the two, and 1% use other staff to deliver science. When examining the differences by school size, 15% of small schools (those with less than 100 pupils) have a specific science teacher, compared with 5% of all other schools.

Regularity of science teaching

Teaching science weekly

Respondents to the science leadership and teaching surveys were asked whether they taught science weekly either as an individual subject or as part of cross-curricular work. Across schools a high proportion of year groups are taught science weekly. Standalone lessons are more prevalent for older year groups with younger pupils (especially Reception) 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

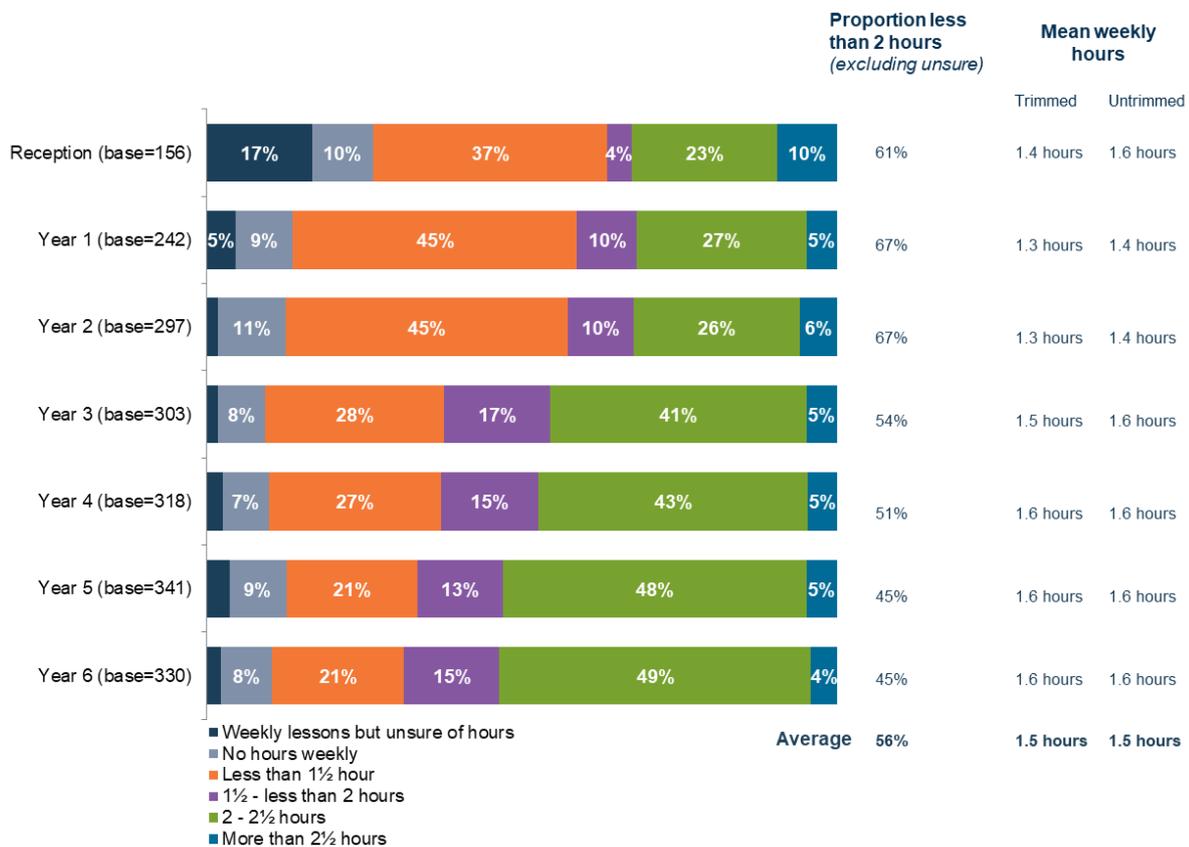


Those participants (in the science leadership and teaching surveys) who taught science weekly as either standalone lessons or as part of cross-curricular work were asked how many hours of science they teach each week. Just under one-fifth (17%) of those teaching Reception pupils are unable to estimate the amount of time they spend teaching science. For the remaining year groups, the proportion who could not indicate the number of hours of science teaching is much lower.

On average, science is taught weekly for 1.5 hours a week (1 hour and 30 minutes) and 56% of classes receive less than 2 hours a week. Lower year groups received fewer hours of

weekly lessons with the amount of science taught increasing slightly as pupils become older reflecting the baseline findings.

Figure 12: Hours of weekly science delivery by year group as reported in the science leadership and teaching surveys²⁷

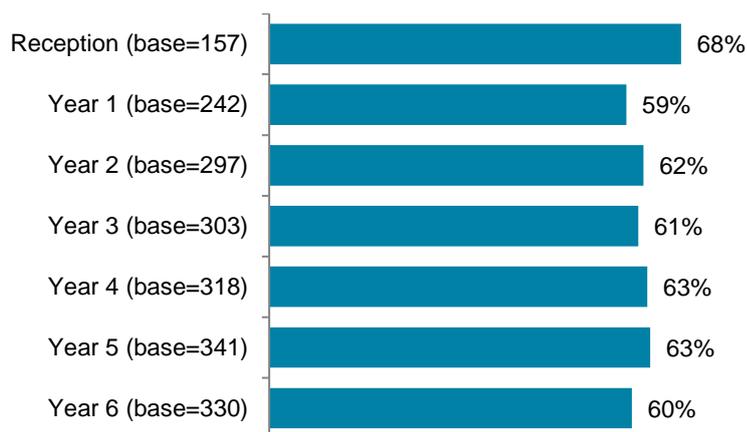


Dedicated science weeks

Just over half (circa 60%) of all respondents deliver science through dedicated science weeks. Across most teachers (see Figure 15 later in the chapter) this is an additional activity that complements other delivery methods rather than a standalone approach. For the majority (90%) of teachers offering this provision, science weeks are delivered once a year. Only a small minority delivered two or more science weeks a year (See Table 5 in Appendix 2 for a full breakdown by year group).

²⁷ 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.

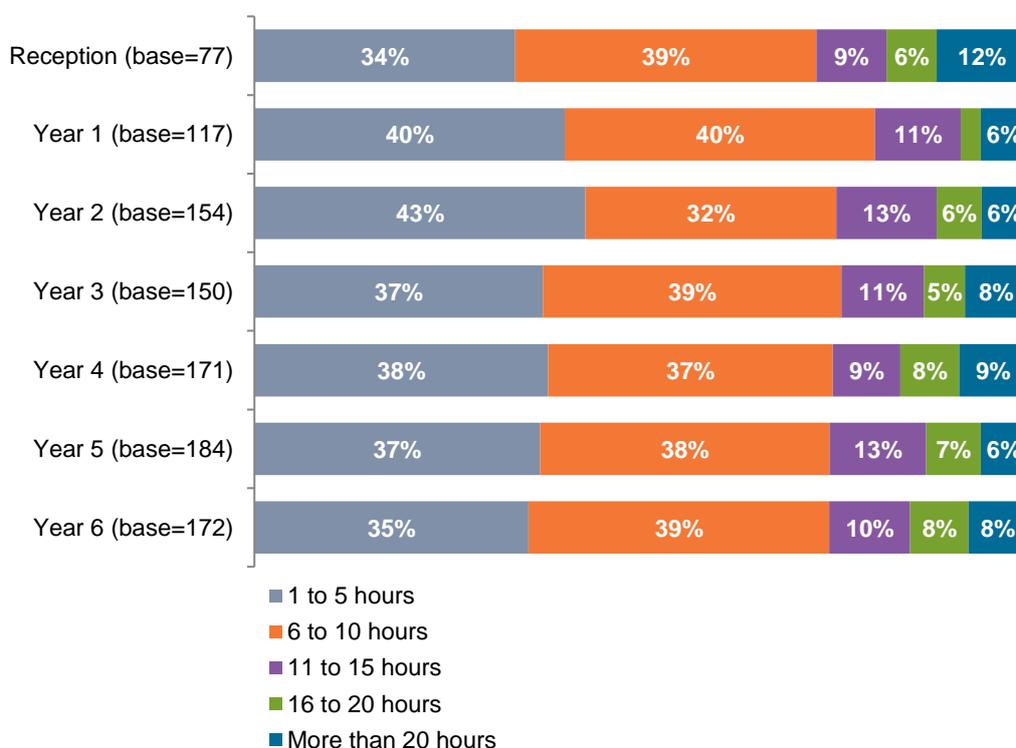
Figure 13: Dedicated science week delivery by year group as reported in the science leadership and teaching surveys.



Dedicated science week hours of delivery

Participants who teach science through dedicated science weeks were asked how many hours of science they teach during each one of these weeks. Figure 14 shows the total number of hours delivered to year groups in each dedicated science week. In each science week most teachers typically teach science for up to 10 hours for each class, with an average of between 9 and 10 hours across the week.

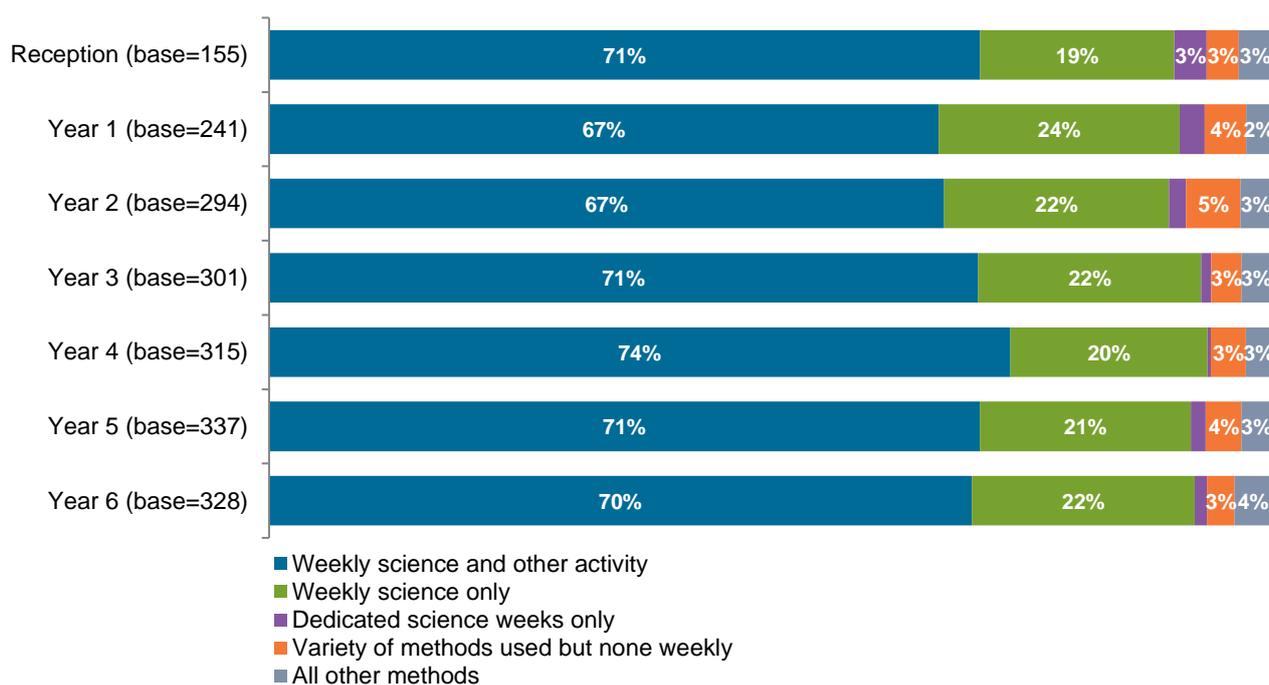
Figure 14: Total number of hours delivered through each science week in the school year as reported in the science leadership and teaching surveys



Main delivery methods

Science is taught across the school year in a wide variety of ways. The majority of respondents teach some form of science weekly, although most combine this with other types of activity such as dedicated science weeks, science days and visits. Only a small proportion (up to 3%) of respondents teach science through dedicated science weeks only. Under 5% of respondents teach science through a variety of methods (more than 1 method used but none weekly) or 3%–4% through a standalone method (such as block teaching or fortnightly lessons). These are similar findings to those reported in the baseline report.

