



The impact of COVID-19 on primary science education

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

© CFE 2021

CFE are research and consultancy specialists in
employment and skills. We have been providing our expert
services to public and private sector clients for over twelve
years. We re-invest our profits to fund innovative research
projects and our Policy Insight series.

Foreword

This is the last of our reports for primary science education. Our first report in 2017 formed the baseline for our campaign for primary science, aiming to see more and better science being taught in UK primary schools. Science was low on the list of priorities in many UK primary schools: most pupils probably did not receive enough science teaching to enable them to fully understand the curriculum and few of those responsible for leading science in schools had dedicated leadership time or access to continuing professional development (CPD).

Since then we have seen some encouraging improvements¹. Where schools recognise the importance of effective science subject leadership and make provision for it, the benefits are clear: better teaching and progress; pupils' understanding of the importance of science strengthens; teachers have increased confidence and understand how science can benefit wider learning, including thinking, planning, observation, reasoning, and explaining. Science provides pupils with opportunities to practise and improve skills in oracy, writing, data analysis, and accurate measurement. It is inclusive and accessible.

But the impact of COVID-19 on education since March 2020 has been significant. We expected science teaching to be negatively affected but what has amazed and humbled us is how inventive and adaptable teachers have been to strive to make science teaching count, working harder than ever to support their pupils while having to support their own families, learn new technologies, and manage an increased workload.

Despite teachers' huge efforts, disadvantaged pupils have been the most negatively impacted - teachers highlight the difficulties faced by their pupils' parents and families and the consequences for pupils' progress. Teachers in schools with high proportions of disadvantaged pupils often experienced difficulties regarding access to technology, professional development and support for subject leadership.

Now teachers are concerned about gaps in science knowledge and skills that will take time to address. They value the need to develop pupils' skills to work in a scientific way and acknowledge that this has been hard to manage with remote learning. It would be tempting to rush into quick knowledge-based fixes, but we must equip young people for their futures by building deep knowledge and scientific understanding and ensure that teachers have the support they need too. It is vital that:

- schools allocate enough opportunity for quality primary science teaching and learning as part of the rich curriculum that every child should experience
- each school's science curriculum must enable pupils to build on prior learning with opportunities to embed learning and apply it in less familiar contexts
- science leaders must be given regular time to lead and develop science in their schools.

Louise Stubberfield

Primary Science Lead

Wellcome Trust, August 2021

¹ Evaluation of the primary science campaign, 2020. London: Wellcome Trust <https://cms.wellcome.org/sites/default/files/2020-10/evaluation-of-the-primary-science-campaign-2020.pdf>



Contents

1. Introduction and methodology	7
2. Impact of the COVID-19 pandemic on schools and teaching	10
3. Impact of the COVID-19 pandemic on science teaching and learning	19
4. CPD and support to teach science	32
5. Impact of COVID on science learning	38
6. Use of Explorify during the pandemic	44
7. Impacts of Explorify	51
8. Conclusions	62

Authors and acknowledgements

The authors of this report are Sarah Leonardi, Claire Tyers, Hayley Lamb, Chris Milner, Peter Howe, Michelle Hansel and Sophie Spong.

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

EXECUTIVE SUMMARY

CFE Research, was 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,² a free resource of engaging, creative science activities for all primary school teachers. Explorify launched in autumn 2017 following a pilot in spring of that year. It was designed to stimulate curiosity, discussion and debate and is intended to support teachers to encourage children to think like scientists.

The research explores the nature of science delivery across the UK and evaluates the impact of the Primary Science Campaign. 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.³ Our 2020 report⁴ presented data captured from schools in England using Explorify in the 2019/20. This highlighted the impact Explorify was having on both teachers and pupils.

The focus of the research in 2021 broadened due to the COVID-19 pandemic. We explored the impact of using Explorify on teachers and pupils throughout the pandemic and the overall impact of COVID-19 on schools and science delivery.

Approach

The data presented in this report was captured via four methods:

- An online survey of **2,823** teachers, science leaders and senior leaders between March and May 2021.
- Depth interviews with 33 staff who use Explorify during the Summer term of 2021.
- Seven case studies of schools focused on how they use Explorify.
- Interviews with three providers of primary science continuing professional development (CPD).

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

² <https://explorify.wellcome.ac.uk/>

³ <https://wellcome.ac.uk/sites/default/files/state-of-the-nation-report-of-uk-science-education.pdf>

⁴ <https://wellcome.org/sites/default/files/evaluation-of-the-primary-science-campaign-2020.pdf>

Key findings

COVID-19 has had a significant impact on both schools and teachers

Schools have had to adapt to the restrictions caused by the pandemic and deal with a whole host of logistical challenges. Individual teachers have then had to deal with the changes to their role, their own personal situations and an increased workload.

	'Agree'	'Strongly agree'
My workload has increased	46%	33%
It has been challenging for me to balance my personal responsibilities alongside teaching	36%	18%
I found it difficult to adapt my teaching content and pedagogy for remote learning	38%	5%

Teachers have had to **adapt their approach to teaching at a significant pace** with the move to remote learning. Schools were not equipped for this before the pandemic but largely, over time, been able to provide staff with the equipment and skills needed to teach remotely. Making lessons exciting and encouraging pupils to engage in lessons is difficult remotely. It is also challenging to identify when pupils are struggling and to differentiate lessons.

Most teachers agree that pupils have access to devices and the internet to undertake online learning, but around one-in-ten disagree with this (12% disagree or strongly disagree). Teachers from English **schools with the highest Free School Meals (FSM) entitlement rates⁵** are more likely to **disagree or strongly disagree that their pupils have the equipment they need** (18% compared to 7% of teachers from schools with the lowest rates of FSM). Whilst equipment or access to remote learning was a challenge for some pupils, there was also a **heavy reliance on parental engagement**. Engagement with remote learning was therefore variable between pupils.

As a result of all of these difficulties **seven out of ten** teachers expect to find it **challenging to cover the full primary curriculum** during the 2020/21 academic year.

Science teaching and learning has been affected by COVID-19

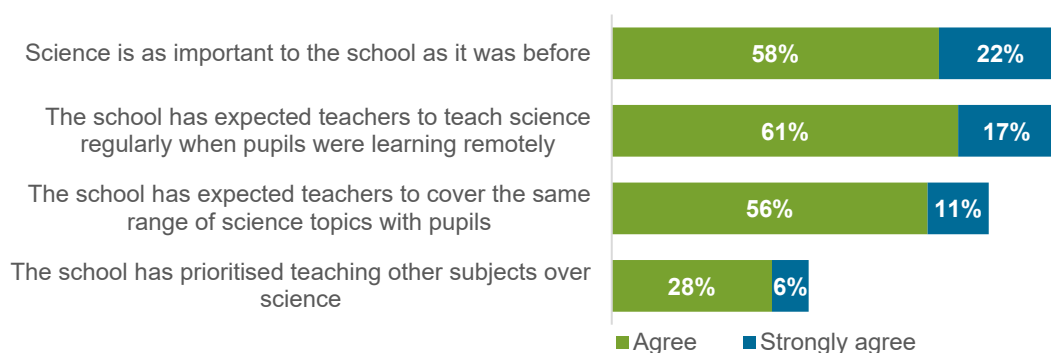
Science teaching

There was agreement amongst most that **science had continued to be prioritised** in schools with the expectation it was taught regularly with a wide range of topics; although there were some schools where this was not the case.

⁵ The FSM bands used in this report are: higher rate schools have 30% or more of pupils entitled to FSM, mid rate schools have between 10% and 29% of pupils entitled to FSM and lower rate schools have less than 10% of pupils entitled to FSM.



Figure 1: Extent of agreement on priority given to science by schools during COVID.



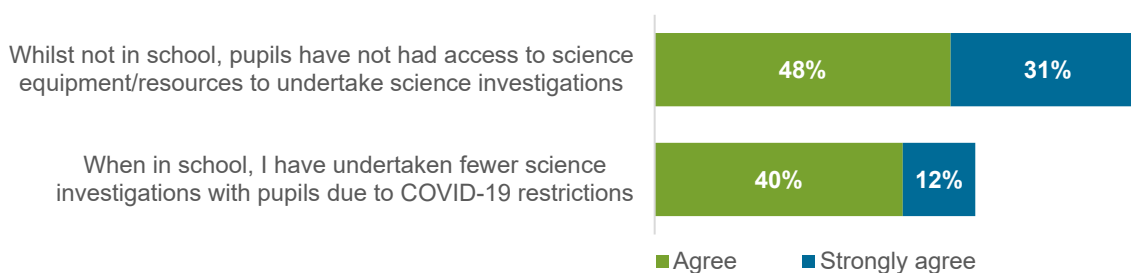
But even when it was still a priority **other subjects such as English and maths were prioritised more.**

Most agree that science teaching was affected. For many **less science was taught, particularly when teaching remotely.** It was difficult to cover the full science curriculum – especially the topic ‘working scientifically’.

	‘Agree’	‘Strongly agree’
It has been challenging for me to differentiate science lessons for pupils when teaching remotely	59%	23%
It has been difficult to teach science when pupils were learning remotely	59%	13%
I have been able to teach science regularly when pupils were learning from home	59%	7%
I have been unable to assess the progress of pupils in science	52%	10%
Overall, I have taught fewer hours of science	42%	4%
I have been able to adequately cover the science curriculum with pupils	39%	5%

Adapting pedagogy for science remote learning was seen as even more difficult than for other subjects. An important element of science is practical learning and investigations alongside discussion and enquiry which is difficult to replicate on-line. Remote learning for science was also more difficult for parents as teachers ideally wanted pupils to undertake investigations at home to support their learning. When in school investigations were also difficult to implement due to social distancing and sharing equipment.

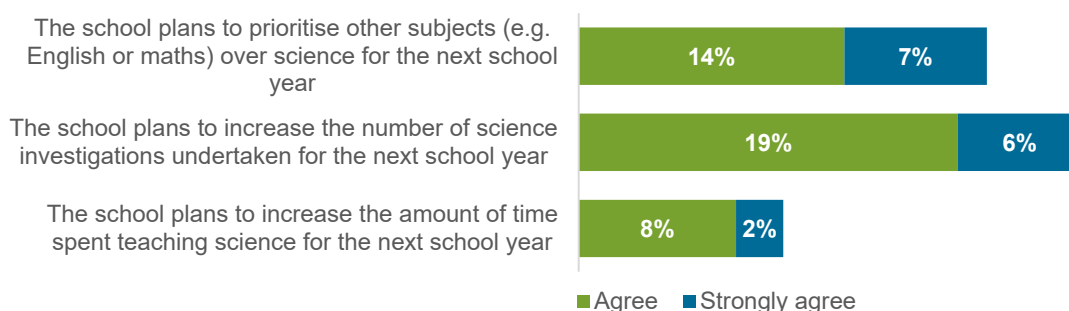
Figure 2: Impact of COVID on science investigations.



The **pandemic also had a negative impact on some teacher’s confidence** when teaching science and other subjects.

Schools' plans for the future varied and one-third plan to wait until more is known. **21% planned to prioritise other subjects over science next year.**

Figure 3: Extent of agreement on future plans for science teaching within schools.



Science leadership

Almost three-quarters (72%) of science leaders received release time to lead science during the pandemic; however, 50% had received less release time than they would have done normally.

61%

of science leaders received CPD to help them lead or develop science throughout their school.

28%

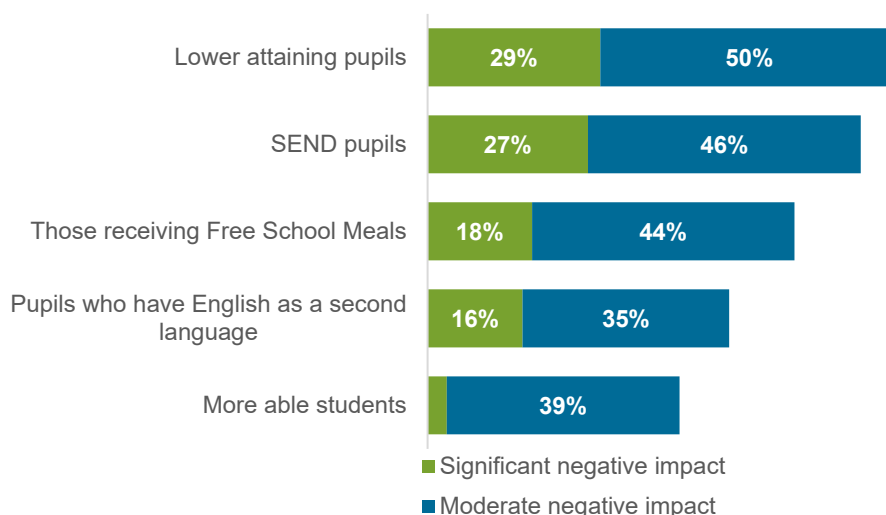
of teachers stated their school had not provided any support to deliver science lessons since the pandemic.

Science learning

Two-thirds (67%) of teachers reported that there were **gaps in pupils' science knowledge and investigation skills**. For those who did not engage with remote learning the impact will be even greater.

Whilst COVID-19 has affected all pupils teachers describe a differential impact in science for certain groups when compared to other pupils.

Figure 4: Extent of impact of COVID and the associated disruption on science learning for different groups of pupils compared to other pupils in the school.



Explorify has supported teachers during the pandemic

Teachers were able to draw upon the support of Explorify throughout the pandemic:

- **86%** used it in the classroom
- **38%** shared videos for pupils to watch at home
- **29%** used it when teaching a live class where pupils could speak
- **8%** used it when teaching a live class where pupils could not speak

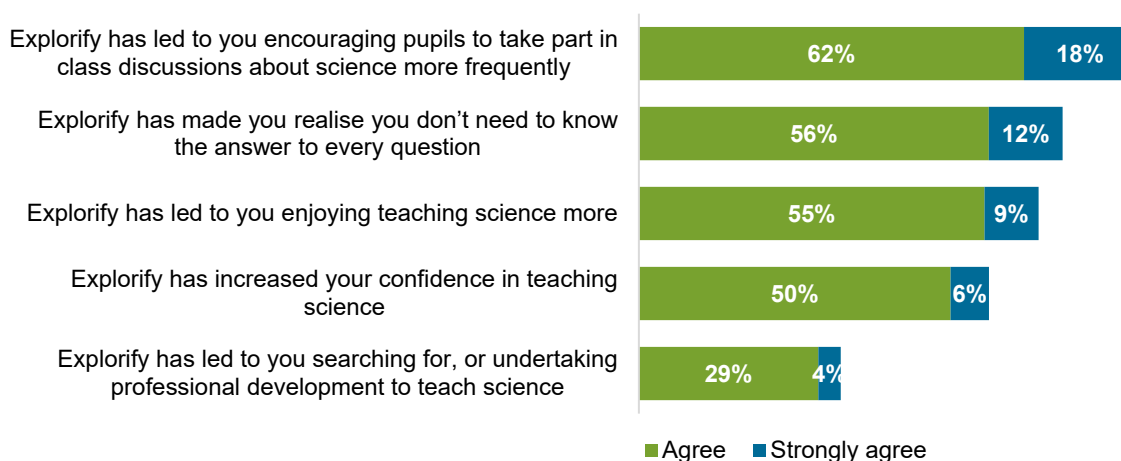
Those who used Explorify regularly reported fewer challenges when teaching science during the pandemic. It was used as a starter for science lessons, but also to support science assessment and delivery of other subjects. Teachers describe how Explorify engages and stimulates pupils, uses high quality images and videos, and ultimately reduces planning time for lessons. Teachers, on reflection, often thought they could have made better use of Explorify during the pandemic when remote teaching.

Explorify has an impact on teachers' practice and pupils

The impact of Explorify is greater for both teachers and pupils when used regularly.

Explorify has had an impact on teachers' practice and their confidence. It provides them with ideas for lesson planning, and gives them additional science content to support their teaching ensuring they fully understand and are confident teaching a topic. This is particularly important for those without a science background.

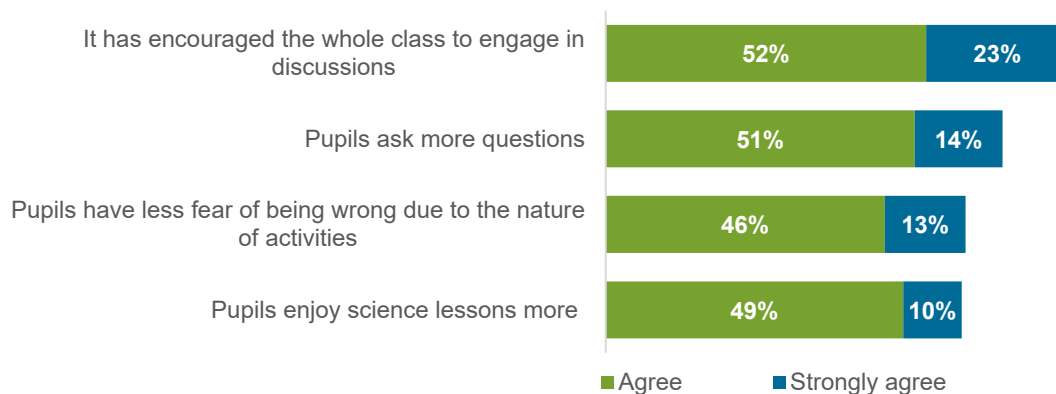
Figure 5: Impact of using Explorify since the outbreak of COVID on teachers and their teaching.



Science leaders have seen an impact not only on themselves but on teachers in their school and they describe that more science teaching is taught as a result.

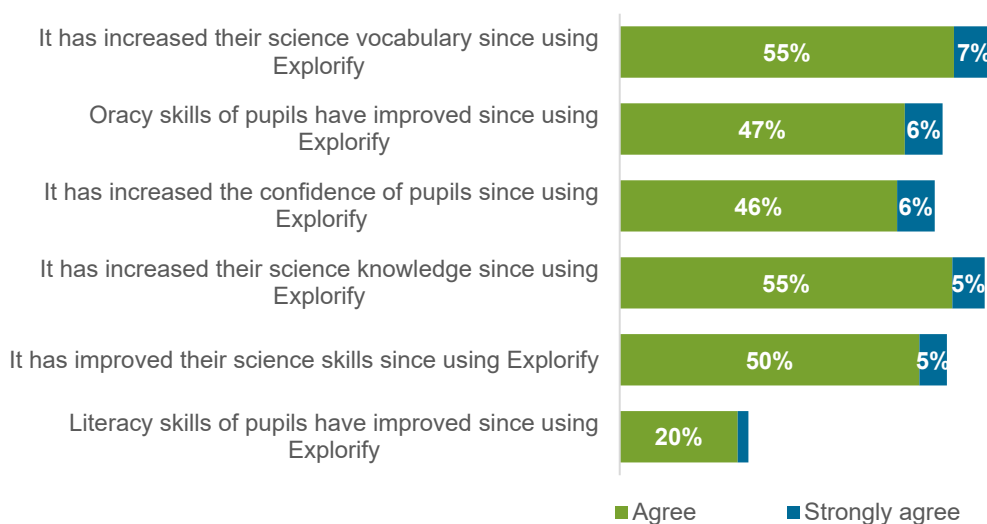
Explorify has an impact on pupils through creating exciting and engaging lessons which all pupils can engage with. It sparks discussion and increases pupil confidence as they have less fear of being wrong. These were the areas seen as a challenge during the pandemic and could support pupils to develop skills they have lacked in the new academic year.

Figure 6: The impact of using Explorify activities with pupils since the outbreak of COVID-19.



Explorify also supports pupils to increase their science knowledge and skills, alongside improving their oracy and confidence which is transferrable across all of their learning.