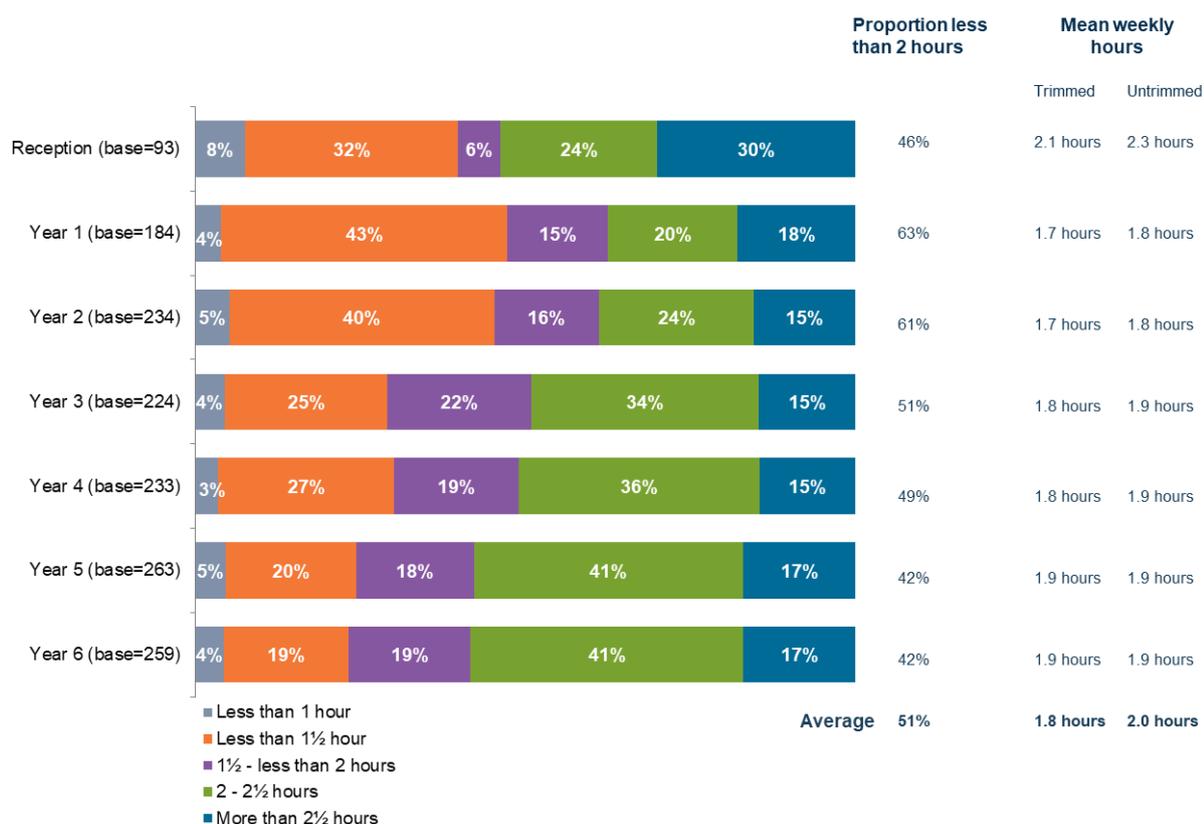
Figure 15: Overall delivery method by year group as reported in the science leadership and teaching surveys



Total hours of delivery

Across the various methods used, the number of hours of teaching was combined to calculate a total number of hours taught in a year. This was then averaged across the 39 weeks of the school year to calculate a weekly average. This indicates that on average pupils across all year groups receive between 1.7 (1 hour and 42 minutes) and 2.1 hours (2 hours and 6 minutes) of science a week. On average, science is taught for 1.8 hours a week (1 hour and 48 minutes). Other than Reception, where teaching hours start off higher, the proportion of year groups receiving *less than 2 hours of science teaching* a week decreases by age from 63% in Year 1 to 42% in Year 6. These findings are again similar to those reported in the baseline study.

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



Total hours of delivery – differences explored by key characteristics

To examine the amount of time spent teaching by key characteristics (school and individual level characteristics) we created a new ‘hours’ variable. This combines all teaching time undertaken, irrespective of year group, and an average was calculated for those teaching more than one year group. We undertook analysis to explore how the combination of individual- and school-level characteristics influence the number of hours of science taught.²⁸ We find some differences, but these account for only 6% of the variance. Characteristics associated with a higher weekly average of science teaching hours are shown in order of importance below:

- Being a Science Leader in a school as opposed to non-Science Leader
- Working in the teaching profession for a longer period of time
- Being in a school that currently has PSQM or is in the process of applying for PSQM
- Viewing science as important to the school

Whether a respondent used Explorify or not with classes in their school does not influence the total science teaching time. However, on exploration of the data, very few respondents

²⁸ Multiple regression. Variables added into the model but no differences found for: if holds a science A level, gender, Science Leader in the school, role in the school, FSM, full/part time worker, Explorify user, confidence teaching science, school size, enjoyment teaching science. Non-English schools were removed from the analysis due to low base sizes.



included their Explorify use within the total hours of teaching recorded for science. A follow-up question in the survey (described in Chapter 3) reveals that 50% of respondents who use Explorify believe it has increased the time they spend teaching science.

Deciding how many hours to teach science

Almost all interviewees report that science teaching time is decided at the senior leadership level. Therefore, Science Leaders without a senior leadership role only play a minor role in making these decisions. Around half of all interviewees say that the national curriculum is shaped in such a way that it constrains time spent teaching science due to the wide number of subjects that are covered.

“I mean I very much push for science being seen as a core subject with maths and literacy, to try and keep it as a high-profile subject, and so, we aim for two hours a week science teaching. I think that can vary in classes, just because of timetable constraints and there’s so much to try and fit into the curriculum.”

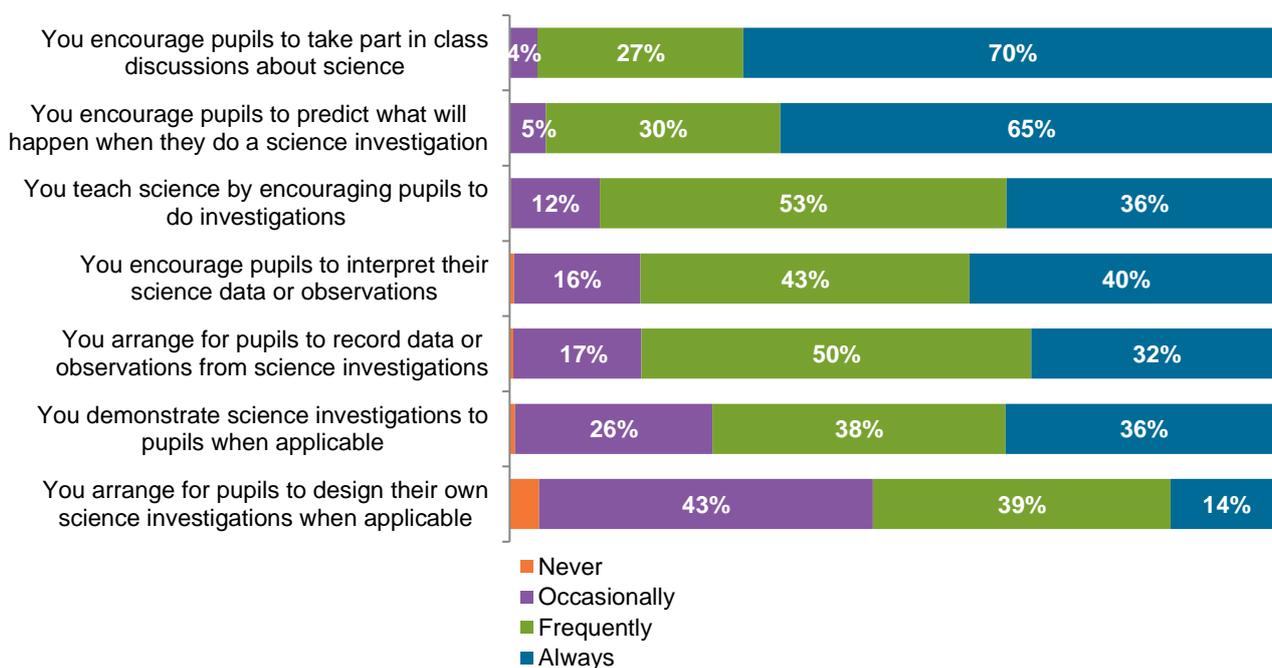
— Science Leader

Around half of interviewees report that they would like more science to be taught in their school, but balancing this with other subjects, which often take higher priority, means it is unlikely. A few interviewees report that science teaching hours are influenced by recommendations from government bodies, including Ofsted.

Teaching methods

Those participants who had responsibility for teaching science were asked how often they undertook different activities with pupils when teaching science. The 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=1,289–1,312.



We undertook further analysis to explore whether school- or individual-level characteristics increase the likelihood of using those methods more frequently. The modelling techniques²⁹ reveal the significant indicators that positively influence each question, as shown in Table 6 (Appendix 2).

For each question, the characteristics that impact on the likelihood score are shown in rank order of importance, with ‘1’ as the most important. Across the different questions there are common school-level and individual-level characteristics that affect an individual’s likelihood of using these methods more frequently:

- Confidence teaching science
- Perceived importance of science in the school
- Being a Science Leader

Being an Explorify user increases an individual’s likelihood of encouraging pupils to do investigations, but does not influence the other categories.

Half of all interviewees report that whilst there is a minimum expectation for science teaching hours, they have the autonomy to increase this. Interviewees also described how they are given autonomy over *how* they teach science and *what* content is covered.

²⁹ Multiple regression. Variables added into the model but no differences found for: time spent teaching science, if holds a science A level, gender, Science Leader in the school, role in the school, FSM, full/part time worker, PSQM at the school. Non-English schools were removed from the analysis due to low base sizes.



“[Teachers] can't make a decision on the minimum amount of Science, so there needs to be one session of Science, so probably one afternoon would amount to about two hours. The minimum they can't decide, but the maximum, it's up to them.”

— **Science Leader**

Pupils in focus groups were asked about their science lessons and described what they liked and disliked about the lessons. Doing investigations was repeatedly described as a favourite and pupils from all focus groups reported that the practical investigations they carry out in lessons stand out as being fun. Children favour investigations because they get the chance to be involved in the activity rather than simply watching someone else carry it out. Pupils in one focus group talked about how this gives them the opportunity to work out how to do things themselves.

“We don't really get much information, and we just, kind of, get left to experiment ourselves. We just, like, trial and error when we're doing stuff”.

— **Pupil**

Pupils reported they did not mind if the experiment went wrong as they are given the time to repeat it until they discover how to rectify what might be going wrong; this allows them time to learn. They also highlighted how it can often be funny when it goes wrong. Another pupil likes investigations because they are directly involved in creating the end product, which they have ownership of. If they have seen experiments being done by their teacher, or by a 'scientist' on a video, then carrying out the same experiment themselves can very fulfilling.

“I like it because sometimes we get to take it home. When you get the practical experiments done, you really feel proud and stuff.”

— **Pupil**

Some pupils highlighted that investigations helped them learn as they may observe something which is only noticeable when carried out in person. Pupils in almost all focus groups cite interactivity as an additional reason for liking investigations, saying they enjoy working together in groups. A few pupils also say that group work is valuable for their learning and allows them to discuss ideas which they may not have considered themselves, often helping when they, or others, are struggling.

“You never do experiments on your own. You always either have a big group, or just do it with your partner next to you, never on your own...then you've got people to talk to if you're stuck or something.”

— **Pupil**

Similarly, when pupils are given challenges by their teacher, it gives them extra motivation to work with, and also compete against, their classmates. Pupils from two focus groups observed how this builds their teamwork skills.

“Sometimes we do the odd challenges, like we work as teams to get the top results and it’s like really fun just to do that because not only does it help us with Science, but it helps us with teamwork too.”

— Pupil

Group work does not have to involve investigations to be enjoyed by pupils, as pupils from a few focus groups say they enjoy discussions around other activities such as videos, questions and images.

“I think when you’re with your friends it’s more fun because you can talk to your friends a bit, but when you need to listen you will listen more, because then you know that after that you can go back to your friends and go back to the cool science work you’re doing.”

— Pupil

Pupils clearly enjoy the interactive element of their science lessons, and almost all of them were vocal about how they would like to do more investigations. Pupils from one focus group say that they “do experiments, like, two or three times a year” and therefore would like to them more often. There are, however, components of investigations which pupils are not fond of. Pupils in half of the focus groups said they dislike writing “excessively” after they have done an experiment. One pupil said that they would prefer to be given a choice about how they record what they have done in a practical activity.

“[Our teacher] makes it really fun, but still, we always have to do the same thing. When we’re recording, we always have a table. It’d be a bit more fun if we could choose which one we wanted.”

— Pupil

Pupils from another focus group highlighted they do not want or expect the writing element of investigations to disappear completely, but would rather write observations up in a more concise manner.

“We normally write like entire sentences of how we do it instead of bullet points and it’s a lot easier to just do bullet points. Because, like, most people just want to get on with the experiments and do that instead of the bullet points.”

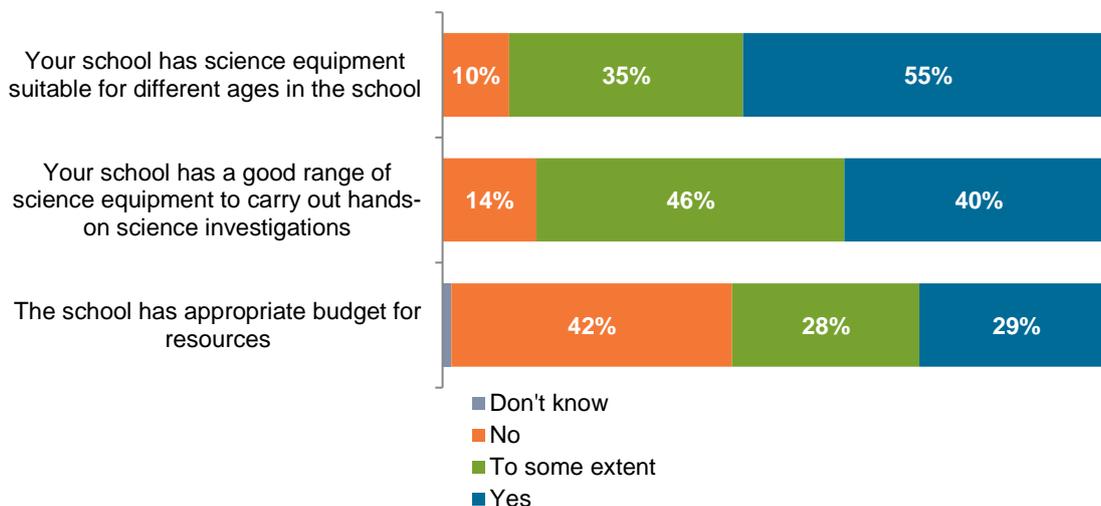
— Pupil

4.4 Science resources in the school

Respondents to the science leadership survey were asked whether they agree with a series of statements about the suitability of science resources. Just over half of all respondents (55%) consider that the science equipment in their school is suitable for different ages. Two-fifths (40%) state that their school has a good range of equipment to enable children to carry out hands-on -science investigations. Less than one-third (29%) of respondents

state that the school has an appropriate budget for resources in the school, and 42% state that their school does not.

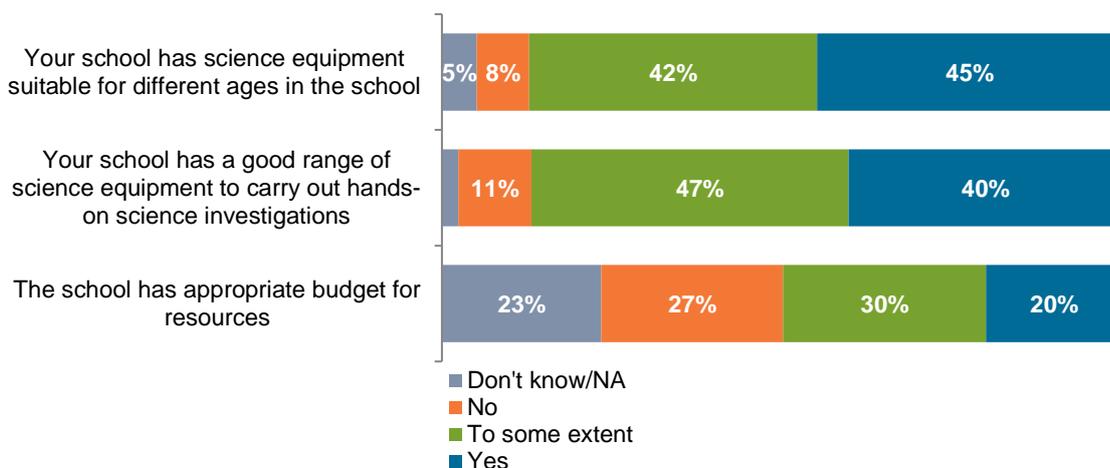
Figure 18: Extent of agreement about the suitability of science resources in schools as reported in the science leadership survey. Base=705–706.



Respondents in larger schools are more likely to indicate that the school has the appropriate budget for resources (33% at schools with either 200–299 pupils or 300 or more pupils, compared with 17% in schools with less than 100 pupils).

Respondents to the teaching survey are less likely to agree with these statements than those responding to the science leadership survey (with the exception of having a good range of science equipment). Just over two-fifths (45%) agree that the science equipment is suitable for different ages. Only 20% state they agree that their school has appropriate budget for resources; however, 23% did state don't know/not applicable.

Figure 19: Extent of agreement about the suitability of science resources in schools as reported in the teaching survey. Base=624.



A higher proportion of teachers who perceive science as ‘very important’ to their school state that they have science equipment suitable for all ages (60%), compared with those who perceive it as ‘important’ (40%) and ‘neither important or unimportant’ (30%).

Teachers at schools where one or more teachers use Explorify are more likely to agree with all three statements regarding resources:

- “Your school has a good range of science equipment to carry out hands-on science investigations”: 44% of teachers from Explorify schools agree, compared with 25% from non-Explorify schools.
- “Your school has science equipment suitable for different ages in the school”: 50% of teachers from Explorify schools agree compared with 24%.
- “The school has appropriate budget for resources”: 23% of teachers from Explorify schools compared with 7% stated ‘yes’.

All Science Leaders interviewed state they are responsible for monitoring the level of physical resources and equipment within their school. Whilst the level of autonomy amongst Science Leaders differs, almost all interviewees have a central role in deciding school science resources. However, even those with a high level of influence regarding budget and resources in the school are required to verify decisions through the SLT or headteacher.

“Budget obviously plays a factor, so if it’s something that I’m wanting that’s very expensive, that needs clearance.”

— **Science Leader**

In a few instances, decisions regarding which resources can be bought have to be taken to a higher level than the headteacher, usually due to being part of an academy trust. One interviewee explains how this influences the time required for larger purchases:

“Since the academy took over, there are a lot of decisions there that have to be made centrally which didn’t happen before. For instance, we can’t purchase things over a certain amount without getting three contracts in and three quotes in.”

— **Science Leader**

Whilst around a third of interviewees report that their school has a science budget separate from other subjects, at least half say they still have to compete with other subject areas and limit purchases to items that are essential to teaching the subject. For many schools, funding for English and maths has been protected more than other subjects, leading to further restrictions on science resources.

“English and maths get a bit more, they’ll actually get some budget, but science is out at the moment, you have to bid for it. I think pretty much all the subjects are in the same place, but maths and English obviously get more emphasis because that’s where the results are based.”

— **Science Leader**

In other schools, funding for all resources has reduced. Almost all interviewees observed that their science budget has dropped in the last five years, and also highlight their overall

school budget has decreased. One Science Leader reports that their budget has dropped significantly in recent years.

“Even in the four years I’ve been at the school, the amount of money that we’ve received has halved [...] It’s budgets across the school unfortunately. I think a lot more of the budgets were redirected to English and Maths, so they seem to be quite stable.”

— Science Leader

At least half of interviewees say they also rely partly on fundraising and grants from trusts and private companies.