Figure 7: The impact of using Explorify activities with pupils since the outbreak of COVID-19



Due to the visual nature it is seen as accessible for all and has an even greater impact for some groups of pupils such as lower attaining pupils, SEND pupils and those with English as an Additional Language as it is not dependent on written English skills.

1. Introduction and methodology

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

1.1 Aims and objectives of the overall evaluation

CFE Research, was 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,⁶ a free resource of engaging, creative science activities for all primary school teachers. Explorify launched in autumn 2017 following a pilot in spring of that year. It was designed to stimulate curiosity, discussion and debate and is intended to support teachers to encourage children to think like scientists.

The research explored the nature of science delivery across the UK and evaluated the impact of the campaign until 2021. Specifically, the research focussed 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; and
- examining how the campaign is bringing about changes within schools and the nature of the impacts on subject leaders, classroom teachers, pupils and schools as a whole.

1.2 About this study

In 2017, research was undertaken by CFE, with support from The University of Manchester, to examine how science is taught across the UK, including the number of hours it is taught for and attitudes towards science. It captured the baseline position from which the outcomes and impacts of the Primary Science Campaign will be determined, and that were reported in the *State of the Nation* report of UK primary science education.⁷ Our 2020 report⁸ presented data captured from schools in England using Explorify in the 2019/2020. This highlighted the impact Explorify was having on both teachers and pupils.

The focus of the research in 2021 broadened due to the COVID-19 pandemic. We explored the impact of using Explorify on teachers and pupils throughout the pandemic and the overall impact of COVID-19 on schools and science delivery.

⁶ <https://explorify.wellcome.ac.uk/>

⁷ <https://wellcome.ac.uk/sites/default/files/state-of-the-nation-report-of-uk-science-education.pdf>

⁸ <https://wellcome.org/sites/default/files/evaluation-of-the-primary-science-campaign-2020.pdf>

Approach

The data presented in this report was captured via four methods:

Teacher survey

An online survey of **2,823** teachers, science leaders and senior leaders was undertaken from schools in England, Northern Ireland, Scotland and Wales. This survey was disseminated between March and May 2021 through two methods:

- A sample frame was created of teachers who had signed up to use Explorify (some had used Explorify regularly whereas others had not). A direct email was sent inviting them to take part in the study.
- The Primary Science Teaching Trust shared the link to the online survey in two newsletters.

Depth interviews

Interviews were undertaken with a cross-section of staff who use Explorify. These interviews explored the impact of the COVID-19 pandemic on their school and science teaching, how teachers use Explorify, and the impact of using Explorify on them and their school.

Interviews were undertaken 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; and
- teachers with responsibility for teaching science to their classes.

Interviewees were selected from those who completed the teacher survey. This enabled interview recruitment to be based on Explorify usage of both individuals and their school, and allowed for further exploration of survey responses.

In total, 33 semi-structured interviews were undertaken with staff during the Summer term of 2021. The key characteristics of those responding are outlined and highlight a mix of different school roles.

Role	Number of interviews
Headteacher/senior leader	3
Science leader	22
Classroom teacher	8

Case studies

Case studies focused on schools where a science leader or teacher was interviewed and where Explorify was used across the school. Case studies were selected where a significant number of teachers used Explorify or where there was a marked impact on pupil outcomes. Seven schools were selected by the research team which included in total 17 depth interviews.

In addition to the science leader's interview the case study research included interviews with:

- a member of the Senior Leadership Team (SLT i.e. a head or assistant headteacher/principal)
- other staff with responsibility for science teaching (e.g. classroom teachers, Teaching Assistants).

Data collected from the case studies was analysed alongside the depth interviews.

Interviews with providers

Depth interviews were undertaken with three providers of primary science continuing professional development (CPD). These explored the impact of the COVID-19 pandemic on the uptake of primary science CPD within schools during the early stages of the pandemic.

1.3 About the report

All differences reported in the analysis of the survey data were tested for statistical significance and only those statistically significant at the 5% level have been reported in the commentary of the report.⁹

Interviews produce a significant volume of qualitative data. For this study, a coding frame was applied to transcripts and was cross-checked for consistency. This led to the generation of a series of themes on which to build an understanding of the overarching and interlocking issues. Sample attributes were assigned to transcripts based on school and individual-level characteristics of interviewees to interrogate differences by sub-group. Due to the semi-structured nature of the interviews, no inferences can be drawn about the scale or frequency of particular attitudes or opinions. For this reason we do not quantify the number of responses to a particular theme. To aid the reader, we provide an assessment as to the proportion of interviewees who commented under a given theme. However, please note that other interviewees may also hold this opinion or undertake these activities but did not describe this during the interview. Throughout the report, findings from interviews are presented alongside survey findings.

Following this introduction, the report is structured in seven main chapters: **Chapter 2** looks at the impact of the COVID-19 pandemic on schools, while **Chapter 3** examines the impact of the COVID-19 pandemic on science teaching. **Chapter 4** explores the CPD and support available to teachers and **Chapter 5** explores the impact of COVID-19 on pupils and their learning. Finally, **Chapter 6** explores the use of Explorify during the pandemic, **Chapter 7** the impact of Explorify of teachers and pupils and **Chapter 8** summarises the key conclusions.

⁹ Please note that some graphs contain statistically insignificant findings. Please refer to the text for statistically significant differences.

2. Impact of the COVID-19 pandemic on schools and teaching

This chapter explores the impact of the COVID-19 pandemic on schools, teachers and their teaching.

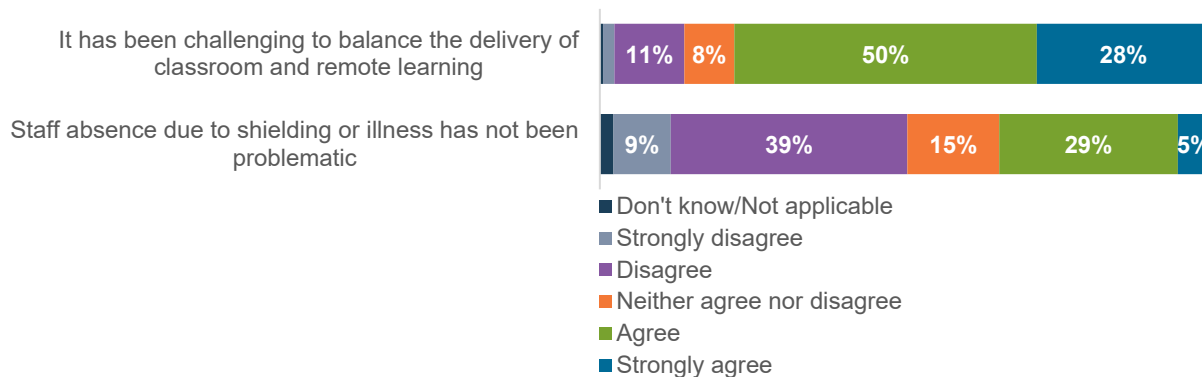
COVID-19 has had a significant impact on both schools and individual teachers. Schools have had to adapt to the restrictions caused by the pandemic and deal with a whole host of logistical challenges. Individual teachers have had to deal with the changes to their role and their own personal situations.

2.1 COVID-19 has had an impact on teacher workload

The impact of COVID-19 restrictions

Over three-quarters of respondents find balancing the delivery of both classroom and remote learning challenging across their school (78% agree or strongly agree) (Figure 8). A higher proportion of respondents from small¹⁰ schools find achieving this balance more challenging than larger schools (36% of respondents from small schools compared with 26% in larger schools strongly agree). In addition staff absence due to shielding or illness has been problematic for half of respondents (48% disagree or strongly disagree that staff absence due to shielding has **not** been problematic).

Figure 8: Extent of agreement about the school-level challenges of teaching during COVID. Base=2,813-2,817 (all respondents).



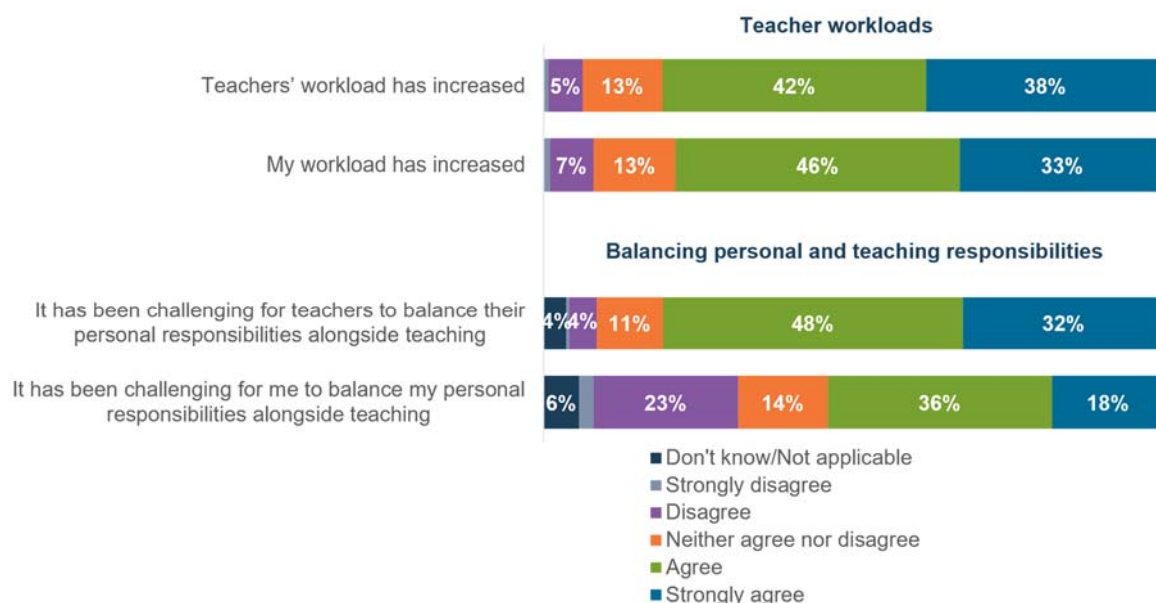
Interviews with senior leaders and teachers reflect these challenges. Implementing social distancing measures throughout schools has been difficult for leaders to manage, for example setting up and maintaining pupil and staff 'bubbles'. Alongside this balancing remote learning with in-school provision (e.g. for children of key workers) added to the pressures. One assistant headteacher described how it felt like having to manage two schools simultaneously – one virtual and one physical. Another senior leader had been asked to step up to a leadership post to cover the headteacher who was shielding (e.g. from a deputy to a headteacher role).

Teachers and leaders have experienced challenges personally and seen these challenges affect other teaching staff (Figure 9). Around 80% of respondents agree or strongly agree that both other teacher's and their own workloads have increased during the pandemic with only a minority who disagree. It has also been challenging for many teachers and leaders to balance their personal responsibilities alongside their teaching

¹⁰ Small schools are defined as those with fewer than 100 pupils and larger schools as those with 300 or more pupils.

during this time (54% of agree or strongly agree that they had found this challenging personally, and 80% agree or strongly agree that teachers had generally found this challenging).

Figure 9: Extent of agreement about the challenges of teaching during COVID. Base= 2,806-2,813 (all respondents).



Around one-third of teachers interviewed faced difficulties juggling caring responsibilities with their teaching commitments. Most commonly this is due to parental duties such as providing childcare and/or teaching their own children during lockdowns. One teacher described the 'blurred boundaries' between work and home as a challenge as it is difficult to stop "being a teacher" and step back from work when mainly working from home. The workload pressure has been exacerbated for some because they also had to work rotas to cover the education of key worker children in-school as well as provide remote learning. Some of these teachers described how the increasing demands from parents for more hours of remote live teaching during lockdowns is not always feasible given other demands on their time.

We've just been trying to get through the pandemic and try and not only teach the children that I teach, but obviously manage my home life as well and my children. I was going on live teaching and in-between times I was having to teach my own children, mark the work that my class was submitting, plan the next day; it was awful.

Science leader

2.2 Schools had to adapt to remote teaching quickly

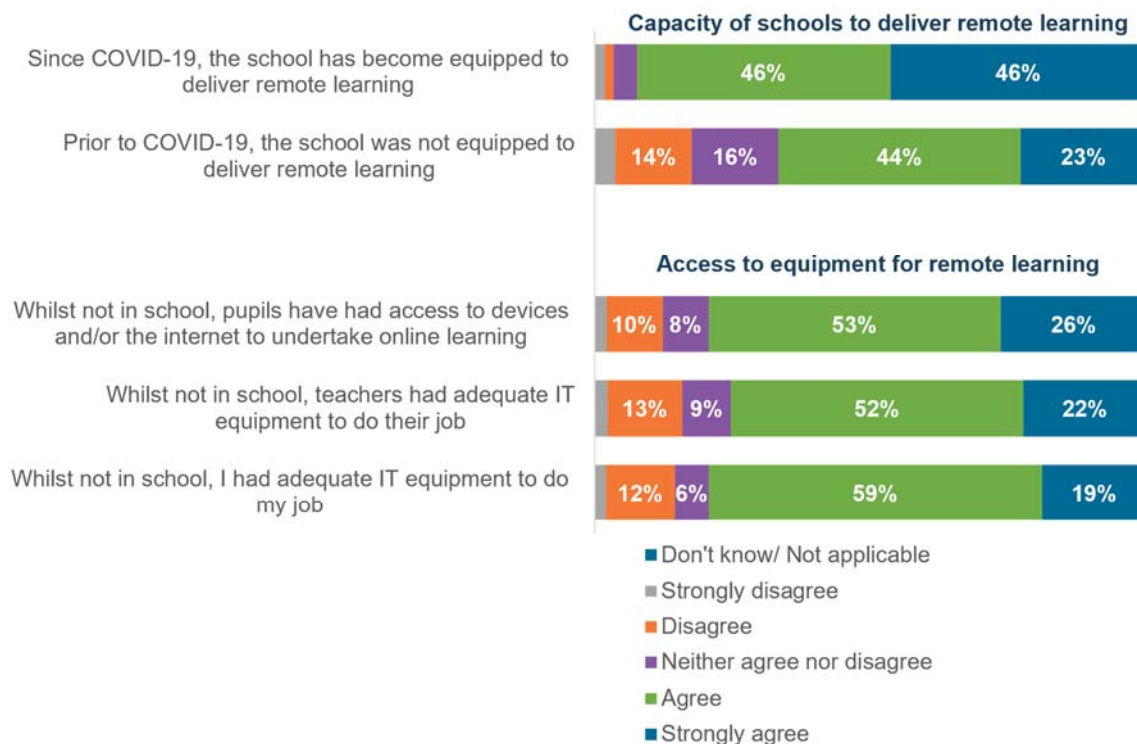
Schools and individual teachers adapted their teaching methods and either adopted new technologies, or broadened their use of existing technologies, at a significant pace. Schools have largely, over time, been able to provide staff with the equipment needed to teach remotely. But to successfully engage pupils through online methods teachers have had to adapt their teaching approach.

Just over two-thirds of respondents agree or strongly agree that prior to COVID-19 their school was not equipped to deliver remote learning (Figure 10). Encouragingly, almost all respondents (92%) agree or strongly agree that their school has become equipped since the pandemic with only a minority who still disagree. Whilst most teachers agree that they, and other teachers, have had access to adequate IT equipment to do their job, a small minority disagree (around 15% disagree or strongly disagree).

Technology is not just a challenge for some teachers but also some pupils. Overall, teachers largely agree that pupils have access to devices and the internet to undertake online learning (although very few strongly

agree), but around one-in-ten teachers disagree with this (12% disagree or strongly disagree). A higher proportion of respondents from Scottish schools strongly disagree that their pupils have access to devices and/or the internet compared with English school respondents (7% compared to 2%). Teachers from English schools with the highest Free School Meals (FSM) entitlement rates¹¹ are more likely to disagree or strongly disagree that their pupils have the equipment they need (18% compared to 7% of teachers from schools with the lowest rates of FSM entitlement).

Figure 10: Extent of agreement about how well-equipped schools and teachers were for remote learning. Base=2,806-2,818 (all respondents).



Remote learning is difficult for some pupils and parents

Teachers commonly described the position of some families who lack the tools necessary to engage with remote online learning. They either lack devices suitable to access learning resources entirely or struggle when siblings have to share devices. Additionally, a lack of internet access or a reliable Wi-Fi connection means that online learning simply is not possible for some families. To overcome these difficulties, schools provide paper-based resource packs as an alternative (something which one teacher described as a “mammoth task”) or IT equipment for their pupils. Examples were given of schools providing families with:

- new IT equipment (e.g. tablets or laptops)
- reconditioned old computer equipment
- Wi-Fi boosters for families in rural areas

Accessibility was our biggest stepping stone, because children who maybe have devices, so they might have an old tablet, but then they didn't have the internet at home to be

¹¹ The FSM bands used in this report are: higher rate schools have 30% or more of pupils entitled to FSM, mid rate schools have between 10% and 29% of pupils entitled to FSM and lower rate schools have less than 10% of pupils entitled to FSM.

able to hook up to. So, it was a case of knowing who can access at home and then, trying to support those children who can't.

Science leader

Even when families can get online, connection problems during lessons mean pupils are not heard or that they cannot hear their teacher or other pupils, leading to them disengaging. Households without a printer also find it difficult to fully engage with some tasks, and several teachers print and deliver learning packs to families who need them.

Another difficulty is the need for parents and children to adapt to using new technology. Some parents are more technology 'savvy' than others, and where families struggled to adapt, this led to them disengaging with learning. Lower attaining pupils who struggle more in class often find it difficult to follow online lessons, particularly when these are recorded rather than live. Where parents were not there to supervise, some pupils did not watch the videos that teachers had prepared. Some pupils suffer from screen fatigue and find it difficult to concentrate when accessing live or recorded lessons. One teacher also described pupils becoming 'distressed' during live lessons because they had not seen their classmates or teacher for so long – with the result that their parents opted out of livestreaming.

For a limited number of pupils online learning worked well. For example, one teacher described how a pupil with attention deficit hyperactivity disorder was able to better concentrate at home (when not surrounded by other pupils) with a structured timetable with breaks in between.

Pupil engagement is highly reliant on parents and carers

It was clear across all teacher interviews that schools had seen differing levels of engagement from their pupils during remote learning, with a continuum from those who demonstrated complete engagement with all lessons and topics set by teachers, to pupils who simply did not engage at all, or engaged very little.

Whilst this is influenced by access to devices and the internet, pupil engagement is highly dependent on parents and carers. Some teachers reported that the ability of parents to support their children with learning was the most important factor in predicting academic progress during lockdowns, but that this is not necessarily linked to economic or social factors (although this also played a part). Working parents, for example, often struggle if they are working during lockdowns and not available at the time when lessons are scheduled and/or if they had other children to support.

I think, in our setting, I think it had a lot to do with what support was available at home. Mum and Dad, or carer, whoever was with them, was busy or unable to provide support or routine, which was an issue.

Science leader

Primary school pupils, particularly younger pupils, are unable to access their own learning using online methods meaning reliance on a parent or carer is critical. Teachers engage with parents to enable this to happen to ensure parents know how to log their children on to live lessons and/or support them to complete work in the absence of a teacher. Teachers need to account for varying literacy and numeracy levels amongst parents as well as their children by providing tasks that they think parents are able to support their children with. When teachers provide links to other websites and resources they ensure they are simple and easy to understand so parents could access them and support learning in this way. More engaged parents and/or more able pupils also require additional 'challenge' tasks to maintain their engagement. This all contributes to an increased teacher workload and the need for what one teacher described as "*meticulous planning*".

Several teachers described how it is important to achieve a balance in terms of how much or little work to set for pupils again to keep parent and pupil engagement. Too little risked learning being limited, and the more engaged pupils not having enough to do and parents worrying about keeping their children occupied, whilst

setting too much work could be counterproductive and result in parents feeling overwhelmed and 'switching off'. Some teachers found it difficult to maintain parental interest throughout successive lockdowns. There were occasions when teachers knew that a child had not been able, or had not time, to complete work ready to upload; they explained that some parents felt under pressure to submit something and therefore completed it themselves.

Teachers thought that the impact of pupils not accessing remote learning and having gaps in knowledge was likely to come in later years when they lack the base knowledge of a topic they need for further learning.

Teachers developed new IT skills

Most teachers had adequate IT equipment and had become equipped to deliver remote learning by the time they completed the survey; however, there were still challenges associated with this. About three-quarters of interviewees discussed the various difficulties they had faced initially with technology for remote learning; either difficulties with the technology itself or their struggles to adapt to the use of the technology at short-notice. There was a marked difference in how teachers felt about the first and then subsequent lockdowns.

Most teachers interviewed thought that their school had done the best they could at short notice during the first lockdown as they were unprepared for the wholesale move to online learning. Several described initially relying on resources they knew such as BBC Bitesize, and very few delivered a significant degree of live online teaching. Schools and individual teachers were more prepared by the time of the second lockdown. Online platforms were being commonly used to support delivery such as Seesaw, Class Dojo, Hwb and Google classroom. Videoconferencing software was being used by most schools to deliver live lessons or regular 'check-ins' with pupils.

We were totally unprepared to move to remote learning. It's a completely new way for us as teachers. You know, it took us a while to work out how we were going to deliver our remote learning, it's taken a while to get off the ground, and then just refreshing our IT skills really has been a huge challenge, it's been incredibly time-consuming.

Science leader

A small number of teachers from schools in rural areas reported difficulties with their internet connections, making it impossible, or at least very challenging, for them to deliver live lessons.

At the start of the pandemic not all teachers thought that they, or their colleagues, had the level of IT proficiency needed to switch easily to remote learning. Teachers had to learn new skills and significantly change their teaching practice to make use of this new technology. For example, teachers recording their lessons for pupils and parents to view later. One teacher described how nerve wracking and time consuming this was initially, requiring several 'takes' before they felt comfortable uploading their first lesson – especially as they knew parents may be watching. Subsequently, teachers then had to adapt to delivering live lessons remotely, again something which was new for many.

It was very time-consuming to begin with, and then as the year went on, well as the term went on, really, it sort of became second nature.

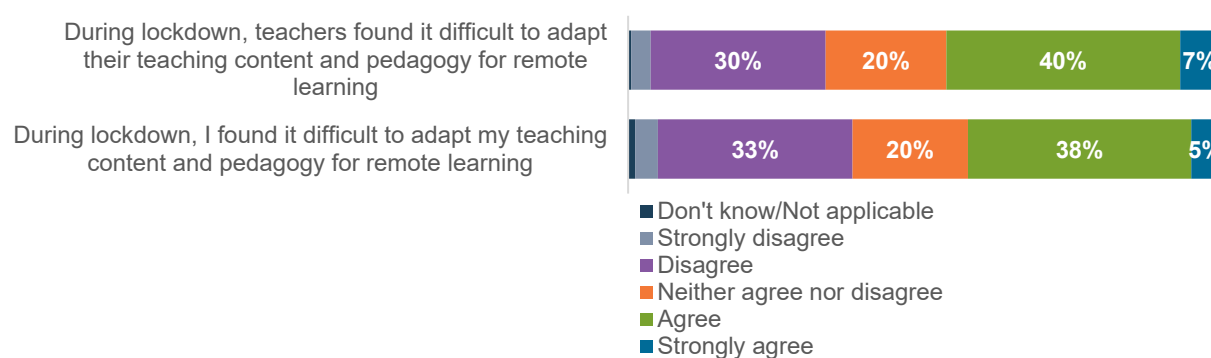
Science leader

During an interview with a headteacher, they described the challenge at a school level of ensuring quality of delivery for all pupils, something which (particularly during the first lockdown) is largely dependent on the 'expertise of the teacher'. Teachers described growing in confidence over time with their use of IT and delivering remote lessons with the view that children received a better learning experience by the second lockdown.

Remote learning required teachers to also adapt content and pedagogy

Effective lesson delivery is not solely related to IT equipment and technology. Just under half of respondents agree or strongly agree that they had personally found it difficult (43%) or that teachers had generally found it difficult (47%) to adapt their teaching content and pedagogy for remote learning (Figure 11). A higher proportion of teachers without senior leadership responsibilities found it more difficult than members of SLT to adapt their teaching approach (44% compared to 34%). This could however reflect the amount of teaching the individual did in their school. A higher proportion of female teachers disagree or strongly disagree that they found adapting their teaching approach problematic (38%) compared to male teachers (28%). Frequent users of Explorify are more likely to disagree or strongly disagree that they have found it difficult to adapt their content and pedagogy for remote learning (42%) compared with infrequent users (35%) and non-users (32%).

Figure 11: Extent of agreement about how difficult it was for teachers to adapt their content and pedagogy for remote learning. Base= 2,804-2,818 (all respondents).



Almost all teachers interviewed described adapting to remote teaching difficult with them facing various challenges. One of the most common issues raised was engaging pupils. Teachers described being unable to engage pupils as well as when they are in the same room with them as there are less opportunities for dialogue and discussion. When teaching in the classroom teachers are able to use a wide range of approaches to suit different learning styles which is more challenging remotely.

We do rely on technology as a society, but that's not what teaching's about. It's about being creative, imaginative, it's about using technology but not depending on it; whereas we all then became dependent on it.

Senior leader

Teachers also experienced challenges trying to make online delivery 'exciting' and when setting tasks for pupils and their parents which they are willing and able to do at home. Some teachers described building in opportunities for children to learn outside of a written exercise (e.g. finding things whilst out on their daily walk/exercise) to overcome this. A small number of schools had not delivered any live lessons. Teachers from these schools described changing the way they taught. They recorded and uploaded lessons or provided links to resources and tasks without any teacher interaction. Others described the difficulties of adjusting their pace when teaching. There is the temptation to move quickly when presenting using videoconferencing, particularly when pupils are not engaging well in the live lesson.

Teachers also find it difficult to identify when children are struggling with an aspect of their learning. Spotting the non-verbal queues when teaching remotely is more difficult with a lack of opportunities to engage with pupils one-to-one to discuss their difficulties.

It is difficult to differentiate lessons and undertake pupil assessment

Even with improved technology and changing teaching styles around one-third of teachers interviewed find it hard to differentiate learning when teaching remotely. Several teachers used 'off the shelf' resources to support remote learning but these did not always fit with what they would have taught if they were in class. This also meant that learning was not always targeted to pupil needs and not differentiated for pupils. One teacher described their normal classroom approach as 'bespoke' compared to when using the 'pre-made' resources online.

Teachers find it difficult to differentiate learning due to a lack of opportunities for one-to-one dialogue with pupils. Teachers emphasised how they ensured that those furthest behind engaged with remote learning during the second lockdown, but this was a significant challenge and slowed the pace for other pupils to ensure they could catch up.

Around one-quarter of teachers raised the issue of monitoring and assessing pupils during lockdowns. Given the huge role that parents play during lockdowns, teachers find it difficult to know how independently pupils are working, and what role parents, or even older siblings, play in the quality of the work submitted. Opportunities for assessment are also more limited than would be the case in the classroom and assessment checkpoints were missed during the various lockdowns. It is therefore difficult to assess how much pupils have learnt and retained. One teacher described having 'no baseline' when pupils returned from lockdown and they felt like they were 'starting again' in terms of pupil assessment.

In terms of assessing them for the end of the year, I think we're probably at a disadvantage in that we can't be confident about individual children and what they've covered because of the periods at home. Some of them were in school the whole time, so we know exactly what they've done, others we don't. And even if we've got evidence that they did do these things, we don't really know whether their mum did it for them.

Teacher

Another teacher, however, described how useful the 'catch-up' materials issued by their local authority had been in addressing some of these issues.

2.3 COVID-19 brought about opportunities

During interviews, teachers reflected on the positive impacts from the changes implemented in response to the pandemic. Most teachers were able to identify some benefits or learning from the experience, even against the wider backdrop of the extensive challenges already discussed.

Improved parental relationships

Around one-third of teachers identified benefits from working in new ways with parental engagement. Teachers described how parents are now more aware of what teachers do and how children learn. Many parents are more engaged with the topics pupils are covering and have developed a greater understanding of the work their children are set, their learning objectives and their capabilities. For some families, where parents had time to work with their children and fully engage with the learning topics and goals, teachers described that the experience of home schooling has been valuable and positive; although teachers were clear some families had also struggled with competing priorities as highlighted above.

Teachers also described having increased levels and different ways of communicating with parents. Learning platforms give families a direct line to the school and teachers have more channels through which to push out key messages. This has resulted, for some, in a more collaborative relationship as teachers became more accessible to parents and vice versa. Teachers also developed a more detailed understanding of children's home lives through their contact with families. However, some families never logged on to live

lessons or joined 'meet ups' – the experience of remote learning was therefore 'polarising' in terms of parental engagement.

Changing school practices

Many teaching staff had improved their IT skills and seen a big change in the overall skill levels and use of IT within the school. This has led to some efficiencies, for example, virtual meetings for split site schools or virtual parent's evenings. The increased use of learning platforms during lockdowns has also continued in some schools, as have practices such as recording lessons so that children can watch the materials again to aid their understanding. Some teachers described pupils developing more independence, resilience and digital skills as a result of their experiences during the pandemic. One teacher described now setting more homework to be completed online, which was particularly useful in preparing older children for secondary school.

Once we got our head round the pedagogy, and almost that secondary school/university style of delivering something to children via an online forum they then were able to take that away and work on it independently and produce something and give it back. So we've continued to harness that with our primary sevens because we think it's a really valuable skill for them to have going on to secondary and into the world. That ability to be given a list of tasks and you go and do it.

Science leader

Other practical measures (e.g. timed arrival slots and children coming into school in their PE kit on days when PE is being taught) were also highlighted as improvements to school practice. Schools have had to rethink their practices from the ground up and some measures introduced as a response to the pandemic are likely to continue because they work better.

For some science leaders and SLT the pandemic had been an opportunity to think and reflect (e.g. because there were fewer expectations to provide feedback during the first lockdown which freed up some time), and then plan their learning provision differently.

Developments to teaching styles

Several teachers described remote learning as an opportunity to further develop their teaching style. For some they became more creative, whilst for others they became more focussed and spent time simplifying topics so they were clearly and quickly explained. Whilst this suits online learning, it is also valuable when returning to the classroom. Teachers also described a shift to more outdoor learning as this gave them opportunities to innovate and motivate children in different ways.

2.4 It will be challenging to cover the full curriculum

Seven out of ten schools expect to find it challenging to cover the full primary curriculum during the current (2021) academic year (70% of respondents agree or strongly agree) with only a small proportion who disagree.¹² A higher proportion of English school respondents with higher rates of FSM¹³ strongly agree that they will face challenges covering the curriculum (31% compared to 22% of schools with lower rates of FSM eligibility).¹⁴ A higher proportion of respondents who have not used Explorify¹⁵ strongly agree it will be a

¹² 27% strongly agreed, 43% agreed, 11% neither agreed nor disagreed, 13% disagreed, 2% strongly disagreed with this statement, whilst 4% did not know or thought it was too early to say.

¹³ The FSM bands used in this report are: higher rate schools have 30% or more of pupils entitled to FSM, mid rate schools have between 10% and 29% of pupils entitled to FSM and lower rate schools have less than 10% of pupils entitled to FSM.

¹⁴ Free school meal entitlement rates are only available for English schools.

¹⁵ Please see Chapter 6 for more information on Explorify usage.

challenge to cover the primary curriculum (33%), compared with frequent (25%) and infrequent Explorify users (26%).



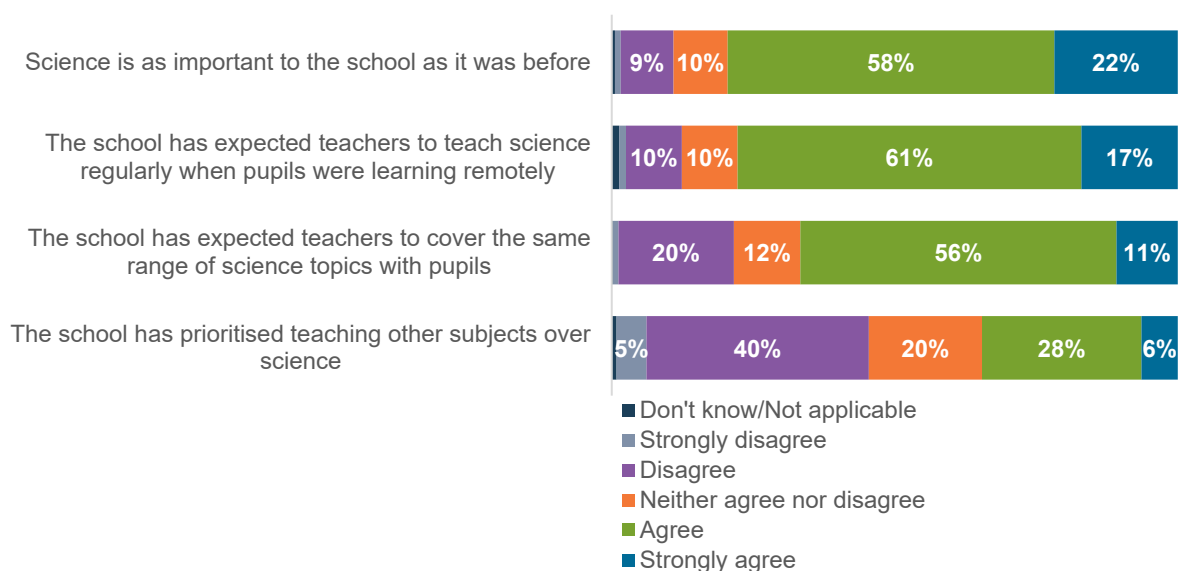
3. Impact of the COVID-19 pandemic on science teaching and learning

This chapter considers the specific impacts of the COVID-19 pandemic on science teaching. It covers the priority given to science teaching during this period and the methods used to teach science.

3.1 Priority was still given to science in most schools during the pandemic

Despite the difficulties of teaching during the pandemic, science appears to have remained a priority for most schools. Around two-thirds of respondents (67%) agree or strongly agree that teachers are expected to cover the same range of science topics with pupils as before the pandemic (Figure 12). Almost eight out of ten stated their school expects teachers to teach science regularly through remote learning (78% of respondents agree or strongly agree), and the same proportion state science is as important to the school as it was before the pandemic (80% of respondents agree or strongly agree). However, a small proportion disagree with this statement and just over one-third of respondents (35%) agree or strongly agree that other subjects are prioritised over science

Figure 12: Extent of agreement on priority given to science by schools during COVID. Base= 2,813-2,818 (all respondents).



There appear to be differing views about this across the UK. A higher proportion of respondents from schools in Northern Ireland (26%) and Scotland (28%) disagree that science is as important to the school as it was before the pandemic, when compared with respondents from England (8%). This is also reflected in the higher proportion of respondents from England disagreeing (41%) their school has prioritised other subjects, compared with Scotland (18%) and Northern Ireland (9%).

SLT members are more likely than other teachers to feel that science is as important to the school as it was before (31% compared to 21% of non-leaders strongly agree) and disagree or strongly disagree (58%) that other subjects are prioritised over science (compared to 44%). Conversely science leaders are more likely to agree or strongly agree that other subjects are prioritised over science (39% compared to 31% of non-science leaders).

Around half of those interviewed stated that their school has prioritised science as much as other subjects during the pandemic and one-third that science had become a greater priority than it was before. Some teachers described science as being one of several subjects that received a particular 'push' or focus alongside English and maths (e.g. modern languages or Design and Technology, depending on school priorities) and others described how their school had tried to maintain a cross-curriculum focus on all subjects. Several teachers saw science as one of the 'core' subjects during the pandemic, being taught regularly when pupils were both in and out of school. One teacher described their school having a more 'flexible curriculum' during the pandemic, but still with a focus on regular coverage of science.

In terms of our curriculum statement and intent and implementation, working scientifically is absolutely at the heart of what we do here.

Science leader

Science remains a priority for schools for different reasons. One school is working towards the Primary Science Quality Mark (PSQM) and needs to demonstrate the quality of its science teaching, others described going through a programme of CPD to support science teaching within the school or being involved in STEM initiatives. From a practical view, several teachers saw science as one of the subjects best suited to remote teaching. This is because it can be taught at home due to science being observable 'everywhere' which is exciting, there are resources available and many topics can use basic home equipment for investigations.

Explorify was brilliant, really good. And then we used the Oak Academy which was the government online school. Their science was also fantastic. And then the Primary Science Teaching Trust... they've worked really hard over the last couple of years and produced loads of really good resources for teaching science remotely. So science is a really easy one to keep going because of the resources that were made available.

Science leader

Teachers did commonly report that although science has priority, English and maths is prioritised more. Typically English and maths was delivered every day during lockdowns but science was less taught less regularly. This does however reflect the regularity of these subjects prior to the pandemic.

Where science has not been prioritised this has largely been due to senior leaders prioritising maths and English especially as schools returned to classroom teaching to redress losses in these areas during lockdowns. Some teachers had set maths and English as mandatory lessons to access from home, but not science. A few teachers highlighted how the measurement of maths and English attainment and progress drives the prioritisation of these subjects with others getting "lost". Some teachers also thought that parents prioritised English and maths, as well as schools, because these subjects are assessed at primary level.

Last year I had a class of 28. For literacy and numeracy you're normally getting 24, 25 responding, but for the third lesson [science or RE] maybe nineteen. That was generally throughout the whole lockdown. Either they themselves or their parents prioritised literacy and numeracy, and the third lesson was, 'Yes, do it if you have time or if you want to.'

Teacher

Science in some schools is therefore perhaps best viewed as an accidental casualty of the pandemic, rather than something which has been systematically or actively deprioritised.

In some instances, or many instances, while they're trying to address the literacy and numeracy, then efforts have been to the detriment of the likes of science, and the likes of ICT and the likes of all the other subjects really. They've been, sort of, neglected a bit.

Science leader

Several teachers spoke of 'filling the gaps' in science learning as well as in literacy and numeracy and one teacher described their attempts to bring science learning into lessons primarily focussed on English and maths to compensate for the loss of science-specific teaching time. A few schools highlighted how pupil wellbeing had been prioritised over other things, including individual subjects, with pupils being 'eased into' classroom learning when they returned to school after lockdowns or teachers focussing on PSHE and resilience rather than attainment.

3.2 Development plans for science were affected

The ability of schools to deliver against their plans for science during the pandemic have been affected by COVID-19. Half of science leaders and SLT members had included science in their school development plans in one, or both, of the last two academic years¹⁶. Amongst these, COVID-19 was generally seen as having had a negative impact (79% of respondents state that COVID had hindered their plans) on their ability to implement changes to improve science as detailed in the plans.¹⁷

Some of the teachers interviewed found implementing school development plans more difficult during the pandemic. They described how they were now focussing activities on assessing children to identify gaps in their learning to help them refresh and update science planning as appropriate.

We're trying to follow [the school development plans] as much as possible from what we developed before COVID, so it's about trying to get back to that now and make sure we address those learning gaps and we're assessing and thinking about next steps. So, because we've all just been trying to get back to just feeling settled.

Senior leader

In some schools science development planning has been supported when teachers have had more time for CPD during lockdowns (e.g. because of reduced contact or teaching time). This gave them time to explore and evaluate different resources like Explorify and develop new ideas for how to cover the science curriculum. Some teachers used the time they had gained during the pandemic as an opportunity to reflect and review their teaching strategies which in turn helped them redesign development plans.