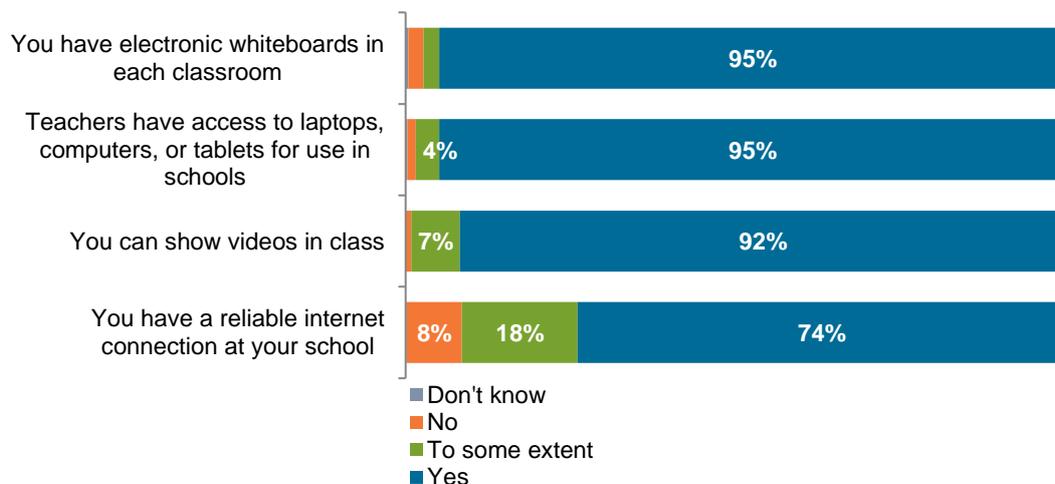
“I think we’re pretty lucky compared to some because some schools don’t have any budget and we have some, and we have a strong parent body who are behind me because I’ve worked really closely with them, so, if I ask that we need something that’s very expensive they will raise the money through bake sales and whatever to get that. It might just take some time but they’re very good at responding to, if we need something, they will help us out, and we’ve also had the [name] grant this year.”

— Science Leader

A small number of interviewees say their school has made a concerted effort to improve the profile of science, including the use of Explorify, and in these schools there is generally more money allocated to science.

The science leadership survey explored the extent to which technological resources are available in schools. The majority of Science Leaders report that teachers have access to laptops, computers or tablets (99%), there are electronic whiteboards in each classroom (97%), and they can show videos in class (99%). However, almost one-tenth (8%) report that their school does not have access to a reliable internet connection and a further 18% have this only ‘to some extent’ (Figure 20).

Figure 20: Views of technology in the school as reported in the science leadership survey. Base=706.



A higher proportion of smaller schools reported difficulties with their internet connection (14% from schools with less than 100 pupils and 16% from schools with between 100 and 199 pupils) compared with larger schools (5% from schools with between 200 and 299 and 4% from those with over 300 pupils).

A few interviewees say their school experiences intermittent issues with internet access and their internal server which occasionally prevents them from accessing Explorify activities. Access is dependent on a reliable internet connection.

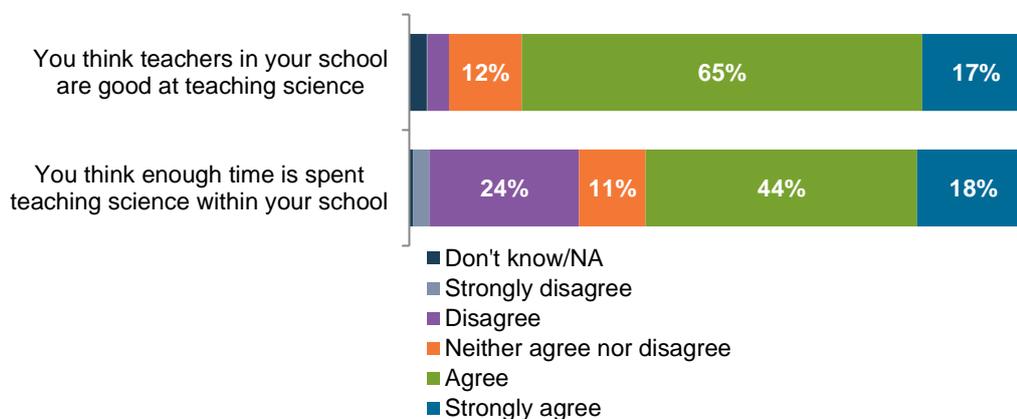
“The only thing that ever causes any difficulties is obviously you’re reliant on the infrastructure of the school and the wireless working. I mean, we’re having a bad day today, for instance, on wireless, so I wouldn’t be able to use it today.”

— Science Leaders

4.5 Attitudes towards teaching of science

The majority of respondents to the science leadership survey (82%) ‘strongly agree’ or ‘agree’ that teachers in their school are good at teaching science. However, a much lower proportion (62%) think that enough time is spent teaching science in their school reflecting the baseline findings.

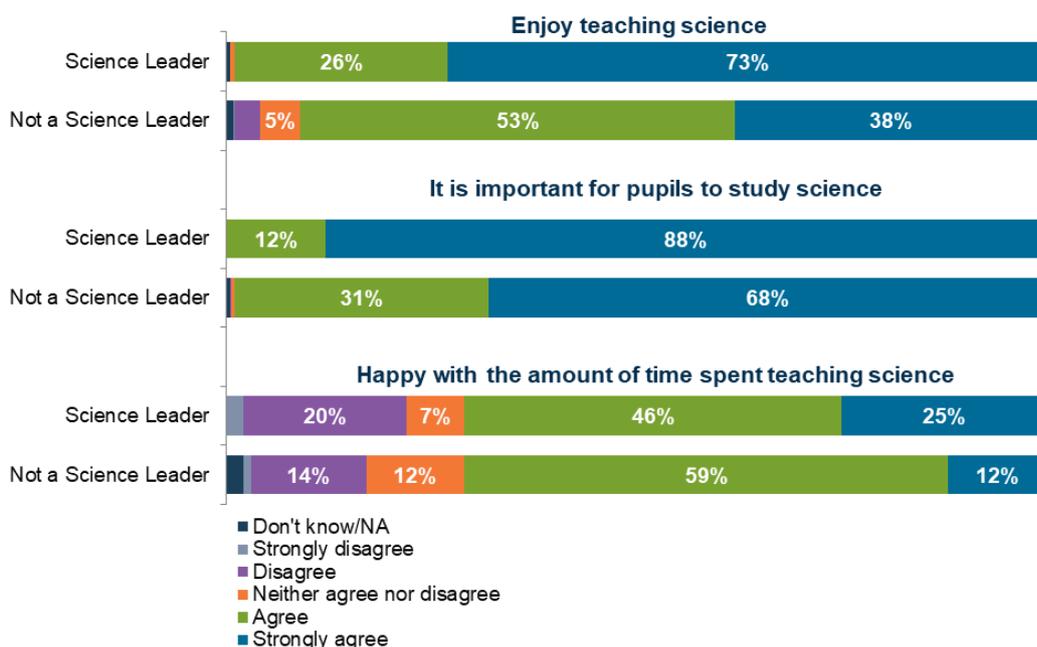
Figure 21: Extent of agreement about time spent teaching science and how good teachers are at teaching science as reported in the science leadership survey. Base=706.



Respondents to the science leadership and teaching surveys were asked about their views of science. The majority of participants (99%) ‘strongly agree’ or ‘agree’ that ‘it is important for pupils to study science’, whilst 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, but encouragingly those who strongly agree with this statement teach significantly more science a week (2.3 hours) compared with those who agree (1.9 hours), neither agree or disagree (1.9 hours) or disagree (1.7). Amongst respondent groups, Science Leaders have the highest levels of agreement with these statements.

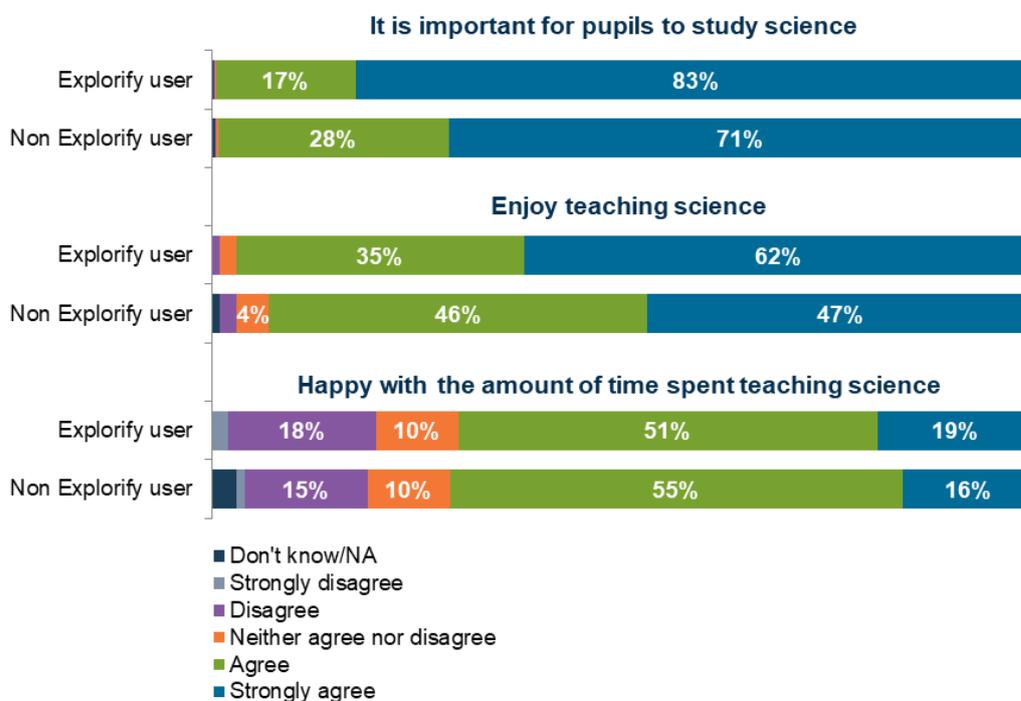


Figure 22: Extent of agreement about science views by role as reported in the science leadership and teaching surveys. Base: Science Leader=662–664, Non-Science Leader=747–752.



Explorify users are more likely to ‘strongly agree’ that it is important for pupils to study science and are more likely to say they enjoy teaching science. However, they are equally likely to agree that they are ‘happy with the amount of time they spent teaching science’.

Figure 23: Extent of agreement about science views by Explorify user as reported in the science leadership and teaching surveys. Base: Explorify user=710–711, Non-Explorify user=697–705.



Within the teacher survey, respondents were asked to state the first three words which came to mind when describing science, which elicited 2,129 words from 712 teachers. Figure 24 provides an overview of the most common words reported.