It's given me such a familiarity with resources such as Explorify or all of things that are available, I now have a huge network of people within different organisations that I previously didn't know.

Science leader

Another described their work to streamline their plans to ensure that the most important areas of the curriculum are covered whilst another school was already following a new recovery curriculum developed by senior leaders. There were, therefore, some positive impacts of the pandemic on science planning even though it had been a difficult time for schools; but the scale of these examples were limited.

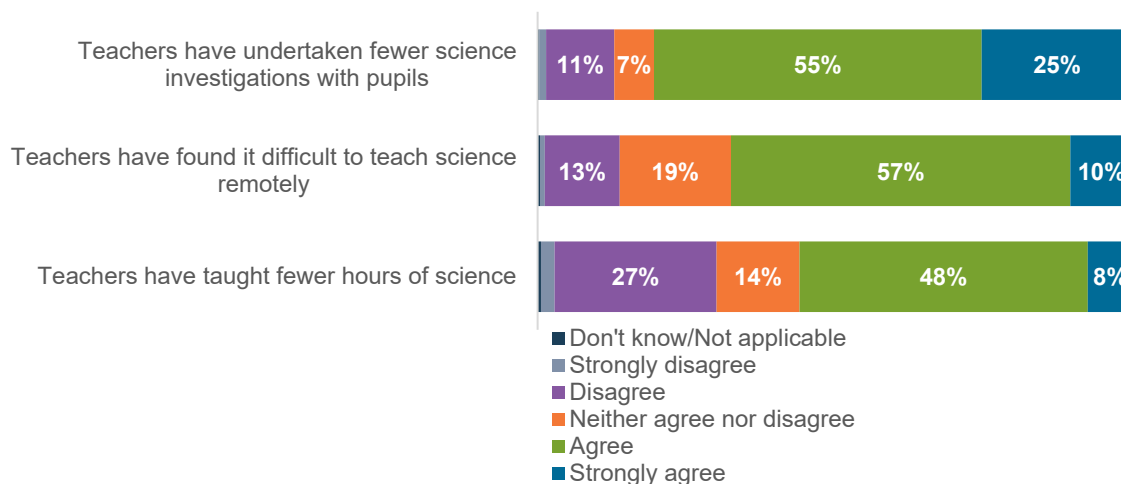
¹⁶ 50% had not included science in their delivery plans, 16% had included it only in 2019/20, 11% had included it only in 2020/21 and 23% had included it in both academic years.

¹⁷ Only 4% had seen a positive impact on their development plans for science, 14% stated it had no impact and 3% did not know what the impact had been.

3.3 COVID-19 has affected science teaching

Although science has often remained a priority in school, the pandemic has had an impact on the amount and quality of science teaching. Most science leaders and SLT members agree or strongly agree that during the pandemic teachers have taught less science (56%), have found it difficult to teach science remotely (67%) and have undertaken fewer science investigations with pupils (80%) (Figure 13).

Figure 13: Extent of agreement on the impact of restriction on science teaching during COVID. Base= 1,506 (science leaders and senior leaders only).

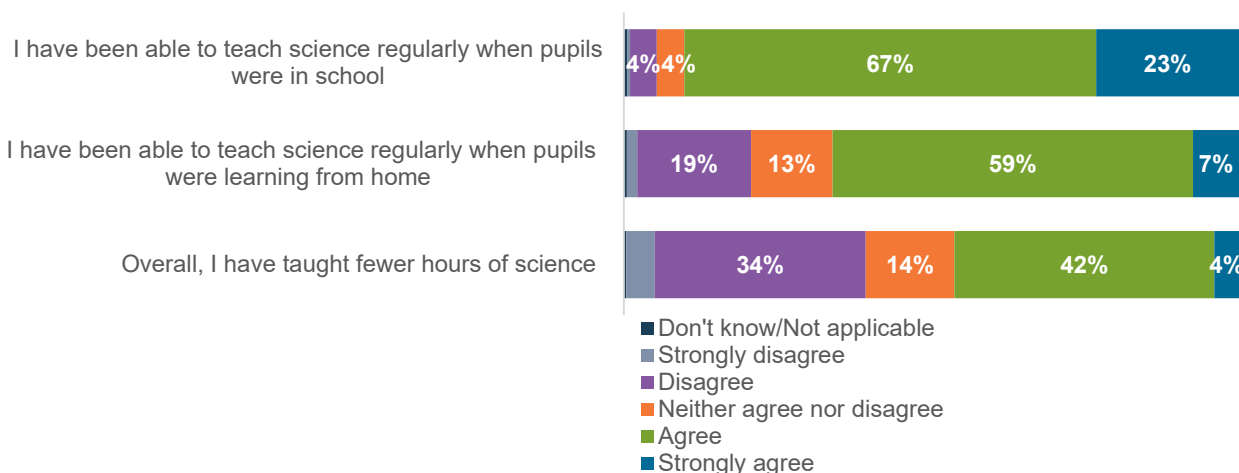


Around half of those interviewed thought that all subjects had been impacted in a similar way to science (as described in the previous chapter) whereas others thought the challenges for science were different. A few thought English and maths were easier to teach remotely because setting work in these subjects was more straightforward and less reliant on equipment, also it is easier for children to study independently. These subjects, because they are covered every day, are also more familiar to children and parents who are clearer on what is expected in terms of children's literacy and numeracy learning.

Less hours of science have been taught

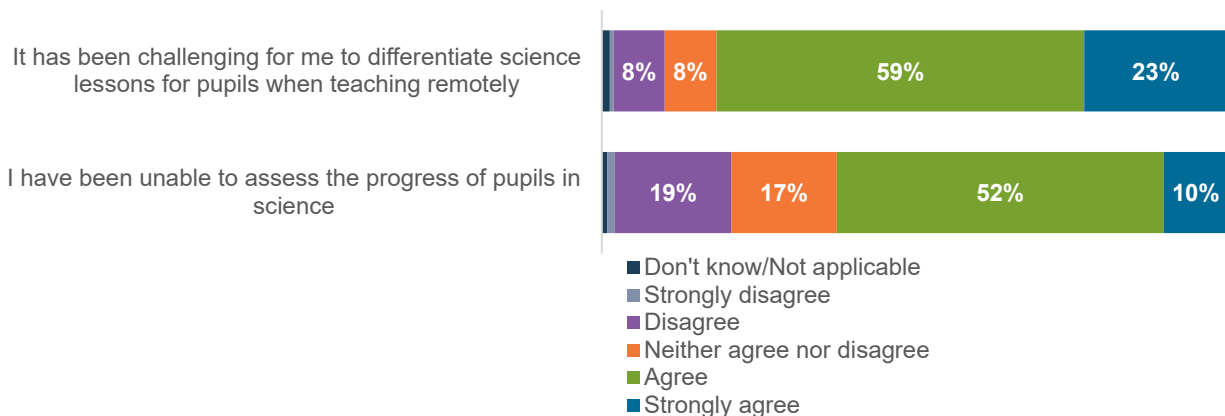
Individual teachers agree that the pandemic has affected their own science teaching. Nine out of ten teach science regularly when pupils are in school (90% agree or strongly agree with this) but this drops to two-thirds when pupils are at home (66% agree or strongly agree with this). Just under half have taught fewer hours of science overall (46% agree or strongly agree with this). Respondents from Northern Irish, Welsh and Scottish schools are more likely to agree or strongly agree (72%, 66% and 61%) they taught fewer hours of science than respondents in English schools (45%). In addition, respondents in rural schools are more likely to agree or strongly agree that they teach fewer hours (50%) compared to urban schools (44%).

Figure 14: Extent of agreement on time spent teaching science during COVID. Base= 2,666-2,675 (science teachers only).



Eight out of ten (82%) teachers agree or strongly agree that they find differentiating science lessons difficult when teaching remotely and six out of ten (62%) agree or strongly agree that they had been unable to assess pupil progress in science (Figure 15). This reflects the findings in the earlier chapter for all subjects where differentiation and assessment has been a challenge.

Figure 15: Extent of agreement on ability to assess pupils during COVID. Base= 2,666-2,675 (science teachers only).

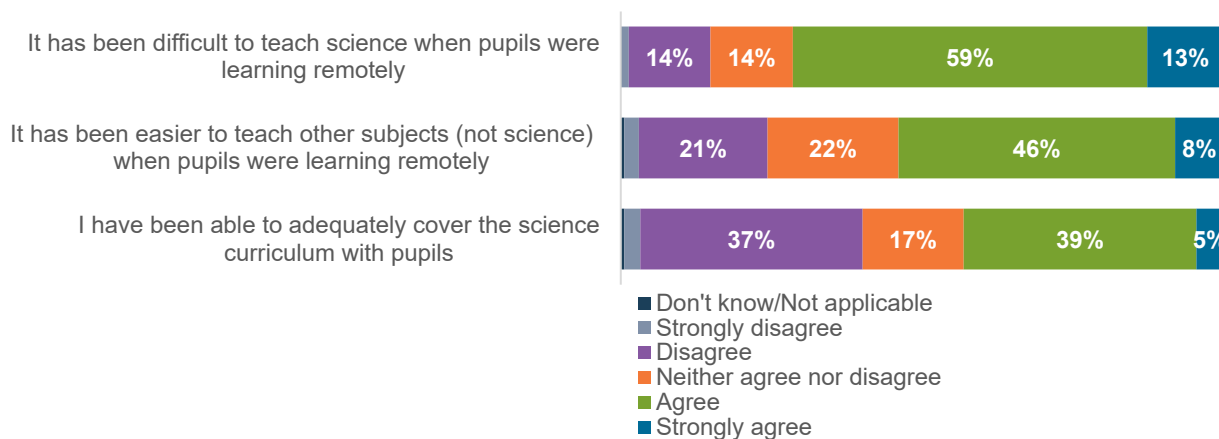


Many of the teachers interviewed stated that a lack of time and resources had affected how much science they were able to teach especially during the first lockdown. However, for most, this changed during the second and third lockdowns when they had more structure and resources available to support the delivery of a more varied curriculum. By this point most schools had also increased their requirement for teachers to provide live or recorded lessons. Teachers also had developed more experience of working with technology. These factors often resulted in an increase in the time spent on science.

It is difficult to teach science remotely

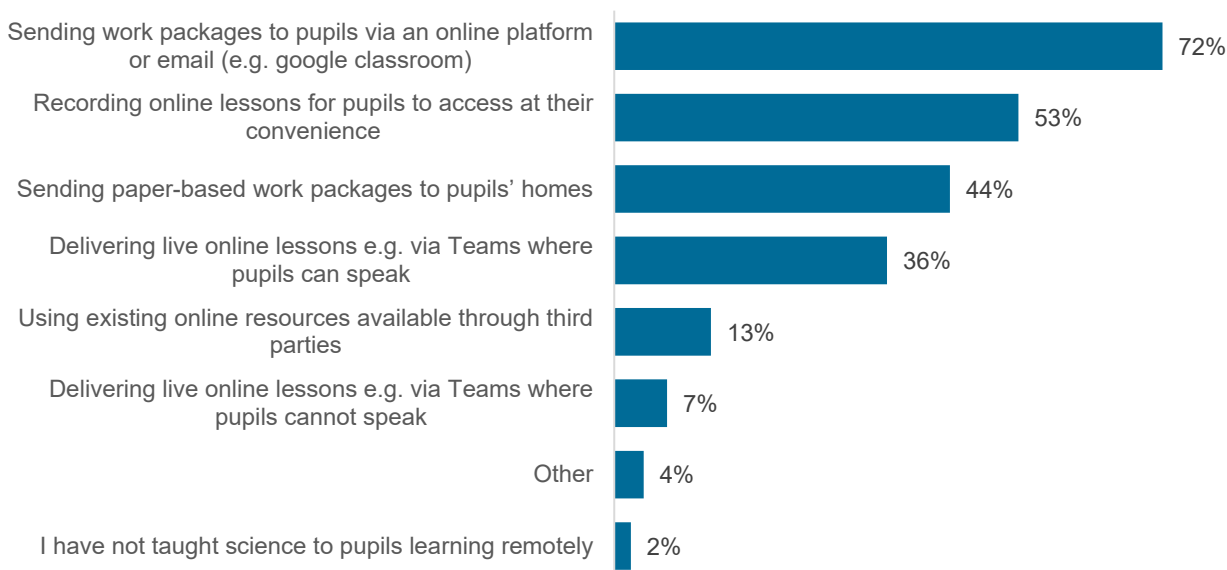
Almost three-quarters of teachers find it difficult to teach science remotely (72% agree or strongly agree) and half stated that teaching other subjects is easier remotely (54% agree or strongly agree). A lower proportion of teachers who only taught Key Stage 1 pupils state it is difficult to teach science remotely (60%) compared with Key Stage 2 teachers (72%) or those teaching both Key Stage 1 and 2 (72%).

Figure 16: Extent of agreement on remote learning methods used to teach science. Base= 2,673 (science teachers only).



Teachers utilise a variety of remote learning methods to teach science. Most commonly teachers send work packages to pupils via an online platform or via email (72% of science teachers). This method is used slightly more in rural schools (77%) than urban schools (71%). Over half (53%) record online lessons; this is more frequent in urban schools (55% compared to 46% of rural schools) suggesting limitations with technology or internet access in these areas. Respondents in the largest schools (300 pupils plus) are more likely to record lessons (58%) than any other sized schools. Other remote learning methods include, sending paper-based work packages to pupil's homes (44%) and delivering live online lessons during which pupils can speak (36%). Only a minority (2%) did not teach science remotely via any method but was reported by 8% of Scottish schools compared to 2% in England.

Figure 17: Remote learning methods used to teach science. Base= 2,673 (science teachers only).



In addition to the challenges already outlined in the previous chapter with remote learning, around half of those interviewed found adapting pedagogy specifically for science difficult. An important element of science is practical learning and investigations; remote learning provides teachers with limited opportunities for this and teachers described that it is difficult to avoid just 'talking at' children and giving them information, rather than encouraging enquiry through interactive teaching. A few teachers found differentiation harder in science because of a lack of response from some children, and described difficulties identifying, remotely, when pupils pick up misconceptions or struggle to understand topics (as highlighted in the previous chapter). The discussion and enquiry part of lessons is more difficult to replicate online.



Science for me is you want them to be doing something, you want them to be thinking and you want them to be talking. And if all of those three things are a challenge because you're at home on your own, then science isn't going to be what it should be.

Teacher

Several teachers also mentioned the role that science related field trips have in stimulating engagement in science which have been limited.

Maximising pupil engagement

Overall, teachers estimate that a relatively high percentage of pupils (up to 80% in one school) were not submitting work during the lockdowns and/or accessing online resources and live learning provision in science. Where pupil engagement was poor, teachers stated they had fallen behind quickly.

Most teachers continue to provide science every week when teaching remotely as they would have prior to the pandemic, but pupil engagement affected how much some pupils took from these lessons. Some pupils did not attend live lessons regularly, or at all, and missed out on whole blocks of science. Other pupils attended all lessons and did extra work because they had the time and motivation, or parental encouragement to do so. Some teachers described how it was easy for pupils or parents to opt out of science as it was often not often mandatory to attend these lessons (in contrast to English and maths). Therefore teachers felt it was important to make it as engaging as possible to encourage pupils to turn up or 'tune in'.

To try and overcome some of these issues several teachers had used Explorify and other resources (e.g. from the [Primary Science Teaching Trust](#)) to try and encourage online discussions. Videoconferencing, including break out rooms, had also been used more effectively during the last lockdown by several teachers to try and overcome this. Explorify is one of a range of resources that teachers used to increase pupil engagement through remote learning to add a visual or practical element to how things are taught. Some teachers use a mix of platforms to maximise engagement and increase the "fun factor". Many teachers also provided parents with details of additional resources to encourage deeper learning/enquiry, but most did not utilise these.

Other methods that teachers had use to enhance engagement include linking science learning to being outdoors and to nature. Several had used the interest in science generated by media coverage of COVID-9 and its impact as the basis of some teaching.

We looked at viruses and medicines, their benefits, what a vaccination can do, and looked at all of the vocabulary the children were exposed to in the news. We used that for science teaching that wasn't directly from the curriculum but it was incredibly important.

Senior leader

Not all teachers had experienced these difficulties, and for a small number they described that remote science teaching is easier than other subjects because children find it an exciting area of the curriculum which engaged them. Families had reported back that the science lessons and investigations they were asked to run with their children were the 'highlight of their week'. These families enjoyed the practical nature of the tasks and found it easier to engage their children with this type of learning. They also enjoyed the different ways in which teachers have adapted their remote learning (e.g. making posters or top trump cards to display learning, rather than more traditional methods of writing things up).

Challenges covering the science curriculum

Teachers are divided on whether they have been able to adequately cover the science curriculum so far during the pandemic; 44% agree or strongly agree that they have and 39% disagree or strongly disagree.

When considering the rest of the academic year most agree it will be challenging to cover (70% agree or strongly agree). During interviews there was a relatively even split between teachers who described the challenges to teaching the science curriculum this year, and those who did not. The most common issue was lost learning during lockdowns. This meant that teachers face challenges covering all the content they would normally cover.

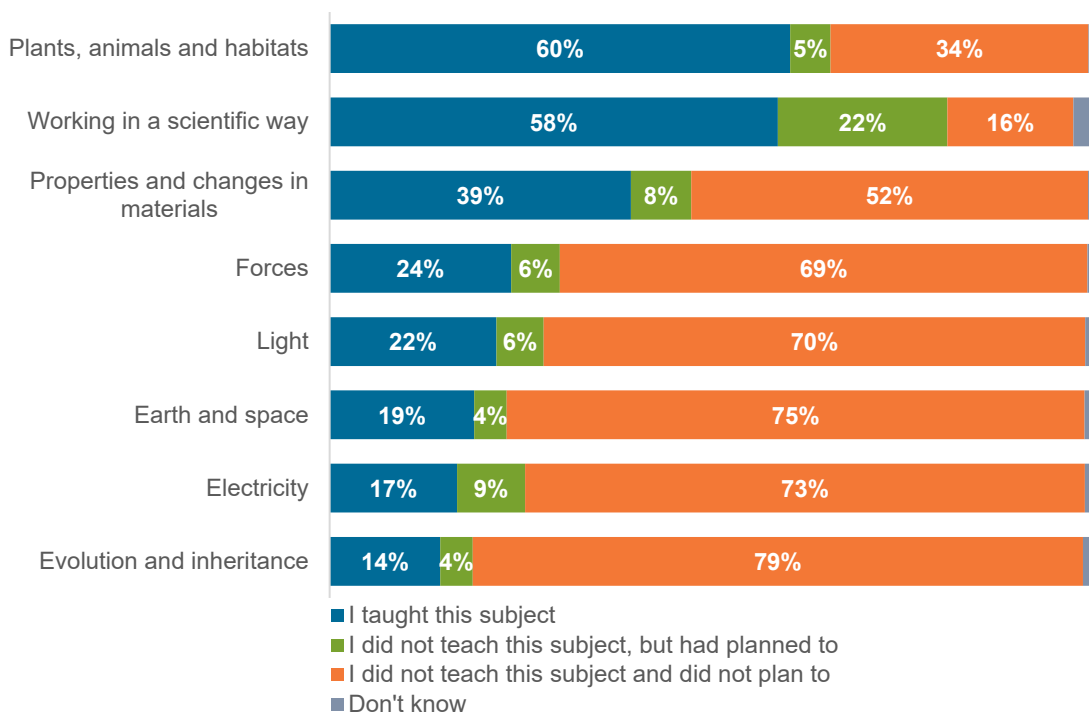
Amongst Welsh schools 42% (17 out of 41) had taught science using the new Welsh STEM curriculum during the 2020/21 academic year. In interviews, this was identified as a challenge for schools, and requiring a certain amount of specific CPD.