Figure 24: Word cloud representation of the most common words teachers think of when describing science



Analysis of the responses reveals that just over three-fifths (61%) of the responses provided by teachers relate to the process of undertaking scientific experiments or investigations with words such as 'Investigation', 'Experiment' and 'Exploration' cited (as displayed in blue in Figure 25). A further 2% link to science disciplines or topics, such as 'Space', 'Plants' and 'Animals'; and 5% relate to words that signify the wider world application of science, such as 'Relevant', 'Knowledge' and 'Life'. Approximately a quarter (26%) of the responses are associated with positive emotions about science, such as 'Fun', 'Inspiring', 'Exciting' and 'Fascinating' (as displayed in green in Figure 25); conversely, around 2% of responses link to negative emotions, such as 'Stressful' and 'Confusing' or those which relate to science being 'Complicated' or 'Challenging' (as displayed in orange in Figure 25). Interestingly, a further 2% of responses were associated with how respondents teach science in their school context, where teachers stated words, such as 'Resources', 'Rushed', 'Group work' and 'Pupil led'.

Figure 25: 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).

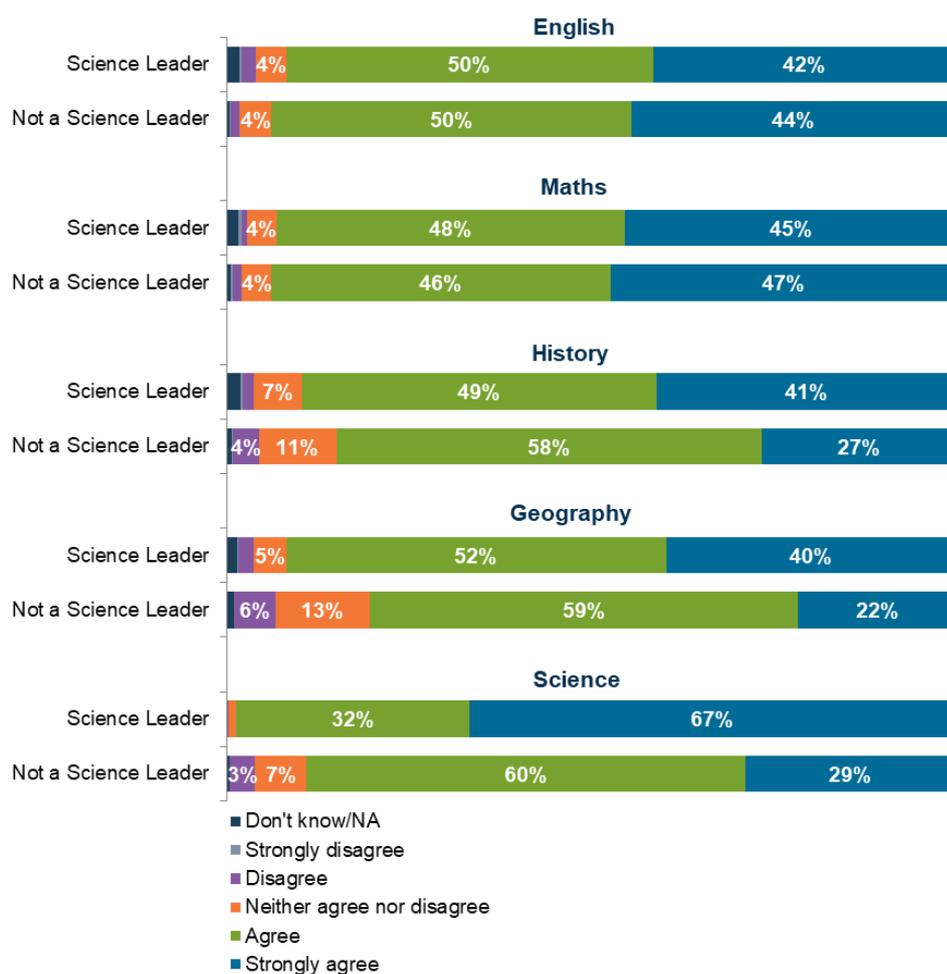


Further analysis reveals that a teacher’s confidence in their ability to teach science impacted on the words they chose when describing science. Over a quarter (27%) of the responses provided by teachers who are confident in their ability to teach science relate to positive emotions compared to just 16% for those who are not confident. Conversely, only 1% of the responses provided by confident teachers link to negative emotions or the complexity of science compared to 8% for teachers who are not confident.

4.6 Confidence teaching subjects

Respondents to both surveys were asked about their confidence teaching different subjects. Levels of confidence in teaching maths, science and English are similar, with most respondents stating they ‘agree’ or ‘strongly agree’ (see Figure 30 in Appendix 2). However, there are large differences found between Science Leaders and non-Science Leaders in terms of their confidence teaching science and other subjects. Whilst there is very little difference between confidence in teaching English and Maths, confidence in teaching science is much higher amongst Science Leaders (67% ‘strongly agree’ compared with 29% of non-Science Leaders).

Figure 26: Extent of agreement about confidence teaching subjects by role as reported in the science leadership and teaching surveys. Base: Science Leader=664; Not a Science Leader=749–753.



A slightly higher proportion (51%) of Explorify users ‘strongly agree’ they are confident teaching science (51% compared with 42%). Amongst Science Leaders a higher proportion who received CPD to lead science in the last 12 months state ‘strongly agree’ (75%) compared to those who did not (63%)

Further analysis was undertaken to explore whether individual- or school-level characteristics influence confidence when teaching science.³⁰ Differences were found which account for 43% of the variance in confidence levels with other factors which have not been measured through the study accounting for this instead. The characteristics that increase confidence are shown in order of importance:

- Enjoying teaching science
- Being a Science Leader in a school compared to non-Science Leaders
- Holding a science A level³¹ or Advanced Higher

³⁰ Multiple regression. Variables added into the model but no differences found for: gender, Science Leader in the school, role in the school, FSM, full/part time worker, school size, importance of science to the school. Non-English schools were removed from the analysis due to low base sizes.

³¹ This has been defined as holding a Biology, Chemistry or Physics A level or Advanced Higher.

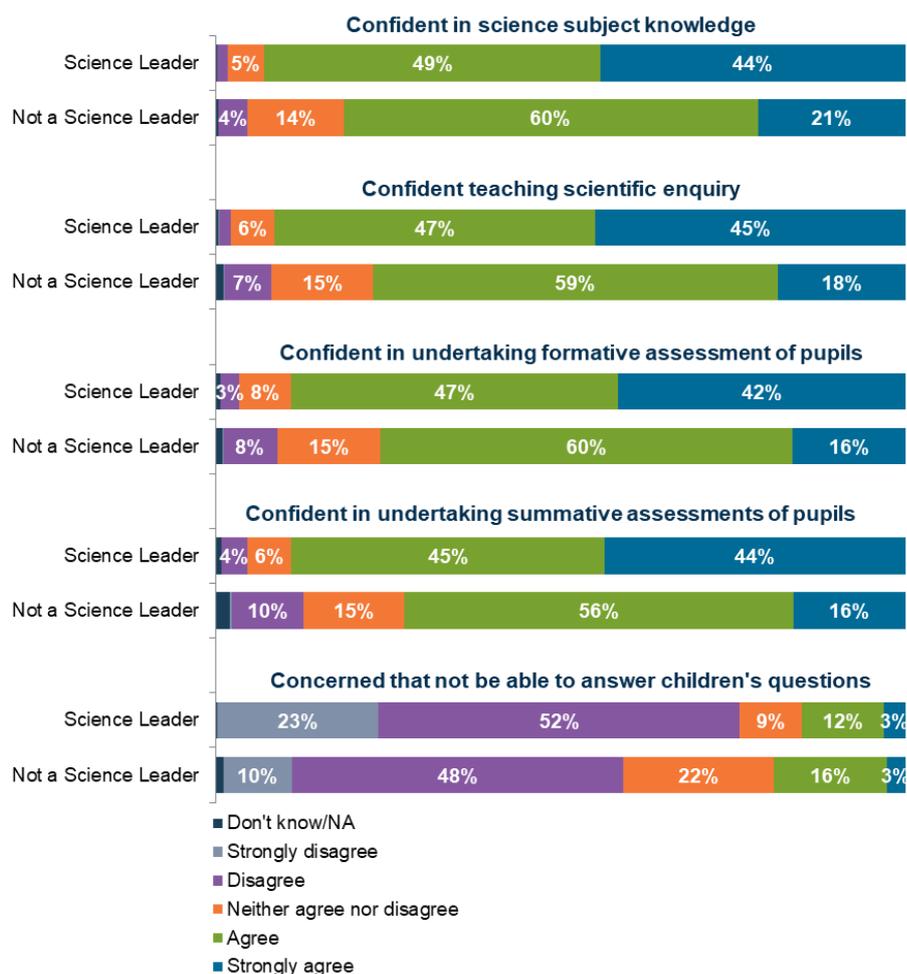
- Working in the teaching profession for a longer period of time
- Being in a school that currently has PSQM or is in the process of applying for PSQM
- Viewing science as important to the school
- Using Explorify

Further analysis reveals that a higher proportion of respondents who on average completed a total of 21 or more (60%) and between 11 and 20 (68%) Explorify activities with each of their classes ‘strongly agree’ they feel confident teaching science compared with those who had completed up to five (41%).

Respondents to both surveys were asked to state to what extent they agree with confidence statements about teaching and assessing science. Just under one-third (32%) ‘strongly agree’ they are confident in their subject knowledge, with a slightly lower proportion (31%) stating they feel confident teaching scientific enquiry, undertaking summative assessments (29%) and formative assessments (28%). Less than one-fifth (17%) of respondents ‘strongly agree’ or ‘agree’ that they are concerned they might not be able to answer children’s questions about science. In addition, 16% state they ‘neither agree nor disagree’ (see Figure 31 in Appendix 2).

As with overall confidence, a higher proportion of Science Leaders (just under half) ‘strongly agree’ with the four options regarding confidence with the various aspects of science teaching compared with non-Science Leaders (one-in-five). Just under one-quarter (23%) 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 10% of non-Science Leaders.

Figure 27: Extent of agreement about confidence teaching science by role as reported in the science leadership and teaching surveys. Base: Science Leader=664; Not a Science Leader=748–753.



Interview findings reflect those in the survey, with almost all Science Leaders reporting they are confident teaching science and around three-quarters of teachers (with no science leadership responsibilities) stating the same. However, teachers who have more support and closer links with their Science Leader, and colleagues, show signs of greater confidence than those who receive less support.

“In terms of CPD, although it’s not been a proper go out and go on a course, the fact I’ve been working with [the Science Leader] on science it has boosted my science teaching no end.”

— Teacher

Almost all teachers report they feel confident now because of the subject knowledge they have accumulated through CPD and prior learning. One teacher reported that being confident in their knowledge directly influences their confidence teaching.



“I think it’s my knowledge. It’s being confident in your own knowledge. I think if you’re not confident in your own knowledge then it’s sort of like, ‘Oh, is this right?’ I’m a bit more wary. But I think if I’m confident with what I know, then I’m fine.”

— **Teacher**

At least half of interviewees believe that science related CPD they have taken part in has made them more confident teaching science, and more of this would further improve their confidence levels.

One interviewee reported that teachers’ confidence is negatively affected when teaching less science especially when compared with maths and English. The fact that they teach core subjects more often means they are more likely to have tried and tested methods for delivering those sessions. Through their previous experience as a Science Leader, the same teacher observed that colleagues seem to have misconceptions about how much subject knowledge they need to be able to teach science to a high level.

“It was a real struggle to upskill teachers to understand that they don’t actually need to know every single thing about it to be able to teach [science] well.”

— **Teacher and previous Science Leader**

One headteacher reported that teachers often lack confidence and struggle with teaching science more than other subjects. As a response, the Science Leader at that school will be increasing the amount of internal training and support they provide.

“I was surprised that quite a few staff, more than I thought, said that they lacked confidence teaching science. So, it’s made us re-evaluate the training programme that we’re putting in place.”

— **Headteacher**

The same headteacher highlighted their staff treat themselves unfairly by having little confidence in their teaching abilities, but believes that the training the Science Leader provides will have a positive influence on their confidence teaching science.

“I think that’s where you have the dilemma, because they don’t think they’re very good, when in actual fact they’re better than they think they are, but I think that’s probably, you know, part of the profession, if I’m honest, but I can’t ignore that, as a headteacher.”

— **Headteacher**

It is also clear that, as evident in the survey findings above, interest in and enjoyment of the subject has an influence on interviewees’ confidence in teaching science. This is especially since it makes it more enjoyable for teachers to spend additional time outside of school hours to take part in CPD and research.

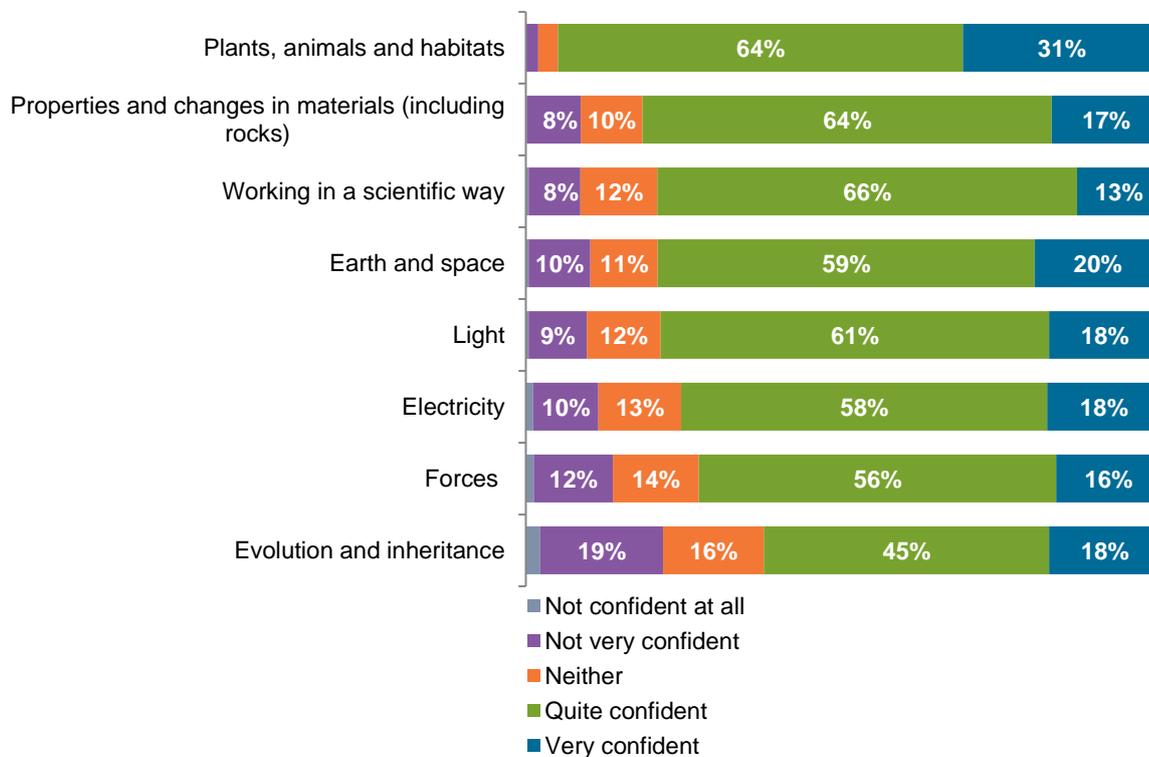
A few teachers reported that gaining constructive criticism and/or positive feedback from colleagues and others would help them to improve their confidence and science teaching abilities.

“If the head of science or another member of staff came in and watched ten, fifteen minutes of our sessions they could obviously, maybe, give a few pointers for next time.”

— Teacher

Respondents to the teaching survey were asked how confident they are in teaching the aspects of science shown in Figure 28. A higher proportion state they are ‘very confident’ or ‘confident’ at teaching ‘plants, animals and habitats’ (95%), followed by ‘properties and changes in materials’ (82%), ‘working in a scientific way’ (79%) and ‘earth and space’ (79%). Only 63% are as confident in teaching ‘evolution and inheritance’.³²

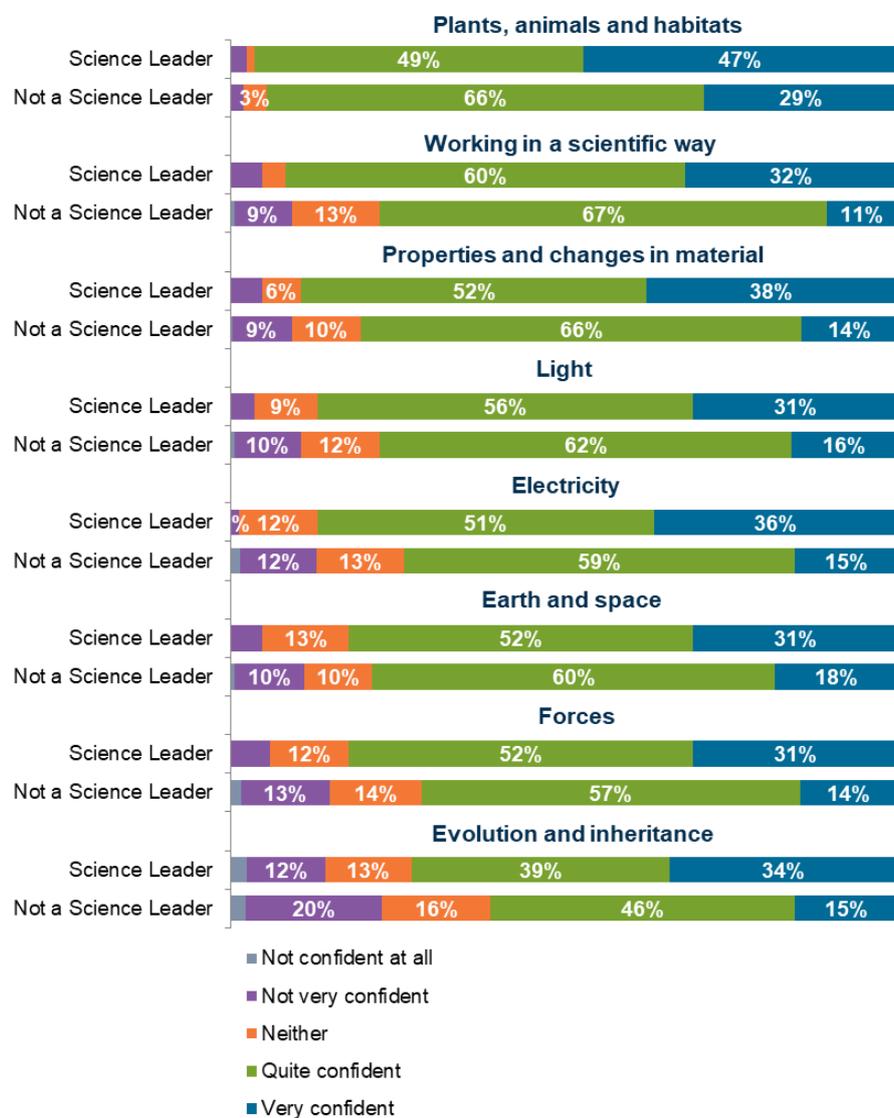
Figure 28: Confidence teaching aspects of science as reported in the teaching survey. Base=707–712.



³² The areas listed apply to the National curriculum in England although it is important to note that not all topics are taught to all year groups which may explain some of the variation in confidence levels reported (in that, a teacher may not be required to teach the topic to their year group). Furthermore, not all of the curriculum areas listed apply to all the other countries of the UK with some differences observed.

Science Leaders are again more likely to report they are ‘very confident’ in all topic areas (Figure 29).

Figure 29: Confidence teaching aspects of science by role as reported in the teaching survey. Base=Science Leader=85, non-Science Leader=622–626.



Interviews reflect the data collected in the teacher survey, as teachers most commonly cite topics related to Biology (such as plants and animals) as the subject they feel most confident teaching. Interviewees highlight they are more confident teaching this because it is accessible and piques their interest:

“Animals including humans, and the plants, and everything like that, I’m pretty confident with, and I find quite interesting, which makes it easier to teach, and also I think that makes you feel more confident with it.”

— Teacher

Experiences before teaching science at Primary also impact on how teachers feel about different areas of science. For example, one Science Leader taught at a higher level and cites this as influential in their confidence levels.

“I’m more confident in Biology but, as I said, I taught Chemistry and Physics up to GCSE which is more than enough to be confident with what I’m doing now at primary.”

— **Science Leader**

Subject knowledge was a major influencer of how confident almost all teachers feel delivering lessons on certain subject areas. One teacher reports having less confidence teaching certain areas of science because there are more facts to learn and therefore more chances to ‘go wrong’.

“I’m not as confident with all the ones that are very knowledge-based, like earth and space...Sometimes the children can ask me questions, I’m just really not sure of the answer because they’re just really interested in it to quite a depth. I’m like, ‘Ah, I don’t know’, and if I’m not sure, I’m googling my answer to things.”

— **Teacher**

At least a quarter of interviewees highlight that CPD helps them to feel more confident in certain areas which may be new to them, largely because it helps them to improve and refresh their knowledge in those areas. Having the chance to keep practicing and carrying out certain investigations helps with confidence as described by one teacher:

“Initially, sort of, setting up experiments was quite daunting but again, having done it for a couple of years now, we’ve done the same topics I’m more confident with doing experiments and just organising the classroom and stuff.”

— **Teacher**

Impact on teaching

A few interviewees commented on how their confidence affects how much they enjoy teaching a subject. One teacher acknowledges that this has an effect on how much pupils enjoy the lesson and acts accordingly, occasionally swapping with a colleague to make sure they deliver the best session can.