In terms of the new curriculum for Wales, the technology side of it has massively developed, there's a lot of coding and programming and that is where the scientific side of the technology is going to be where there's a lack of skills across the staff. So that is going to be a big area that is going to need a lot of CPD.

Science leader

Although teachers thought the pandemic had affected their coverage of the curriculum they have been able to cover most of the science topics they had planned to cover, at least to some extent (Figure 18). For most topics, fewer than 10% of teachers have been unable to teach a topic that they had original planned. The only exception was the topic of working in a scientific way, which 22% of teachers have been unable to teach due to its practical nature.

Figure 18: Science topics covered when teaching during COVID. Base= 2,534-2,615 (science teachers only).



A few of the teachers interviewed have found certain topics more difficult to teach than others remotely. These were topics which usually involve investigations with equipment not easily found at home. Most teachers thought it was still important to deliver science remotely and continued to do so, even if they need to change the way that the topics are delivered to accomplish this. Teachers moved topics around during the school year and when teaching remotely covered subjects with less focus on needing equipment. One example was covering 'changing states of matter' which is more easily taught with basic kitchen cupboard items than a topic such as electric circuits. A few teachers waited to teach some topics within the classroom because they were more appropriate to discuss with the presence of a teacher and the opportunity to fully



discuss with other class members (e.g. topics on puberty and the human body). This was to ensure discussions could take place more easily once pupils were back at school.

I had to think up of other things, but it's just very important that they're still doing science. Their science capital has to be getting topped up at all times. If we have got any notion, by the time they leave primary school, that they're going to have an interest in science, you have to give them the chance.

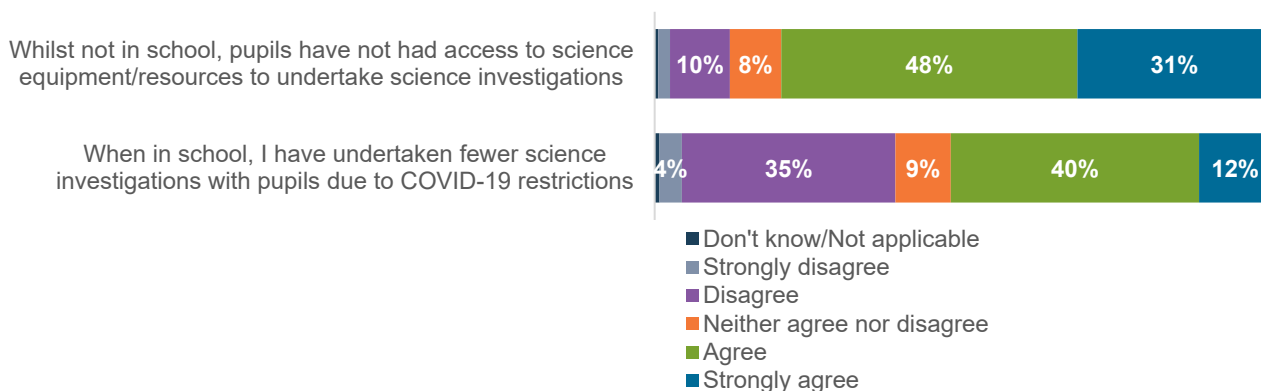
Science leader

Several teachers highlighted the challenges involved in helping pupils to work scientifically and it was common for teachers to describe difficulties in conducting investigations (as highlighted in the next section) or running field trips which impacted their ability to deliver topics in the way they normally would. Some topics (e.g. electricity), were described as requiring equipment that parents were unlikely to have and have therefore been covered less.

The pandemic has reduced the amount of scientific investigations

The impact of COVID-19 on science investigations has been marked. Just over half of teachers have undertaken fewer science investigations due to COVID-19 restrictions (52% agree or strongly agree that this was the case). Around eight out of ten teachers state that pupils lack the resources or equipment they need to undertake investigations at home (79% agree or strongly agree with this statement). A greater proportion of teachers from urban schools strongly agree that pupils lack resources (33% compared with 27% from rural schools). Alongside this, 40% of teachers from a higher FSM school (in England) state this compared to 32% in the middle band and 25% in the lowest band.

Figure 19: Impact of COVID on science investigations. Base= 2,667-2,672(all respondents).



Teacher interviews confirm that, for many, conducting science investigations has been one of the greatest challenges. This is mainly due to the lack of equipment and resources present in pupils' homes. Some teachers could only deliver the subject knowledge content side of a science topic using demonstrations and worksheets and had to leave out investigations altogether.

We had to tailor and pick areas of the curriculum that we knew we could cover online. The more practical experiments and observations are now being done back at school

Science teacher

Most teachers tried to think of alternatives to try and promote scientific thinking using minimal resources. Teachers had, for example, encouraged children to go outside and observe nature as part of a science lesson on 'minibeasts'. A few teachers gave demonstrations and then asked children to do their own simple experiments at home and then upload pictures and videos (e.g. what happens to an egg when it is cooked?). Where these were possible pupils responded well to these challenges.

Teachers were all conscious that children from more disadvantaged homes may not have the items available to more affluent households that were necessary to run investigations. Several teachers described their use of store cupboard basics to make it easier for families to take part (e.g. dissolving experiments could be done with coffee or sugar, and water). However, some experiments are harder to achieve, and some families lack even the basic supplies necessary to conduct simple investigations. Also, parents are not always able to provide the support or time to supervise their children when running investigations. One senior leader also highlighted how investigations without proper scientific equipment limited the extent of pupil's learning from investigations:

Using baking soda and lemon, those kinds of products that people have got at home that can do a good experiment. But actually... that's not going to push the learning to the same level that you want in school when you've got access to pipettes and petri dishes and things like that.

Senior leader

Teachers described how they needed to make sure advance notice was sent to parents of what household items were required for an investigation. Not all parents are sufficiently engaged or have the time to pick up these messages to prepare for the lesson. One teacher also described how some parents simply “*didn't feel safe going out to buy an egg*”.

Without investigations, teachers had to be more creative with their lesson content, but some had found certain topics and subjects became “*dull*” when taught remotely as it is not possible to engage in the same level of exploration and investigation as when in school. Several teachers also thought that the move to remote learning had negatively affected science teaching in terms of how much children enjoyed the lessons.

Although teachers generally found it easier to run science investigations when pupils returned to the classroom, some still experienced difficulties. Equipment being shared with other classes had to be washed and quarantined for 72 hours making the process more time consuming. A couple of interviewees from small schools also described not having enough equipment for even one class as pupils normally share or work in groups. Social distancing also acts as a barrier to investigations with teachers adapting these to suit the smaller groups in classrooms. The emphasis for some teachers is now to bring children back together and encourage them to think more scientifically again, with investigations a key part of these plans.

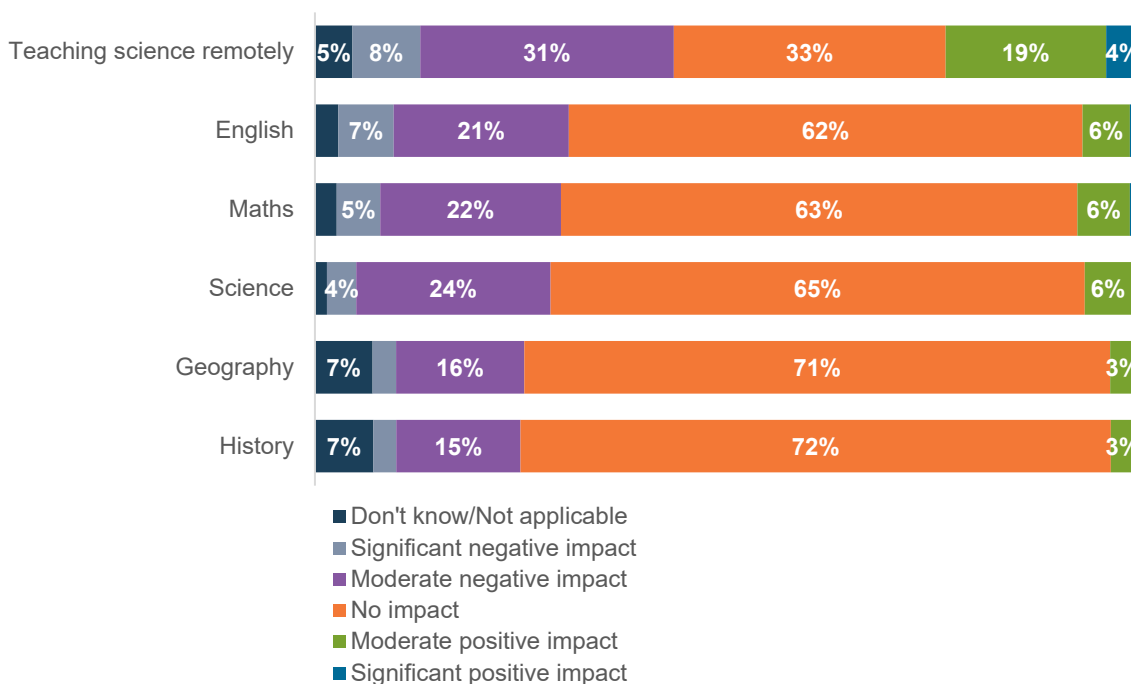
I think initially we shied away from hands on stuff because you think, 'Can they touch things?' And they're meant to be sat in rows, whereas normally you could have groups of children at tables and the range of equipment... So, I guess we've been a little bit more restricted in what we can do.

Teacher

3.4 The pandemic affected the confidence and views of some teachers

Just over one-quarter of teachers state that COVID-19 had moderately or significantly negatively affected their confidence teaching English, maths and science (Figure 20). Respondents in England with the lowest proportion of FSM eligibility were less likely to report a moderate or significant negative impact on their confidence teaching science those in schools with the highest proportion of pupils eligible for FSM (21% compared to 35%). A higher proportion of teachers reported a negative impact (both significant and moderate) on their confidence teaching science remotely (39%), but conversely a further 23% reported a positive impact on this.

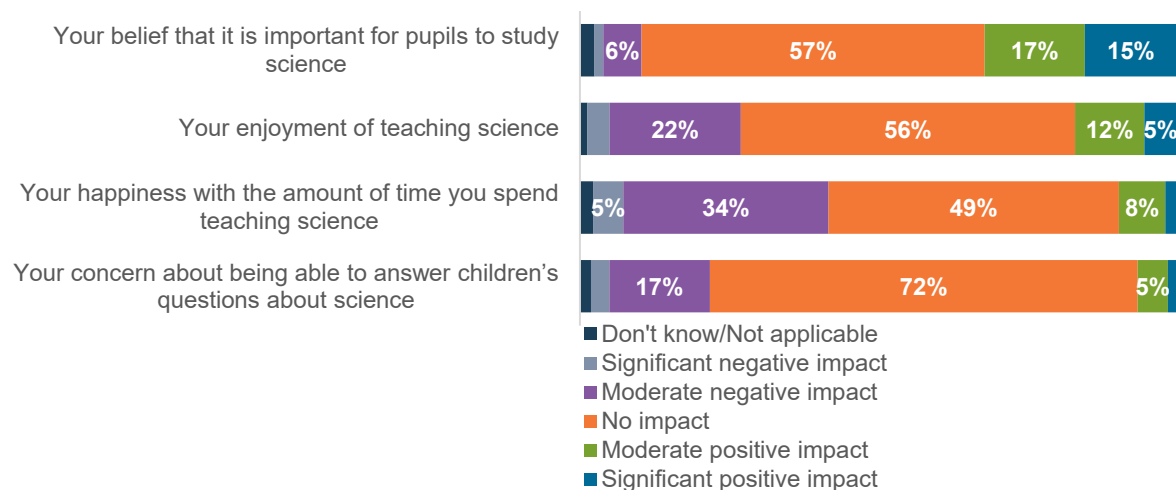
Figure 20: Extent of impact of COVID and associated disruptions on teacher confidence teaching different subjects. Base= 2,651-2,674 (science teachers only).



Teachers continue to believe it is important for pupils to study science and for one-third of teachers the pandemic has had a positive impact on these beliefs (32% agree or strongly agree). Less encouraging, although not surprising, is the proportion of teachers who have seen a negative impact on their views about their science teaching (Figure 21). For example, 41% of teachers have experienced a negative impact on how happy they are with the amount of time they spend teaching science, whilst 26% report a negative impact on their enjoyment teaching science. Also, one in five science teachers feel that there has been a negative impact on their concerns about their ability to answer pupil questions about science which aligns with a reduction in confidence.

A higher proportion of teachers who thought COVID-19 has had a significant or moderate negative impact on their happiness with the amount of science they teach agree or strongly agree they taught less science (79% for significant and 66% for moderate) in comparison to those stating a positive impact (37% for significant and 36% for moderate).

Figure 21: Extent of impact of COVID and associated disruptions on how teachers feel about science. Base= 2,668-2,672 (science teachers only).



Several teachers felt that their approach to teaching science had worked reasonably well under very difficult circumstances. Despite the considerable challenges posed by remote learning teachers strove to deliver high quality teaching across most of the curriculum, albeit with modifications.

I think everybody has worked as hard as they can, to make sure that the children have continued to make progress and have the same kind of access to quality provision.

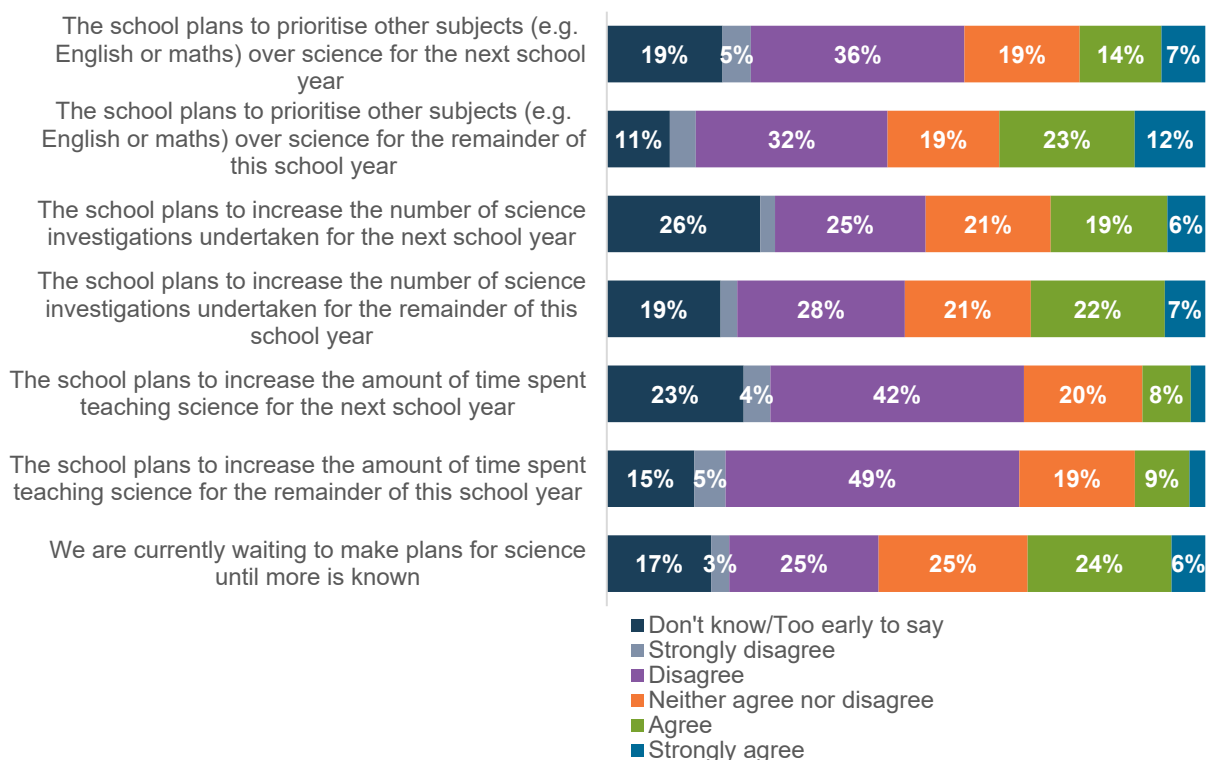
Science leader

3.5 Future plans for science teaching

A substantial minority of survey respondents agree or strongly agree that their school is planning to prioritise other subjects over science in the future (35% agree or strongly agree that other subjects will be prioritised over science for the remainder of this year, and 21% agree for next year). This was more common in Scotland where respondents strongly agree they are planning to prioritise other subjects over science (32%) for the remainder of the year when compared with England (11%) and Wales (10%). While the proportions drop (22% in Scotland verse 7% in England and 6% in Wales), the findings between these countries remain significant, going into the next school year. This highlights that within these schools other subjects such as English and maths will remain the priority.

Around one-third of respondents also disagree and do not plan to prioritise other subjects over science. A small proportion reported that their school will increase the amount of time spent teaching science for the remainder of this year (12% agree or strongly agree) or the next school year (10% agree or strongly agree). Around one-quarter of respondents indicated that their school is planning on increasing the number of science investigations in the future (29% agree or strongly agree for the remainder of the current academic year and 25% for next year). Around one-third of respondents are however waiting to make plans about science until more is known (Figure 22).

Figure 22: Extent of agreement on future plans for science teaching within schools. Base = 2,760-2,806 (all respondents).



Teachers described how the implications of lost and slower learning over the course of the pandemic means that it will be more important than ever to check prior learning before moving forward. Many teachers described the need to understand or map what has been missed over the last year. Some planned to revisit topics for the benefit of those who had been unable to access learning remotely but acknowledged that it will be difficult to do this without losing the interest of pupils who have been engaging whilst in lockdown.

Those that have been able to access stuff have more knowledge than those that haven't. But, then it's how do you address those gaps while ensuring that the others are still engaged and excited.

Science leader

In addition, several teachers highlighted how important it will be for teachers to understand not only the curriculum for their year group, but also that of the preceding year, to allow them to help pupils catch up. It was suggested that teachers in junior schools may find this particularly difficult as pupils transition from infant schools.

Well my main concern is the lost learning obviously. So how are teachers going to backfill to make sure that the children have the knowledge that they need before they go on to the next year group... How can we get practical activities back up and running, and how are we going to backfill that lost learning.

Science leader

Those teachers whose schools have a rolling or two-year learning programme described how this would help to recover learning losses, but also acknowledged that this will take time (one teacher estimating up to two terms). Teachers described a range of ways in which they were already attempting to cover lost ground, such as topic-based learning that allowed them to embed science in cross-curricula teaching with history and geography. One teacher described their approach as trying to “jam” as many science concepts as possible into their general class teaching. Almost all of those interviewed felt that science would remain as high a priority in the future as it had been previously.

Several teachers are approaching science differently as a result of their experience throughout the pandemic. A few are prioritising a more 'balanced' approach to teaching science, which they see as focussing lessons more on teaching scientific skills rather than just imparting knowledge. Other teachers are focussing on outdoor teaching to help children link science to the world around them.

4. CPD and support to teach science

This section outlines the CPD and support schools have provided throughout the pandemic.

4.1 Leading science during the pandemic

Release time for science

Almost three-quarters (72%) of science leaders received release time to lead science during the pandemic. Amongst these, just 6% had received more release time since the COVID-19 pandemic began, 45% had received the same amount and 50% had received less release time than they would have done normally. Science leaders who are not a member of SLT received less release time than those with senior leadership responsibilities (37% of science leaders not a member of SLT compared to 23% of SLT members).