“I don’t enjoy RE, so I tend to get my colleague to teach it for me while I do the science with her class. So, we tend to do a swap because I feel it’s important to have a subject taught by somebody that’s enthusiastic about it to make them enthusiastic about it.”

— **Teacher**

Another teacher recognises the importance of having confidence to teach science in a way which allows them to have the freedom to alter the direction of learning and discussion, depending on where the pupils want to take it.

“I can go off topic, I can go into a lot more detail than they need if they ask the questions. Obviously, some of our brightest kids, our higher-level kids will ask those questions and we can go off topic and explore different things.”

— Science Leader

Whilst teachers’ confidence can have an impact on how the lesson is taught and how receptive pupils may be, there is no evidence from the interviews to suggest that teachers would avoid teaching science or reduce how much they teach the subject.

“I’ve got to teach it, even if I’m not confident, so that’s the nature of the primary curriculum. You’ve got to teach things, so you’ve got to read up and learn.”

— Teacher

4.7 Pupils perceptions of who can be a scientist

Primary school pupils were asked a series of questions in focus groups about who they think could be a scientist. Some pupils in every focus group report that anyone can be a scientist if they want to be. Pupils widely agree that there is an element of intelligence, education and hard work involved in becoming a scientist.

“Everyone is equal, and everyone should have a right to do what they want to do. So, if you want to be a scientist, you can be a scientist, but the only thing is you have to get the right learning scores on your exam.”

— Pupil

“If they just believed in themselves they could be a scientist...Because if you believe in yourself can be anything you want to be.”

— Pupil

A few pupils noted that “everyone has a scientist in them” because we all get “curious” and “ask questions” and find out the “answers”. However, a minority of pupils from one school believe that you need to be “smart” to be a scientist, which prevents ‘anyone’ from becoming one. In this school the Science Leader reported they had been working hard to raise pupils’ aspirations, but recognised further work was needed to help break down these misconceptions for pupils from one of the three focus groups conducted in the school.

Interestingly, pupils from a few focus groups report that their teacher or Science Leader is a scientist, highlighting that someone’s current role does not restrict their ability to be involved in science or being categorised as a ‘scientist’ – if they do something science related in their role they might be seen as a scientist.

What a scientist looks like

Pupils from around half of focus groups highlight that scientists wear a white lab coat and some form of protective mask, such as goggles. A few children also picked up on the

stereotype of a scientist having ‘crazy white’ hair, which most recognised as a misrepresentation of what scientists actually look like.

Pupils who acknowledged the stereotypical image of what a scientist looks like also highlighted that a scientist can wear anything and whilst some scientists have to wear protective clothing, many do not. Similarly, “*anyone can wear a white coat*” but that “*doesn’t mean they’re a scientist*”.

One group of pupils talked about an exercise they did in a science class, where the teacher asked them to draw a scientist. Whilst some children drew men wearing goggles and lab coats, others drew girls/women and people wearing ‘normal’ clothes. Another group felt passionately that anyone could be a scientist and that looks or disabilities should not get in the way of your aspirations:

“Even if they’ve got only one leg... Or only one arm... They could have one of those fake arms or legs, like a robot.”

— Pupil

What a scientist does

Pupils across the focus groups had many ideas about what scientists do, saying that they could work in different fields including archaeology, physics, astrophysics, palaeontology, maths, forensics, technology and biology.

A common theme arising in the focus groups was *progression*, as pupils often say scientists work in fields where advancement of that area is key to their role. For example, pupils frequently think that scientists explore new areas of the ocean or space, discovering new places, species and ideas. One pupil described the role that scientists play in the development of Artificial Intelligence:

“I think scientists help to expand our future and they’re doing it, even if they’re at home they’re doing it little bit by bit because people are experimenting with robots and that’s AI and improving our chances of having, like, robot people that can help us with everyday chores and just advancing our society.”

— Pupil

The concept of *Exploration* and *discovery* of new ideas to resolve current issues was also raised in almost all focus groups. The environment was also cited by children as a key focus for scientists. Children from one focus group reported that “[*scientists*] can help the sea creatures that get affected by pollution”. They might “*find new ways to help the planet*” – for example, “*they could change the way plastic is made*” and solve “*the plastic problem*”.

Another pupil spoke about the concept of validity which they had recently been taught in one of their science lessons.

“I think they might do lots of experiments, and they wouldn’t just do it once, they’d do it like ten times, maybe, to make sure they’ve got the correct answer. If you just do it once then it might not be correct, so you have to do it lots of times.”

— Pupil

Beyond discovering new solutions, pupils also highlight that a scientist’s role is often to use questioning and observation to further refine scientific ideologies by testing current ideas, even their own. The perception that scientists undertake experimentation and exploration is evident across pupils in most focus groups, but some recognised that this may not constitute the entirety of their role. Pupils also stated that those who care for people or animals use science in their jobs.

As outlined earlier, a few children spoke about scientists in relation to themselves, suggesting they could be scientists themselves, specifically because they think scientists perform tasks which are similar to those that they use and develop in their own science lessons.

“It doesn’t really need to be, like, exact job. Everyone could be a scientist, you know, because people think. Like when we do science, we get all involved in questions.”

— Pupil

Another pupil reported their teacher has echoed these thoughts, reinforcing to pupils that the skills they are honing in their classes are used by scientists in their profession.

“[Our teacher] said that everybody’s a scientist because all you need to do to be a scientist is ask questions and answer questions, and just think about things.”

— Pupil

Where a scientist works

Whilst pupils in half of focus groups think that scientists can often work in laboratories, all who mention this also say that this is not always the case. One pupil recognises that although scientists may sometimes work in a lab, they do so for a specific reason (e.g. health and safety) dependent on what kind of work they are carrying out.

Many of the other suggestions of where scientists work related to exploration and discovery that is integral to their jobs. For example, scientists might work in the oceans, underground, in space or in many different countries. Pupils in one focus group – clearly referring to their own teacher – highlight that scientists “*could be in schools, teaching children*” and “*they might be helping to get children to realise that science is more fun*”.

05. DISCUSSION AND 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

Within schools that have one or more teachers using Explorify awareness of the resource is high; however, there is a small proportion of teachers and Science Leaders who are unaware of the resource even though it is used by colleagues in their school. Most Science Leaders find out about Explorify through external science training they have attended whilst most teachers find out about it through their Science Leader or a senior leader in their school. This highlights the importance of recommendations and word of mouth to spread the word about Explorify.

Most respondents who are aware of Explorify use the resource with pupils in their schools; for those who have not, the primary reasons were a lack of time to review the resource, lack of time to prepare to use the activities in lessons and a general lack of familiarity with the resource. Very few think that it would not be useful for them. During depth interview discussions teachers also report they do not use it as often as they would like because they forget about it.

The primary factors that motivated respondents to use the resource in the first instance include its ease of use, requiring limited time to plan and because it is free. Approximately half of Science Leaders interviewed explain that their decision to use Explorify was influenced by how it would support them in their leadership role, as they believe it would be a valuable way for them to support their colleagues to teach science.

Most Science Leaders either formally advocate the use of Explorify or have recommended it to colleagues more informally. They often introduce the resource at staff meetings or via internal training sessions. Two-thirds of teachers have also recommended Explorify to an average of 6 colleagues with the remaining teachers stating they would do so in the future.

Most respondents report using Explorify during science lessons, whilst one-third use Explorify during other subject lessons, two-fifths use Explorify at the start of the day prior to lessons commencing and one-third use Explorify at other times during the day (excluding breaks and lunch time). Interviewees describe how they value the way that Explorify encourages pupils to engage in discussions, which they find useful as a way to supplement their teaching and as a bridge between lessons (either at the beginning or the end). Explorify is also described as an effective method of summarising and reviewing learning from a lesson. 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. On average respondents use Explorify once a week with pupils in their class however, this varies greatly with a minority only using it once a term.

Almost all respondents plan to continue using Explorify with pupils in their school. Keeping content updated with new topics and activities, ensuring it remains topical and fresh, is seen as critical to their continued use. Interviewees found the website easy to use and highlight this as important. Pupils in the focus groups all enjoyed the wide range of activities undertaken through Explorify; they highlighted that they are fun and ‘brought science to life’ keeping them interested in the lesson. Pupils in almost all focus groups say that they would like to do more Explorify activities in their science lessons and within other lessons. Across the different types of Explorify activities there are various aspects that pupils enjoy, such as the fun nature of the activities, the teamwork involved, the aspect of ‘surprise’, group discussions and there being no right or wrong answers.

The impact of Explorify

The majority of respondents who had used Explorify with pupils nine times or more highlight that whilst undertaking Explorify activities it encourages pupils to engage in class discussion, ask more questions and enjoy science more. Interviewees also explain that Explorify encourages greater engagement in class discussions and that this is even more apparent for pupils who lack confidence, were previously disinterested in science, have SEN or had English as an additional language. Interviewees describe how within group discussions, pupils have less fear of being wrong due to the open nature of the activities further encouraging discussions.

More widely, approximately four-fifths of respondents believe that Explorify has a positive impact on pupils’ science vocabulary, their science knowledge, and confidence; and four-fifths believe it has had a positive on pupils’ literacy skills. Almost all interviewees think that Explorify positively influences pupils in their science lessons. Interviewees believe that the critical thinking skills and aptitude for enquiry that Explorify helps to instil aids pupils in conducting scientific investigations.

In addition to impacting on pupils, Explorify also has a range of positive impacts on teachers. Almost all respondents agree that Explorify has led to them more frequently encouraging pupils to take part in class discussions about science and over three-quarters report more frequently encouraging pupils to predict what will happen when they do a science investigation. Interviewees highlight how using Explorify allows greater pupil-led learning and how it can also be used to assess and monitor subject knowledge. Half of all respondents state that using Explorify has increased the amount of science they teach, primarily due to using the resource outside of science lessons. Most respondents also highlight how Explorify has led to them enjoying teaching science more.

The more a teacher has used Explorify with their classes, the more likely they are to agree that Explorify has impacted on a number of these aforementioned impacts; this suggests that repeated use of Explorify increases the self-reported impacts.

Strategic issues relating to science delivery

The vast majority of schools have a dedicated staff member responsible for leading science development and teaching across their school. Science Leaders are typically classroom teachers. Only half receive release time specifically for this role and even then, only a relatively small amount of time is taken throughout the year. Just over half of all Science Leaders have participated in CPD in the last 12 months to help them lead or develop science in their school.

Only one-third of respondents think science is ‘very important’ to their school, compared with 89% for maths and 88% for English. The role that someone holds in a school influences their perceived importance of science to the school. A much higher proportion of respondents in a senior leadership position state that science is ‘very important’ compared with those in all other roles.

Teachers at schools where Explorify is used are more likely to report receiving support from their school to teach science, compared with those in schools not using Explorify. Comparator schools’ experiences of receiving support are in line with the baseline report. Support most frequently consists of receiving lesson plans, coaching or mentoring from the Science Leader; being provided with science training; or gaining access to online courses, training or resources.

The delivery of science

Science in schools is typically taught by classroom teachers. In English schools teachers mostly report teaching science weekly either as a standalone subject or through cross-curricular work. Younger pupils typically receive cross-curricular science teaching rather than standalone lessons and for fewer hours. On average science is taught weekly for 1.5 hours (1 hour and 30 minutes) and 56% of classes do not receive 2 hours of science a week or more.

Teachers also deliver science through science weeks, block teaching or other methods. When combined with the number of hours taught on a weekly basis, the total amount of science delivered throughout the 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 1.8 hours a week (1 hours and 48 minutes) in total and 51% of classes receive less than 2 hours a week. Whether respondents uses Explorify or not does not influence the total science teaching time. However, on exploration of the data, very few survey respondents include the time spent using Explorify within the total number of hours spent teaching science.

A variety of activities are undertaken in science lessons with more limited opportunities for pupils to design their own science investigations. Teaching methods used to deliver science are influenced by teachers’ confidence in teaching science, the perceived importance of science in the school and the individual being a Science Leader. Using

Explorify does increase a respondent's likelihood of encouraging pupils to do investigations. The two main aspects of science lessons pupils report enjoying are investigations and group work.

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. Those who are happiest with the amount of time they personally spend teaching science are those who teach more hours of weekly science.

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 provided relate to the process of undertaking scientific experiments or investigations with words such as 'Investigation', 'Experiment' and 'Exploration' 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'. Further analysis reveals that a teacher's confidence in their ability to teach science impacted on the words they chose with a higher proportion of confident teachers reporting positive emotions and a low proportion stating negative emotions and/or that science is complicated.

Respondents are broadly confident in their ability to teach science, although they rate this lower than their confidence to teach English and Maths. Confidence is higher amongst those who enjoy teaching science; Science Leaders; those with a science qualification; those who have worked in the profession for longer; being in a school that has, or is applying, for PSQM; those who view science as important to the school; and using Explorify. Almost all teachers report that their confidence can be attributed to the subject knowledge they have accumulated through CPD and prior learning in certain areas of science. During the interviews teachers who have more support and closer links with their Science Leader, and colleagues, show signs of greater confidence than those who receive less support. Whilst teachers' confidence can have an impact on how the lesson is taught and how receptive pupils may be, there is no evidence from the interviews to suggest that teachers with lower confidence levels would avoid teaching science or reduce the amount of time spent teaching the subject.

APPENDIX 1: RESPONDENT CHARACTERISTICS

Characteristics of those responding to the Science Leader survey

School country

	Number	Percentage
England	653	93%
Wales	14	2%
Northern Ireland	7	1%
Scotland	32	4%

School size

	Number	Percentage
99 or less pupils	112	16%
100 – 199 pupils	135	20%
200 – 299 pupils	189	27%
300 or more pupils	252	37%

School role

	Number	Percentage
Classroom teacher	575	81%
Deputy/Assistant Headteacher	34	5%
Acting Headteacher	3	1%
Headteacher	82	11%
Other role	12	2%

Years have working in the teaching profession

	Number	Percentage
0-10 years	318	45%
11-20 years	212	30%
21-30 years	147	21%
31 years or longer	29	4%
<i>Mean</i>		14 years
<i>Range</i>		1-41 years

Full time or part time work

	Number	Percentage
Full time	548	78%
Part time	158	22%

Gender

	Number	Percentage
Female	582	82%
Male	124	18%

School years taught by Science Leader

	Percentage
Reception	8.5%
Year 1	14%
Year 2	19%
Year 3	19%
Year 4	22%
Year 5	20%
Year 6	20%
Our school does not have specified school years due to offering special/alternative provision	1%
None	18%
Base	706

Characteristics of those responding to the teacher survey

School country

	Number	Percentage
England	672	95%
Wales	16	2%
Northern Ireland	5	1%
Scotland	17	2%

School size

	Number	Percentage
99 or less pupils	40	6%
100 – 199 pupils	79	11%
200 – 299 pupils	161	23%
300 or more pupils	404	59%

School role

	Number	Percentage
Classroom teacher	701	98%
Deputy/Assistant Headteacher	7	0.9%
Headteacher	1	0.1%
Other role	8	1%

How many years have you been working in the teaching profession?

	Number	Percentage
0-10 years	406	58%
11-20 years	198	28%
21-30 years	86	12%
31 years or longer	8	1%
<i>Mean</i>		11 years
<i>Range</i>		0-36 years

Do you work full time or part time?

	Number	Percentage
Full time	591	84%
Part time	116	16%

What is your gender?

	Number	Percentage
Female	614	87%
Male	89	13%
Prefer not to say	4	1%

APPENDIX 2: ADDITIONAL ANALYSIS

Table 5: Number of weeks and hours dedicated science weeks are delivered as reported in the science leadership and teaching surveys

	1 week	2 weeks	3 or more	Mean hours delivered each week
Reception (base=95)	89%	5%	5%	10
Year 1 (base=136)	88%	9%	4%	9
Year 2 (base=178)	90%	5%	4%	9
Year 3 (base=172)	89%	7%	4%	9
Year 4 (base=191)	91%	6%	3%	10
Year 5 (base=207)	87%	9%	4%	9
Year 6 (base=191)	90%	7%	3%	9

Table 6: Rank order of variables affecting each question through multiple regression for frequency of science delivery methods used in lessons as reported in the science leadership and teaching surveys

	Rank of linear regression for influences					
	Encouraging pupils to do investigations	Encourage pupils to take part in class discussions about science	Demonstrate science investigations to pupils	Arrange for pupils to design their own science investigations	Arrange for pupils to record data or observations from science investigations	Encourage pupils to interpret their science data or investigations
You feel confident teaching science	1	1	3	3		1
How important is science to the school		2	4	2		2
Person is a Science Leader	3		1	1		
You enjoy teaching science	2				1	
Working for a lower number of years in the teaching profession			2			3
Explorify user	4					
Being in a smaller school				4		

Figure 30: Extent of agreement about confidence teaching subjects as reported in the science leadership and teaching surveys. Base=1,318–1,410.

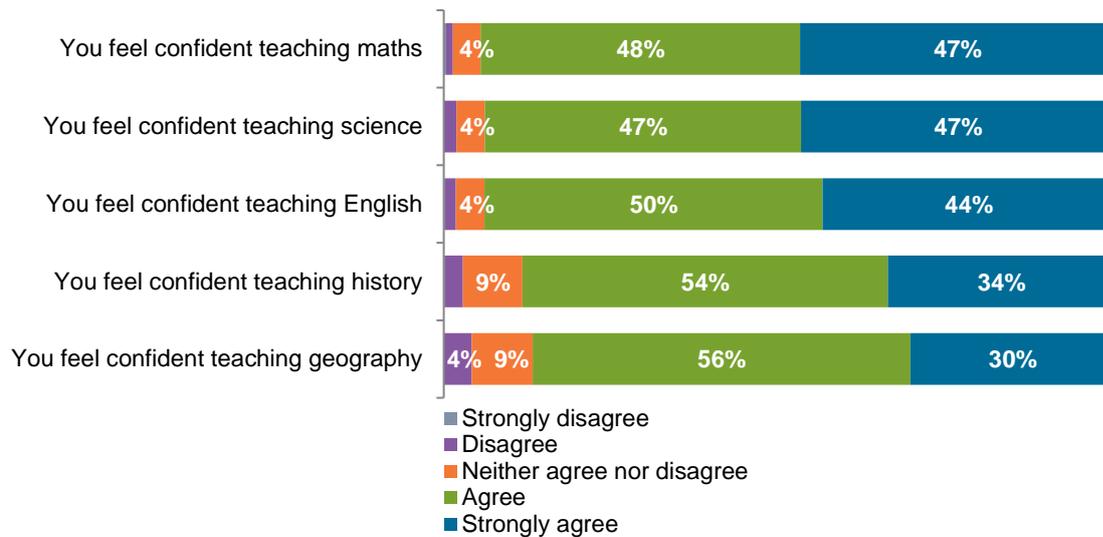
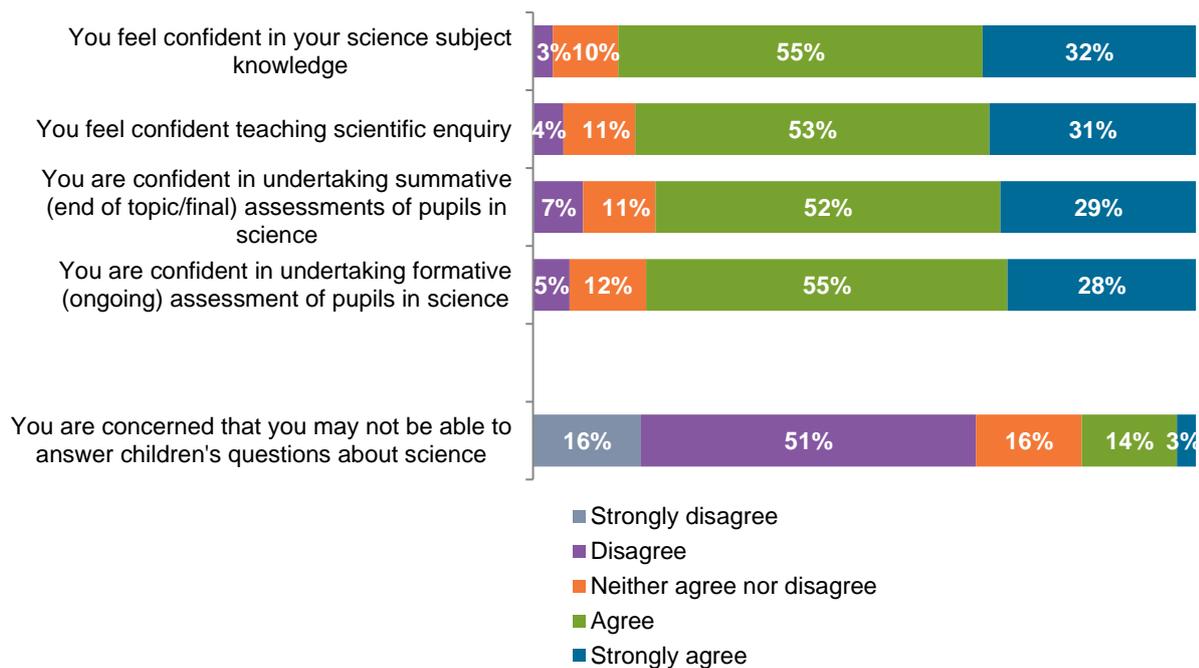


Figure 31: Extent of agreement about confidence teaching science as reported in the science leadership and teaching surveys. Base=1,391–1,408.



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**Wellcome Trust, 215 Euston Road,
London NW1 2BE, UK
T +44 (0)20 7611 8888, F +44 (0)20 7611 8545,
E contact@wellcome.ac.uk, wellcome.ac.uk**

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