Amongst the minority who received more release time, when interviewed they described using this to conduct research and undertake CPD online. However, others found it difficult to access their normal release time because of the need to undertake other tasks (e.g. covering staff absence due to shielding or self-isolation), or because the school required them to focus on other priorities (e.g. supporting staff and promoting well-being).

CPD for science leadership

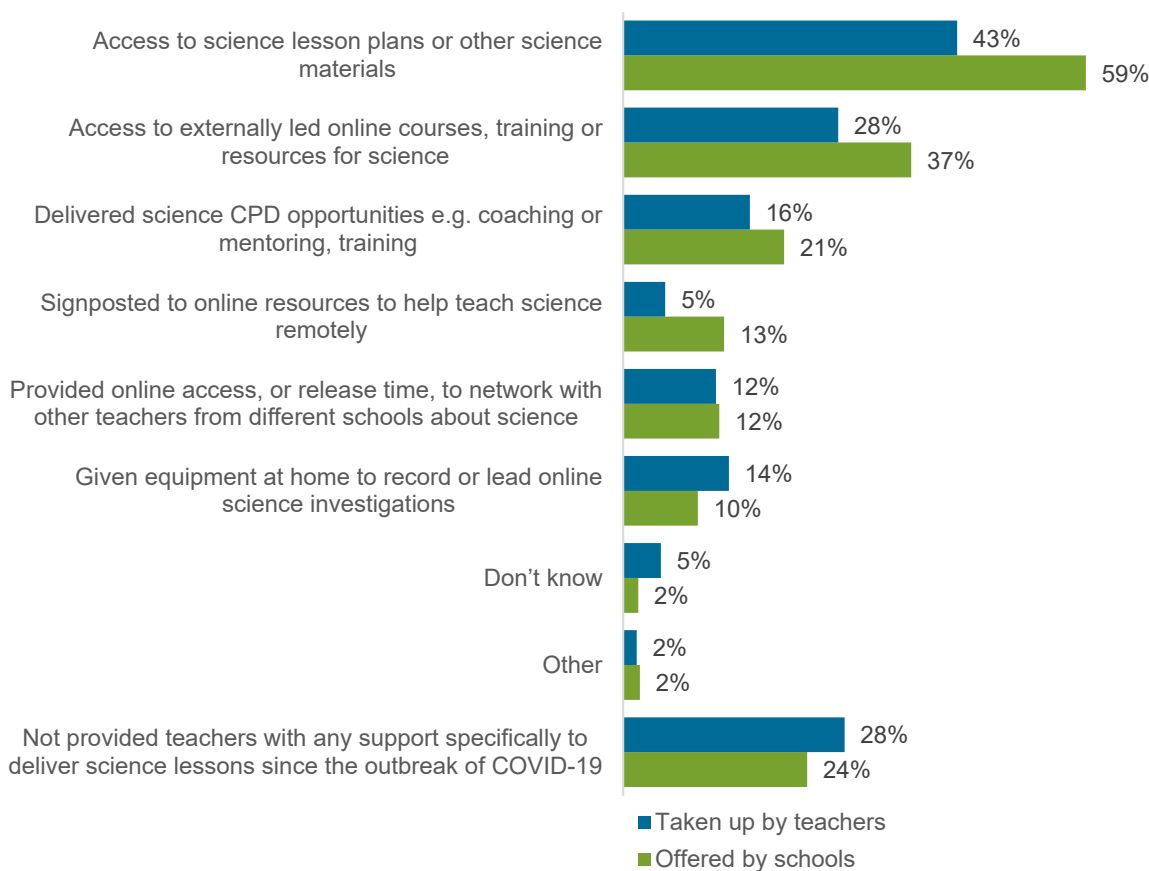
Since the outbreak of COVID-19, 61% of science leaders received CPD to help them lead or develop science throughout their school. There was a roughly even split between those interviewed who were able to participate in more CPD than usual, and those who had less CPD opportunities. The type of leadership CPD varied across science leaders. One science leader, for example, had attended CPD as part of their work towards PSQM which was led by expert speakers from the science community and focused on specific leadership areas (e.g. assessment). Some science leaders took the opportunity to refresh their knowledge and prepare for the new academic year by completing self-directed CPD to refresh existing skills. They have used a range of resources to support this including existing [STEM hub](#) links and the science leadership page on Explorify. One science leader participated in a training course focused on the delivery of science in the foundation phase as part of a wider programme directed by their local authority to roll out the new primary curriculum in Wales. Other CPD opportunities mentioned by Science Leaders included webinars on environmental science and space.

4.2 Support for science teaching

Most schools provided support of some kind to their teachers to deliver science lessons during the pandemic. Only one-quarter (24%) of science leaders and SLT members had not provided any specific science support.

The supportive measures that leaders report most commonly provide are those that teachers state their school has offered them (Figure 23). The most common methods used since the start of the pandemic are lesson plans and access to science materials (59% of science leaders and SLT stated this) and access to external courses, training, or resources for science (37% of science leaders and SLT stated this). Through the interviews teachers reported being signposted to a variety of online resources, most commonly Explorify, the Oak National Academy and the PSTT. Fewer schools had delivered their own science CPD (21% of science leaders and SLT stated this), provided opportunities to network with other science teachers (12%) or given teachers equipment to use at home to record or lead investigations (10%).

Figure 23: Support provided by schools (Base = 1,493 – science leaders and senior leaders only) and taken up by teachers (Base= 2,650 – science teachers only) to deliver science lessons.

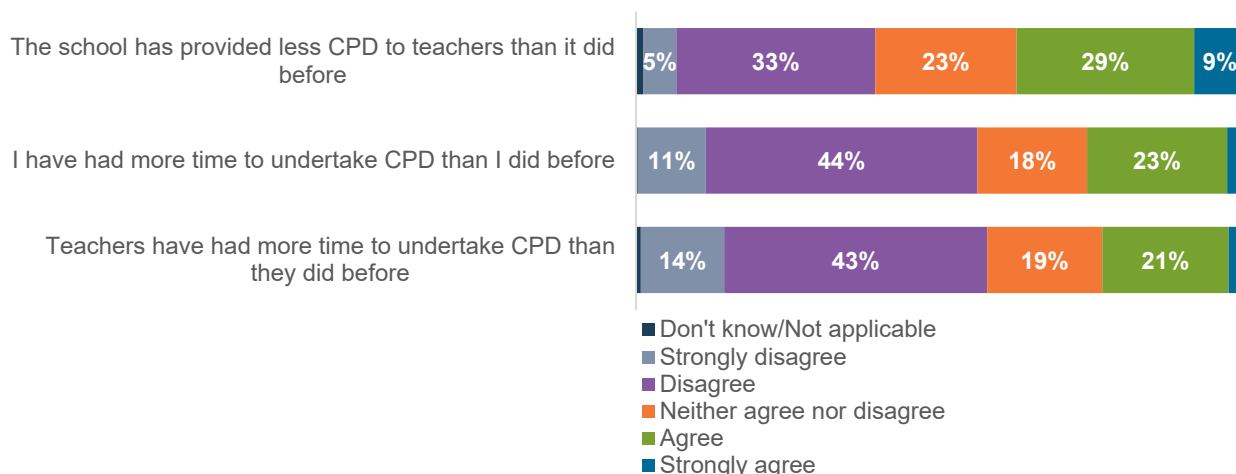


4.3 Access to CPD

There was an even split between survey respondents who agree and those who disagree that their school provided less CPD during the pandemic (38% of respondents agree or strongly agree and the same proportion disagree or strongly disagree). In addition to the supply of CPD was the time teachers had available to take part in this. Again this varies by teacher with one-quarter who had more time to undertake CPD than before (for example through a reduction in their live teaching time) and 56% who had less time.

Respondents from Northern Irish and Scottish schools are more likely to agree or strongly agree (57% and 46%) that their school had provided less CPD, than respondents in English and Welsh schools (38% and 23%). Conversely, schools in the highest and middle FSM bands (in England), were more likely to disagree or strongly disagree (45% and 39%) that they had received less CPD than those in the lowest band (33%) and a higher proportion thought their teachers had more time to undertake CPD (29% agree or strongly agree from the highest band, 25% from the middle band and 16% in the lowest) which was also reflected by individual teachers. This highlights that CPD remains a priority in these schools.

Figure 24: Extent of agreement about the time available to undertake CPD and its availability. Base= 2,810-2,812 (all respondents).



Overall most teachers interviewed had received less CPD opportunities during the pandemic, some saw no change to the amount of CPD available to them and only a few thought they had access to more. Some teachers had more opportunities to self-select topics for their development during this period to meet their own individual needs, whilst others reported a strong focus on school level specific topics (e.g. marking assessments, digital skills) to support them to teach during the pandemic. Commonly, schools provided CPD through internal development opportunities, for example sharing experiences and utilising the skills of other staff (e.g. staff within a school's IT department) rather than accessing externally delivered courses.

Teachers described schools being focussed on addressing pupils' learning losses, for example, to the exclusion of other activities including CPD. The way in which teachers could access CPD was also restricted as no face-to-face courses were being delivered, instead teachers were asked to learn via online sessions or courses.

There were also some opportunities. The move to online learning resulted in teachers requiring less time away from work to learn, and some leaders had encouraged staff to undertake online learning to meet their own interests and needs. One teacher completed more CPD than normal because they could do it in their own time and focus on topics that interested them. Another teacher from a small school had been able to access more CPD because virtual learning meant less pressure on other staff as they were not asking for as much release time when undertaking training.

Other supportive measures

There was a range of examples provided in interviews of how schools had worked to ensure they offered a supportive environment to help teachers cope with the many challenges raised by the pandemic. Many leaders described creating mechanisms for staff to share experiences, for example during virtual staff meetings. Stronger inter-staff relationships have also developed in some schools. Examples were given of how teachers were now working together to solve problems, share their learning about what works and what does not in terms of remote learning and act as a support for one another.

I felt that the team had a much, kind of, more joined-up approach to the whole school. Everything, the ethos, and going back when we came out of lockdown, I saw that very

apparent, that there was a more supportive team spirit about the place that hadn't been there before.

Headteacher

Some leaders also described offering emotional and well-being support to staff directly. In addition, a number of leaders described 'stepping back' or trusting staff to do their best, acknowledging the dual pressures of balancing work and home lives that they knew their staff faced.

I think we just had to provide a lot of, sort of, well-being support and make sure that was at the heart of what we did, and provide training and just listen to the team, and just make sure we actually cared about them.

Senior leader

Science specific CPD accessed

Some science leaders and teachers accessed science CPD more easily during the pandemic but for others this has been more difficult. In line with the survey findings, most science CPD undertaken during the pandemic has been run internally by schools (e.g. subject team meetings and inset days). External training opportunities were primarily in the form of webinars and online workshops. For some teachers, the volume and availability of free online training during the pandemic has been a positive aspect of their experience. Some staff have shared these resources between each other and with other schools.

I think it's opened up a lot more opportunities for training remotely, training that we would never have been offered, or been able to access and a lot of free training as well during COVID times. I think that's definitely been a plus. I've seen a lot more courses, so much. I think I've got an Explorify workshop this afternoon.

Science leader

A few science leaders have received training from the [National STEM Learning Centre](#) or other sources and they are now rolling this out to other staff. One school has embedded science into the school development plan and is showcasing their work to others. One science leader also described their use of the Explorify school audit which had helped them to identify gaps in teaching staff's knowledge of working scientifically. They are now implementing training to address these.

I gave them some quick fixes such as using Explorify starters and things, which could be implemented quite quickly, that would immediately improve the overall science teaching and things. But, yes, then I did a couple more that were mainly based on the enquiry types and the working scientifically skills and doing some practical activities where I got them to identify which enquiry types there were and what skills are we using.

Science leader

The provision of primary science CPD

Providers of primary science CPD described a range of provision that they developed in response to the pandemic. This ranged from creating newsletters or hubs to signpost teachers to resources, to creating new resources that supported teachers to deliver a remote curriculum. Such resources included activity sheets that could be sent home; online videos delivered by expert scientists for children to engage with either at home or when back in the classroom; and devising ideas for science investigations that involved minimal equipment, such as a cardboard box or a bit of tin foil, or ideas for outdoor exploration in gardens and parks. When developing such materials, providers highlighted the need for activities to be accessible for all children; therefore, it was important that any materials for investigations were inexpensive and easily found

within the home, and that any online sessions were easily accessed via mobile phones without the need for a laptop or tablet.

What I was really worried about at that point was that digital divide, so we didn't want to develop any resource that was going to make it harder for them or increase the gap, so the thought with the video clips is that they are short so that they could be viewed on a mobile phone.

Science CPD provider

Providers also explained that the videos they produced supported teachers delivering lessons in the classroom and online simultaneously, as they allowed the teacher to play videos presented by expert scientists – to the class and children learning from home – which gave them a small amount of respite during a challenging time.

In addition to developing resources to aid teaching, providers also designed remote CPD to replace the face-to-face sessions that they could not deliver because of COVID-19 restrictions. Such provision included supporting teachers to deliver science lessons online, holding online conferences, and delivering webinars to help science leaders establish how they could plug gaps in pupils' learning once they returned to the classroom. One provider was particularly concerned that the online delivery of CPD would reduce the impact of the provision on teachers, so they decided that it was important that their remote learning packages were interactive – to give teachers the chance to ask questions and contextualise their learning – and that they were delivered in several sittings to allow teachers to implement things they had learnt between sessions. Provision focussed on improving subject knowledge in addition to pedagogy.

Providers that would normally offer tailored support to science leaders to improve the delivery of science within their school continued to offer this support. However, this was largely done remotely due to restrictions. Whilst this facilitated regular contact between the provider and science leaders, it made it more difficult for the provider to assess the schools' needs and support them accordingly. The provider, therefore, acknowledged that this support had not been as effective as usual, and they were looking forward to face-to-face contact resuming when it was safe to do so.

Since COVID-19, it has been more difficult. In the schools where I would run INSETs, generally these are the sorts where I think the science leader needs someone to run it alongside them rather than work with someone on planning it and then deliver it themselves, and so quite often it's about trying to get that practical element of science in place, and so since COVID-19, that's much more difficult.

Science CPD provider

Providers highlighted that the uptake of their provision and use of their resources was dependent on the specific situation a teacher was facing. They explained that during the first lockdown, when schools were under less pressure to deliver online learning, teachers who were not in school teaching key-worker children sometimes had more time to undertake CPD. In these instances, providers reported that there was a 'springboard' effect as teachers were finding resources for the first time which spurred them on to look for more. However, other teachers who were in school teaching key-worker children and sometimes also delivering the curriculum remotely, or those who were delivering online learning, had less time to undertake CPD.

Generally, during the first lockdown, providers saw a huge demand for the resources and CPD they devised in response to the pandemic. Providers reported that traffic to their websites and interaction with mailouts had vastly increased, in some instances by over 200%.

The remote learning resources have been particularly popular because they've really hit the spot, you know. They've been the right resource at the right time.

Science CPD provider

One provider reported that their remote CPD delivered over the summer term (2020) attracted over 1,000 teachers, with very little drop-out, and approximately 80% of these teachers were previously unknown to them, so they were reaching new audiences. Whilst they acknowledged that this provision was free which may have influenced this, they also thought that the online mechanism of delivery had made their provision less daunting and more accessible to a wider audience of teachers.

I wonder whether we got teachers that wouldn't normally be brave enough to log on to face-to-face courses.... when we have teachers come [to face-to-face sessions] once they've got to know you a little bit, they will tell you, 'Do you know, I was really scared about coming here, I was really nervous. And I was thinking there was going to be all these people who are really clever, and good at science, and I'm rubbish. I didn't even do it as a GCSE.'

Science CPD provider

However, providers noted that the large increase in demand for their resources and CPD declined as teachers went back into the classroom when there was a strong focus on the recovery curriculum. Providers also explained that during later lockdowns when schools were under greater pressure to deliver online teaching, they also saw a decline in the uptake of their CPD compared to the first lockdown. That said, one specific resource launched in January 2021 had already achieved 19,000 downloads alone by February 2021, indicating that these resources were still in high demand amongst teachers.

Moving forward, providers were keen to continue supporting teachers to ensure that science remained high on their agendas in a time where they were being encouraged to prioritise English and maths.

5. Impact of COVID on science learning

This chapter explores the impact of the COVID-19 pandemic on pupils.

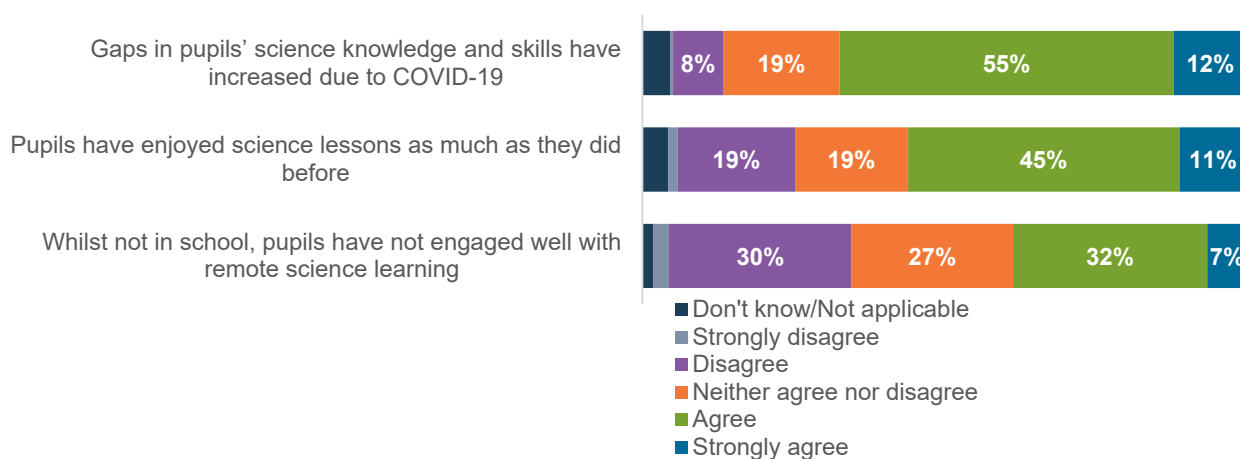
5.1 COVID-19 has affected pupils' science knowledge and skills

Most science teachers believe that COVID-19 and the associated disruptions have had a negative impact on pupil's science learning (Figure 25). Two-thirds of science teachers state gaps in pupils' science knowledge and skills have increased (67% agree or strongly agree). A greater proportion of respondents in high FSM entitlement schools (in England) strongly agree with this (19%) when compared to schools with middle (11%) and lower (10%) levels of FSM.

Four out of ten teachers reported that pupils have not engaged well with remote science learning (39% agree or strongly agree) and they disagree or strongly disagree that pupils have enjoyed science lessons as much as before. Conversely, over half of teachers did believe that pupils enjoyed science as much as they did before.

There was a stark difference in the engagement levels reported by teachers with a much higher proportion of respondents from English schools with high FSM levels agreeing or strongly agreeing that pupils have not engaged well with remote learning (54%) compared to those with middle FSM levels (42%) and those with low (26%).

Figure 25: Extent of agreement on pupil engagement with science and science progress during COVID. Base= 2,667-2,675 (science teachers only).



Gaps in knowledge

The issue of pupil engagement during the pandemic cuts across many of the other topics covered previously in this report. The extent to which pupils engaged with science, and other lessons, whilst learning from home is at the heart of their skills gaps and progress during lockdowns. This in turn then affects how and what teachers can do in the classroom when pupils return to school, and the extent of learning losses that pupils have experienced.

During interviews, teachers described pupils as having gaps in knowledge across all subjects. Some pupils, they thought, had simply learnt less about everything and science was no different. However, the opportunities for some aspects of science teaching (e.g. investigations) which are important for certain topics



have been more limited during the pandemic. Whilst topics may have been taught during lockdown, some teachers described that they have not been explored in the same way as they would have been normally.

We would have four science topics per year, four to eight science topics per year, but because these haven't been done that knowledge side has definitely increased the gap there, and I guess some of the skills there as well.

Science leader

A further issue for science learning is that pupils who have not engaged with online learning have missed topics which act as building blocks for learning in later years. Some teachers described a loss of science vocabulary over the last year. To some degree this was dependent on the involvement and capabilities of parents, with the gap between those whose parents have been able to support their child's engagement with science topics whilst in lockdown and those who were unable to being wide. Teachers described how science vocabulary is often developed when undertaking investigations therefore the reduction in these has further limited this.

Several teachers described the difficulties that their pupils had retaining information after the long absence from school. This was likened to the return to school after the summer break, but worse. Several teachers are concerned that the drive for pupils to make up lost ground does not mean that science topics are covered too quickly, and/or that the quality of teaching and pupils engagement is maintained. Some schools have chosen to skip some science topics for now but are planning a September restart, hoping to revisit missed concepts and areas in later years. One teacher described focussing, with their year group, specifically on topics that will be important in secondary school.

We've had to go back and teach certain concepts again or revisit them, so that's slowed us down a little bit. But at the moment, we are thinking of that slow down to go faster type of approach. It's just little and more often.

Senior leader

Changes to teaching style required for remote delivery included less discussion and exploration. There was also little or no opportunities for group work. This meant that teaching typically focussed more on imparting facts, and tasks based on these facts (e.g. worksheets, posters, written tasks) rather than discussion. This meant it was harder to promote scientific thinking and enquiry and for pupils to pick up ways of working scientifically. Some schools had done little or no live teaching at all and so had no way of setting up the discussions/debate that pupils normally found most engaging.

I think the biggest impact on their science learning is not being in a whole class situation where they can engage in that good quality discussion. That's the biggest impact. They've been sat on their own, in their bedroom, just having a go. You need the collaborative learning in science, it's what it's all about.

Science leader

Investigation skills

Teachers saw investigations as core to science learning and had seen the impact on pupils where these have been missed or conducted differently. The opportunities for investigation at home were limited by the resources available, as teachers felt that they could not expect too much of parents in terms of the equipment or time required for an experiment. Even when back in school, some teachers felt that the loss of freedom to use and share equipment and just 'touch things', due to the need for infection control measures, had limited pupil's ability to develop investigation skills.

There's a certain amount of science which is theory-based and you can do with worksheets and instructional videos. But then, actually, the sticky part, the sticky

knowledge part for children, is actually doing an experiment, that's what they remember. And that's what they build their knowledge on.

Science leader

Where pupils had been able to conduct investigations at home, teachers described that this had significant benefits in terms of engagement, confidence, and learning. For example:

I think the ones that actually did the practical experiments at home, the fact that they were trying things out and doing things. Also, even simple things like doing experiments with [sweets], and looking at the colours and how you can mix, just doing things like that. I know I've had some of the younger ones come back, 'We did it at home, we did this.' It's exciting when it spills over into home learning.

Science teacher

One teacher highlighted how, whilst there had been opportunities for pupils at their school to participate in science activities, such as observation, recording and analysing data during the pandemic due to their online learning programme, these types of activities have not taken place as much as would normally be the case. In addition, those pupils not engaged with online learning missed out on all these opportunities.

The potential impacts of conducting fewer, or different types of, investigations during the pandemic was also described in terms of pupils having less in-depth understanding of topics. Investigations that pupils conducted at home lacked the breadth of those offered in class. A few teachers described pupils having less resilience when investigations did not work as planned, which they felt was a result of their experiences (or lack of experiences) during lockdown. Another issue was that, even now pupils were back in school, time pressures, due to social distancing, staggered start times, and the need for hygiene and infection control measures make conducting investigations challenging. The time taken to write up investigations is also significant, particularly given that some pupils have literacy losses after lockdown. A couple of schools were looking at ways of recording investigations differently (e.g. using videos) to cut down on the time required.

I think definitely the investigation skills, or quite a lot of them, and there's definitely a gap with vocabulary, like that has been a huge focus of ours since we've been back, we're trying to get them to use that vocabulary.

Science leader

Confidence

Alongside gaps in knowledge, pupil confidence has also been affected. Where teachers have seen a loss of confidence amongst their pupils, the main impact of this has been on their conduct during lessons – this is a difficulty across all lessons and not just science. Several teachers described their classes are asking fewer questions during class and that it is more difficult to 'draw out' answers from them, particularly when they first returned to school. Others had seen participation in group work affected which they attributed to pupils not being able to work in groups during lockdowns and are now struggling to adapt to being back in class which is important to science. Some teachers described pupils as struggling with the 'social side' of science learning, having missed opportunities to discuss and share ideas over the last two school years. Many teachers, therefore felt that it had been more difficult for them to encourage pupils to speak up and voice their opinions since the pandemic which is critical during science.

It was quite difficult to draw stuff out of them whereas before they knew how the science lessons worked and they were quite engaged and would come up with ideas and things.

Science leader

Where parents had been able to encourage critical thinking as part of home learning pupils this had been easier, but this is a big ask of parents in a difficult time. Some pupils also lacked confidence in their scientific abilities in areas like accuracy in measurements and drawing conclusions.

Several teachers observed that a lack of confidence about science topics, both amongst pupils and their parents, had sometimes led to a lack of engagement with science whilst home learning when compared to other subjects. One teacher thought it was because children were able to access those subjects independently and science needed more input from teachers or parents.

When they were doing the online learning, a lot of them would go straight to the English or the maths, straight away, because they could access it on their own. So when it then came to science, they would leave it a little bit more, because they didn't have that same level of confidence that they did for the other subjects.

Science leader

Several teachers also highlighted how self-conscious young people could be when seeing themselves on screen using videoconferencing software which could affect their confidence about contributing to online sessions.

Whilst some teachers have seen a loss of confidence, others have seen their pupils grow in confidence as they worked independently whilst home learning.

Sometimes you had parents working at home and having to manage the distance learning as well, I think the children were starting to get opportunities to be that little bit more independent and propose their own questions, suggest ways to actually carry out an investigation.

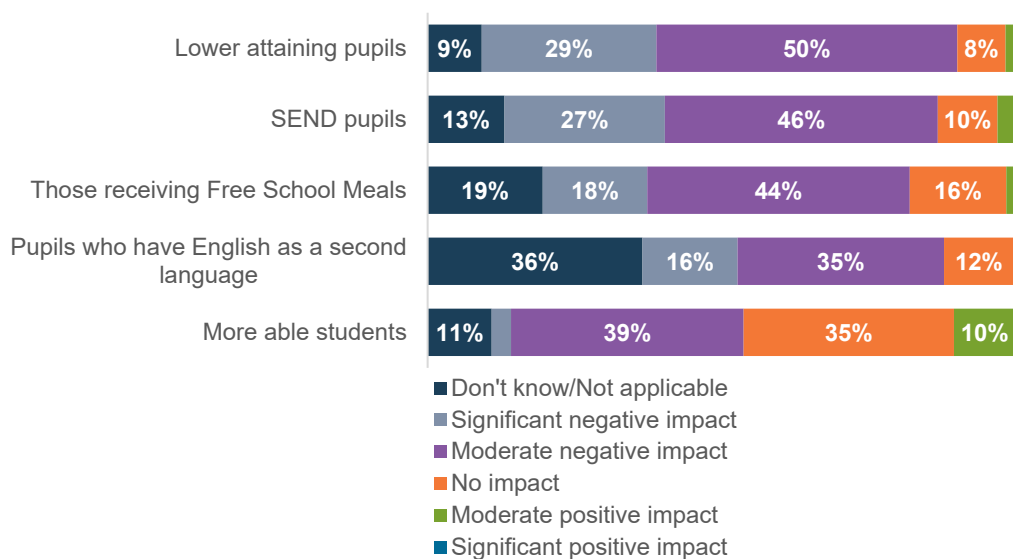
Science leader

Pupils most affected by COVID

Just over half of science teachers stated the attainment gap in science has widened (52% agree or strongly agree with this statement) during the pandemic. A higher proportion of respondents from schools with higher levels of FSM agree or strongly agree (63%) compared with those with middle levels (56%) and lower levels (42%).

Whilst COVID-19 has affected all pupils, teachers believe it has had affected certain groups of pupils more than others. The most common groups of pupils who teachers state are affected in science are lower attaining pupils and those with special educational needs and disabilities (SEND). Over 70% of teachers thought there had been a moderate or significant negative impact on both of these groups of pupils (in comparison to other groups of pupils). Teachers also observed impacts on pupils in receipt of FSM (62% stated a moderate or significant negative impact on these pupils). For those with English as a second or additional language 51% had seen a moderate or significant negative impact on these pupils – with very few stating no impact at all. Alongside lower attaining pupils, those who are more able were also negatively affected, although for a small proportion there had been a positive impact.

Figure 26: Extent of impact of COVID and the associated disruption on science learning for different groups of pupils compared to other pupils in the school. Base= 2,800-2,808 (all respondents).



Around half of the teachers interviewed thought that the effects had been felt relatively evenly across pupils from all backgrounds and ability levels. For these teachers, learning during the pandemic has simply followed the patterns of normal learning whereby children who would have struggled in class continued to do so.

Lower attaining pupils

Those pupils who struggle to engage whilst in class often found it even harder when working remotely. Some of these pupils often benefit from having a teacher or teaching assistant available in the classroom to explain topics in different ways and they often need multiple exposures to the same topic to grasp concepts, which is difficult, or impossible, when remote learning.

Once pupils were back in school, the priority on helping lower attaining pupils catch up was often focused on maths and English, leaving little time for the inclusion of science. Parents with lower literacy levels also found it difficult to help children understand topics. To compound this effect, some teachers felt that higher-achieving pupils had been relatively unaffected as they were often better able to work independently, pick up topics quickly and engage with topics online. This had led to the learning gap between the highest and lowest achievers being widened.

I think it will have had an impact across all subjects, but I think science would have been hit a little bit harder, just due to the fact that some of them would be able to access some of the English and maths, more so than the science.

Science leader

Pupils with SEND

The learning style of some pupils with SEND did not lend itself well to remote learning and parents often struggled to provide the specific support their children needed. As with lower attaining pupils when in the classroom many of these pupils need more support which is not possible during live or remote lessons.

I did extra one-to-one sessions with the kids who are on our special needs register, and it was deeply frustrating not to be able to touch, show, give, [equipment]. It's very

difficult for those children to have it so remote...So, I think it's going to take quite a bit of catching up for them.

Special Needs Co-ordinator and science teacher

In contrast, some pupils with SEND found it less challenging to be at home and found it a positive learning experience; but then struggled to readjust to being back in school.

Economically disadvantaged pupils

Around half of teachers who were interviewed discussed the relationship between a lack of learning progress and socio-economic disadvantage. Children in households with lower incomes are more likely to face digital poverty and lack the equipment or internet access necessary to fully engage in remote learning. Whilst some schools had supplied devices to those in need, they could not always do so quickly, or overcome a lack of internet access.

Economic challenges also affected overall family well-being, and where parents had financial concerns this understandably impacted their ability to support children with their learning or limited their engagement with the school. Finally, teachers identified that families with less disposable income lacked access to the resources necessary for pupils to conduct investigations.

Science lessons in particular were a lot more of a struggle because there's so much practical element to it, so teachers were having to pre-record themselves doing an experiment, and if the children could do it at home, great. But obviously we had to bear in mind that, because we're in a very deprived area, not all the children had access or the resources that they may need.

Science teacher

Other groups of pupils

There were two other groups which a smaller number of teachers drew attention to. The first of these was learners with English as a second or additional language. If their parents did not speak English in the home, their English language skills and abilities were reduced which impeded them when learning and when returning to school.

Another factor was the age of pupils. Some teachers highlighted how difficult it had been for younger pupils to cope with the return to school and described how difficult it had been for them to develop social skills whilst learning at home. These pupils also needed a greater amount of encouragement and modelling from teaching staff¹⁸. However, other teachers felt that pupils in years 5 and 6 had been most affected as they prepared to transition into secondary school.

¹⁸ Modelling is an instructional strategy in which the teacher demonstrates a new concept or approach to learning and pupils learn by observing and making learning notes.

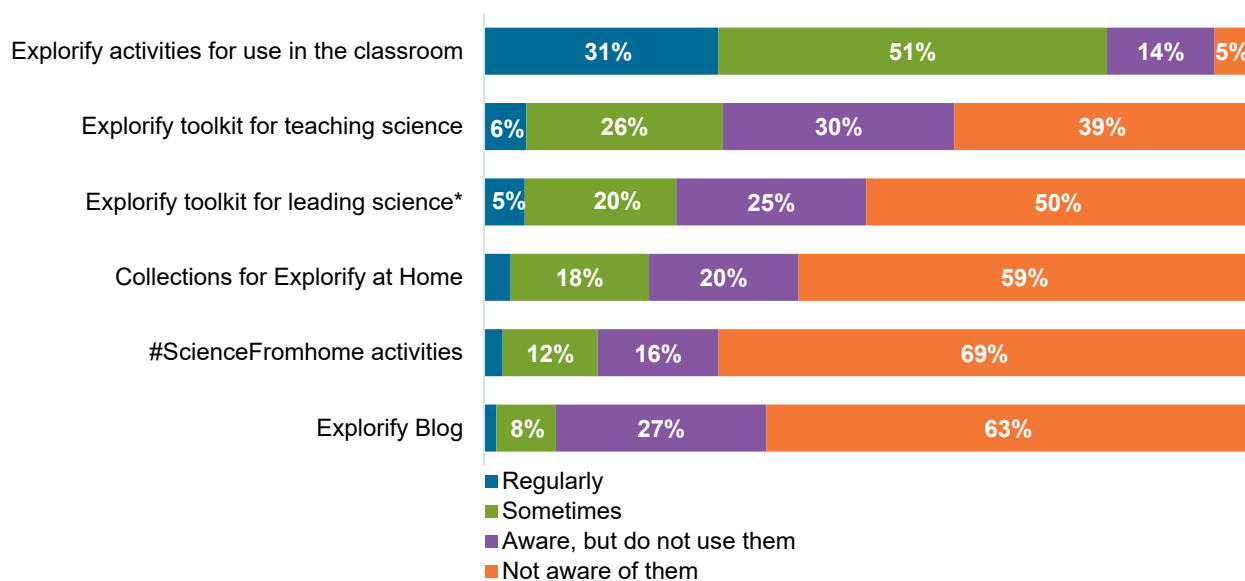
6. Use of Explorify during the pandemic

This chapter considers how Explorify has been used during the pandemic. It also explores which elements of Explorify have been used and why teachers have used the resource to support their teaching during this difficult period.

6.1 Using Explorify during the pandemic

Explorify has a range of elements which teachers and science leaders can use (Figure 18). Eight out of ten (81%) respondents use Explorify activities for use in the classroom regularly or sometimes, one-third (32%) use the Explorify toolkit for teaching science, and one-quarter (25%) use the Explorify toolkit for leading science. There was less use and awareness of the Explorify at Home and the #ScienceFromhome activities, with teachers using the Explorify Blog the least.

Figure 27 How regularly have you used or shared any of the following since the outbreak of COVID-19 to support pupils in your school? Base=1,355* (science leaders only) -2,823 (all respondents).



When considering all of the above resources, most respondents (83%) had used Explorify during the pandemic – 32% had used at least one tool or activity regularly and 51% had used at least one tool or activity sometimes. The pattern of use varies by country and teaching role. Teachers in England are more likely to be regular users than teachers in other countries (40% of teachers in England compared to 31% in Wales, 24% in Scotland and 23% in Northern Ireland). In addition, a greater proportion of science leaders are regular users of Explorify compared to other teachers (42% compared to 24% of non-science leaders). A higher proportion of Key Stage 1 teachers were regular Explorify users (40%) compared to Key Stage 2 teachers (29%) and those who taught both Key Stages 1 and 2 (32%).

During interviews, several teachers discussed how they have not used Explorify as much during the pandemic as they normally do. This is generally because they found adjusting to remote learning difficult and time consuming. On reflection these interviewees thought that Explorify could have been a useful tool to use as it could have supported their remote learning.

Why do teachers use Explorify?

Teachers use Explorify to support their teaching primarily because it motivates and engages pupils creating enthusiasm for science.

Engaging and stimulating

Most teachers think Explorify engages pupils successfully in class discussions, stimulating interest and excitement. It generates an engaged atmosphere, encouraging pupils to ask questions and voice their opinions ensuring pupils develop scientific skills. Explorify, when used as a 'starter activity' helps lessons begin positively as pupils need to think critically and they become interested to know what might happen next. The variety of resources on offer means teachers can keep changing their approach, ensuring there is always something new for pupils to see and discover.

[Explorify is] mainly used as a tool to get them started, to get them talking. And we vary it, so mine love the 'Zoom In, Zoom Out' one, and the 'Odd One Out'. They're the ones that we tend to get, like, the most discussion from.

Science leader

High quality imagery and videos

Teachers described the images and videos available as high quality, appropriate for their age group and relevant to a wide variety of topics. Pupils respond well to images and videos because they are widespread in their daily lives. One teacher commented on the continuous stream of images children are faced with, and the wide use of technology within family homes, and therefore thought it was important for lessons to reflect this. Another teacher described how useful Explorify is to help children make links between topics taught at school and their daily lives, and with topical news stories, particularly during the pandemic.

"Explorify is real pictures, real photos. It's just much more what the children expect to see in this social media world, this tech world. They want it to be real and there, and they expect to be able to Zoom In, Zoom Out on pictures. So, it's great because it's teaching them in the world, they live in."

Science leader

One teacher described how their current teaching model called 'thinking, talking, and doing science' fitted well with Explorify. The images available in Explorify encourage the 'thinking' and 'talking' aspects and lead well onto investigations to practice the 'doing' part of the process. This approach, including the use of Explorify, has been rolled out across the school to aid lesson planning and teaching.

We have this bright idea at the start of the lesson where we give the children the stimulus that they can just talk for five or ten minutes, about the science behind it. Obviously, Explorify is brilliant for that in terms of the Zoom In, Zoom Out, the Odd One Out, the videos and pausing and things and so that's used readily across the school.

Science leader

User friendly and time saving

Teachers find the Explorify website user friendly and easy to navigate. The resources available can be picked up and adapted, making it a useful tool for planning lessons. Teachers described being able to find what they need for any year group, to support a particular topic, saving them precious time. Teachers see it as a trusted and reliable resource and rely on the scientifically accurate and current content. Those teachers who are not as confident in teaching science use it to help deliver lessons without having to spend too much time researching the topic. Explorify is also used to help establish the right 'pitch' for different groups of

pupils, because there is extensive information on each topic, with readily available explanations, and teachers can adapt their lesson accordingly with little planning time.

One teacher described how they found the notes Explorify provides to be especially useful because they provide additional scientific background to lessons, as well as being a way to access CPD for themselves and other colleagues.

It's got the teaching notes and that's always handy to have. I've given that to my TA before as well. It's like CPD I guess because it makes sure that you know what you're talking about before you teach it.

Teacher

A few teachers highlight how Explorify gives them ideas for starting scientific discussions during lessons and the visuals on the website make this easy to achieve. The activities do not need explaining and the children can start the lesson straight away.

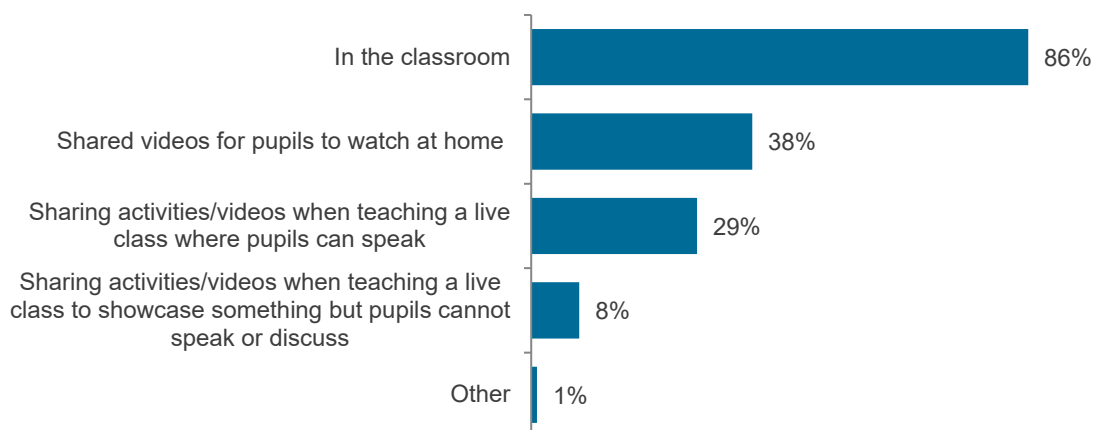
I absolutely love it, and it is my go-to site for science, because it's child-friendly, it's a site when you go on it and it doesn't need explaining.

Teacher

How is Explorify used?

Teachers most commonly use Explorify in the classroom (86%) during the pandemic. Two-fifths share videos for pupils to watch at home (38%), and 29% share activities and videos during live remote lessons where pupils can interact. Science leaders are more likely than other staff to have shared video content for pupils to watch at home (42% compared to 34% of other teachers).

Figure 28 How Explorify activities have been used since the outbreak of COVID-19. Base=2,293 (respondents who have used Explorify during the pandemic).



Most of the teachers interviewed use Explorify to support their science lessons, during plenaries, or both. There were also examples of teachers using Explorify in lessons other than science or to help fill 'gaps' in the school day.

Regular Explorify users reported slightly fewer challenges when teaching science during the pandemic compared to infrequent users and non-users:

- 17% of non-Explorify users strongly agree it has been difficult to teach science remotely compared with 12% of regular or infrequent users.
- 27% of regular Explorify users strongly agree they are able to teach science regularly in the classroom compared with 20% of non-Explorify users.

- 60% of regular Explorify users agree or strongly agree pupils have enjoyed lessons as much as before compared with 56% of infrequent users and 49% of non-users.
- 22% of regular Explorify users disagree they have been unable to assess the progress of pupils in science compared with 18% of infrequent users and 15% of non-users.
- 40% of regular Explorify users disagree they have undertaken less science investigations compared with 33% of infrequent users and 30% of non-users.
- 35% of regular Explorify users disagree that pupils have not engaged well with remote science learning compared with 29% of infrequent users and 25% of non-users.

Use of Explorify during lockdowns

During interviews, some teachers continued to use Explorify activities during lockdowns and found them easy to use during live lessons especially as a starter. Zoom In, Zoom Out, What's Going On? and Odd One Out activities were frequently used in this way. They grab pupils' attention and 'bring subjects to life' which is important as engaging pupils through remote learning is a challenge. One teacher described how they would pause videos and revisit interesting points at regular intervals during live lessons to maintain engagement and momentum.

A few other teachers found sharing a screen allowed them to utilise Explorify activities during regular Teams 'check-ins' with their class. Pupil responses were monitored using the icons (e.g. hand wave) so the teacher could then easily manage the flow of questions and answers.

We were able to keep it going during lockdown because we would have these live check-in sessions, Team's meetings where they would all log on and it was the perfect, sort of, activity to do because they could all virtually put their hands up and contribute and we could keep it going, and it just, it provoked so much discussion.

Teacher

Some science leaders had specifically adapted their use of the Zoom In, Zoom Out activity to suit remote teaching. One used an 'ideas board' where children could post questions and answers, see each other's responses and make an active contribution to topics when teaching was not live. Another science leader allowed each child to take a photograph of something (agreed by the teacher) and, using a microscope plugged into the computer, they could gradually zoom out. Each time a child asked a sensible question, the image was zoomed out further. This was successful in encouraging lesson interaction and for developing questioning skills. One teacher however had found it hard to run and focus discussions when working online such that it was harder to use Explorify and keep lessons on track.

A few teachers did not deliver live lessons and instead produce hard copies of Explorify activities for use at home. Others share Explorify videos for pupils to watch at home. Several teachers described how pupils can easily understand the Explorify website because of the clear language used. They see it as particularly useful when they are trying to explain more abstract or difficult scientific concepts both in-class and remotely.

We especially like things like the Odd One Out and things like that. It worked really well for us to home learn because it was something that we could set a link to on our platform and then they could come back and respond to it. So, we really like it.

Senior leader

A few teachers thought they approached lessons more creatively when working remotely with Explorify. They thought it helped them to deliver a more enjoyable lesson, spending less time on traditional worksheets which was often less appealing to pupils and parents.

Brilliant for starting a lesson and exploring that further and it was something that could've easily been done at home because you can leave them with that question. They can explore it, chat about it with their parents and it was just a different way of thinking for them. It was something they could do at home, so we found that useful."

Science leader

Most teachers had limited time to investigate new resources available on the Explorify website during the pandemic and were unfamiliar with the at Home collection. One teacher did recall seeing communications related to the collection, although had not used it yet. Most were concentrating on the areas they needed to cover for a particular strand of the curriculum. There was interest in using the at Home collection in future, however, and teachers could see the potential for this type of resource.

In-class teaching using Explorify

Most teachers found Explorify was a useful 'hook' into a subject or topic when teaching in-school during the pandemic. As with remote teaching, however, it is sometimes necessary to adapt how the resource is used. When working with key worker children in school one teacher decided to take science lessons outside. They took a picture from Explorify and asked the children to guess what it might be using handheld microscopes. This teacher found it was beneficial to have a break from the screens and being outside felt safer during the pandemic.

I didn't use a screen so, the Explorify stuff, I kind of took it outside. We bought some handheld microscopes for children and then I took a microscopic photograph, photocopied it, took it outside in the polytunnel, showed them, and then they had to try and work out what I had taken a photograph of.

Teacher

Prior to the pandemic one teacher described how they would use Odd One Out exercises to encourage pupils to leave their desks and stick their ideas on post it notes around the room. However, because of the need for social distancing there are limitations on children moving around the classroom such that this approach had to be modified.

I used to stick up pictures, print off the three pictures and I might stick them round the school with a little clue about, 'Find the three pictures. Can you come and find me and tell me which one is the odd one out and why?' Which they all loved. They were rushing up to tell you. But of course, now [the lesson is] not quite as exciting.

Science leader

Some teachers found they used Explorify more often in the classroom than when teaching remotely. A few teachers find Explorify activities easier to use in the classroom because they are equipped with appropriate technology (e.g. large screens to display imagery). One teacher found activities such as the Zoom In, Zoom Out were more powerful in the classroom setting than when delivered at home because remote learning has a greater separation between the teacher, the image and the pupils.

Not just a science teaching tool

Several teachers use Explorify as a starter in lessons other than Science. This is primarily to encourage discussion and to introduce topics which are cross-curricular. One teacher described how they use Explorify in their teaching of non-science topics. Pupils enjoy the activities, are familiar with it and the resource promotes the generation of ideas and develops transferable skills.

I've used it in cross curricular stuff as well, you know, like, if we're doing something in geography, and it's a Zoom In, Zoom Out, an Odd One Out on there, I'll bring that in because it's related to what we're doing, so there's a science element giving opinions, thoughts, ideas, analysing but in history or geography.

Science leader

There were also several examples of teachers using Explorify to assess what pupils already know on a subject and where gaps in their knowledge may be. Explorify helps teachers identify, then rectify, any misunderstandings that pupils develop.

I certainly use them initially when I am introducing a new topic to assess children's prior knowledge. So, what kind of vocabulary do they have, what kind of knowledge do they have?

Science leader

Typically, teachers do not currently use Explorify as an intervention (e.g. to enhance a particular skill such as oracy rather than specifically in relation to a science). This is primarily because they had not considered using it this way; however, most would consider doing so in future. A few teachers had used Explorify to develop whole class oracy skills and one teacher thought it could easily be used to target specific groups of pupils.

We've got quite a lot of children, I have in my class, that have got speech and language targets, and it's honestly nothing that I've ever considered, but I think that's really interesting.

Science leader

6.2 Explorify is frequently recommended to others

Since the outbreak of COVID-19, nine out of ten science leaders (89%) who are aware of Explorify in the classroom have recommended its use to other teachers in their school. Amongst those who have recommended it, 17% estimate that all teachers use it across their school; 14% estimate three-quarters use it; 17% state half of use it and 6% believe up to one-quarter of teachers at their school use it. Approximately one-third (36%) have recommended it to other staff but are unsure how many teachers are now using it.

All the science leaders and teachers that were interviewed encourage others use Explorify. It enhances the delivery of their own lessons and they want other staff to benefit in the same way. Most teachers using Explorify are encouraged by science leaders or members of SMT to do so, rather than being 'expected' to use it. One science leader highlighted how Explorify was more readily adopted by teachers when they saw the benefits of using the resource for themselves (e.g. when they were shown how to use the resource as a lesson starters), rather than when its use was mandated.

A few science leaders conduct their planning in Explorify and do expect teachers to use it in line with these plans. One senior leader has embedded Explorify into the curriculum so it can be used during all science lessons across the school. Another Science Leader actively encourages all teachers to use Explorify to plan their science lessons in advance.

The more they started using it, the more familiar they became with it, the more they actually started using it more within their planning. So, I set out a staff meeting time when I wanted them all to log in, I wanted them all to sign up and I wanted them to look

at their planning that was coming ahead and think about actually what activities can they use to help with this.

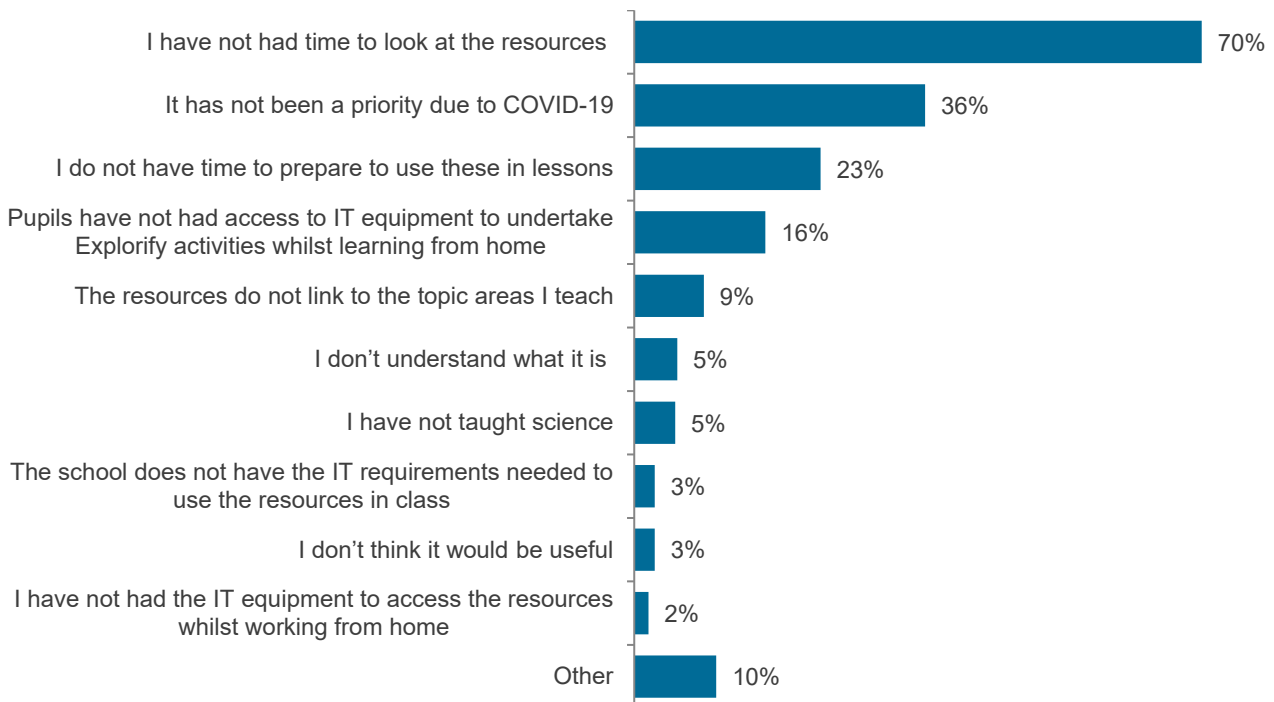
Science leader

Science leaders use different methods to encourage other staff to use Explorify resources. There are several examples of science leaders sharing links with teachers during lockdowns to remind them to use Explorify. Other science leaders use meetings to discuss and recommend Explorify with one who reminds colleagues during every team meeting. A few science leaders also look for evidence that teachers are using Explorify during science lessons by checking pupil's books.

6.3 Why Explorify has not been used during the pandemic

The majority (70%) of respondents that did not use Explorify during the pandemic did not have time to look at the Explorify resources. Just over one-third (36%) have not prioritised using Explorify due to COVID-19 and just under one-quarter (23%) did not have time to prepare to use Explorify resources in lessons. Very few respondents who have not used Explorify say this is because of a lack of IT equipment within the school (3%) or because they thought it would not be useful (2%).

Figure 29: Why Explorify has not been used with pupils since the outbreak of COVID-19. Base=397 (respondents who have not used Explorify during the pandemic).



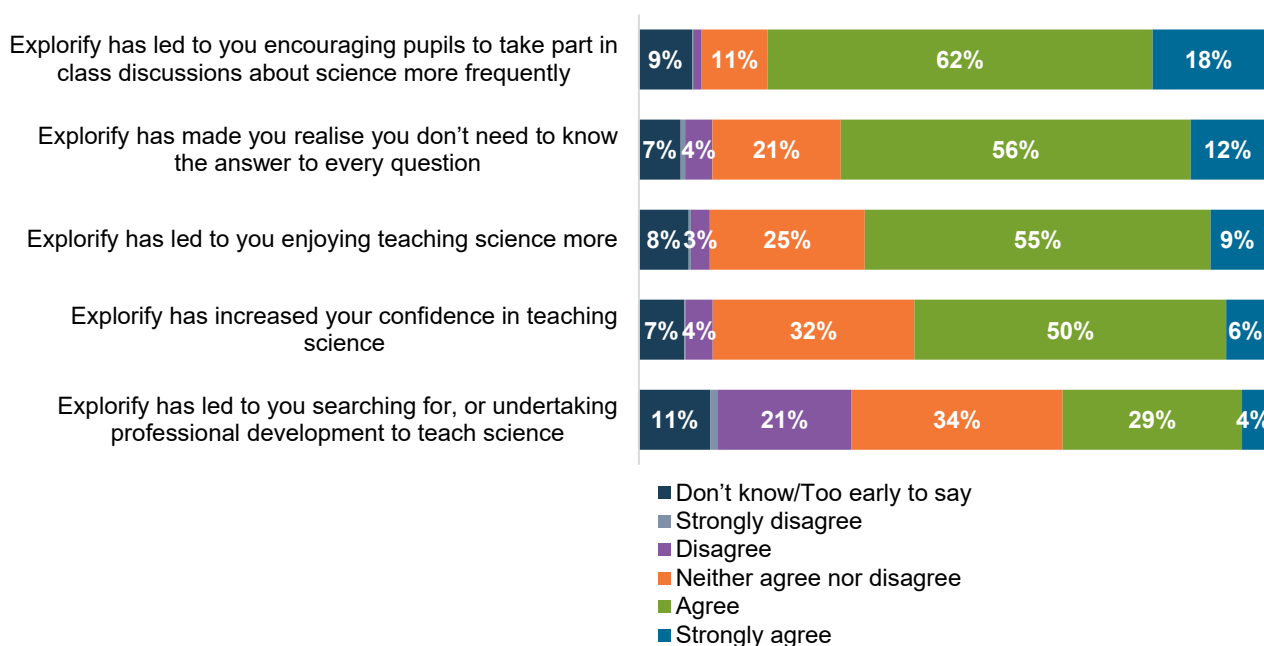
7. Impacts of Explorify

This chapter presents teacher views on the impact of Explorify on both teachers and their pupils.

7.1 Explorify has an impact on teachers' practice

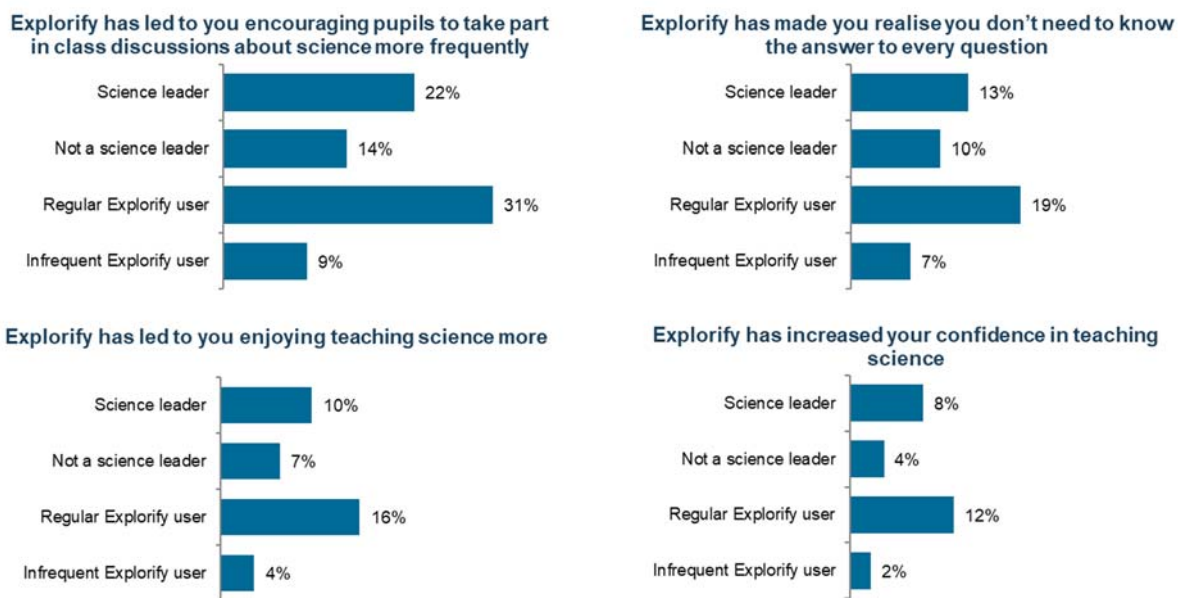
Teachers report that Explorify has a positive affect on their own science teaching and how they feel about teaching science. Just under four-fifths of respondents (79%) who use Explorify agree or strongly agree that using the resource has led to them more frequently encouraging pupils to take part in class discussions about science. Explorify also encourages two-thirds of teachers to realise that they do not need to know the answer to every question raised by pupils (67% agree or strongly agree) and helps two-thirds increase their enjoyment when teaching science (64% agree or strongly agree). Over half of teachers describe how Explorify has increased their confidence in teaching science (56% agree or strongly agree). One-third (33%) also highlight that using Explorify has led to them searching for or undertaking CPD to teach science.

Figure 30: Impact of using Explorify since the outbreak of COVID on teachers and their teaching. Base= 1,915-1,923 (respondents who have used Explorify during the pandemic).



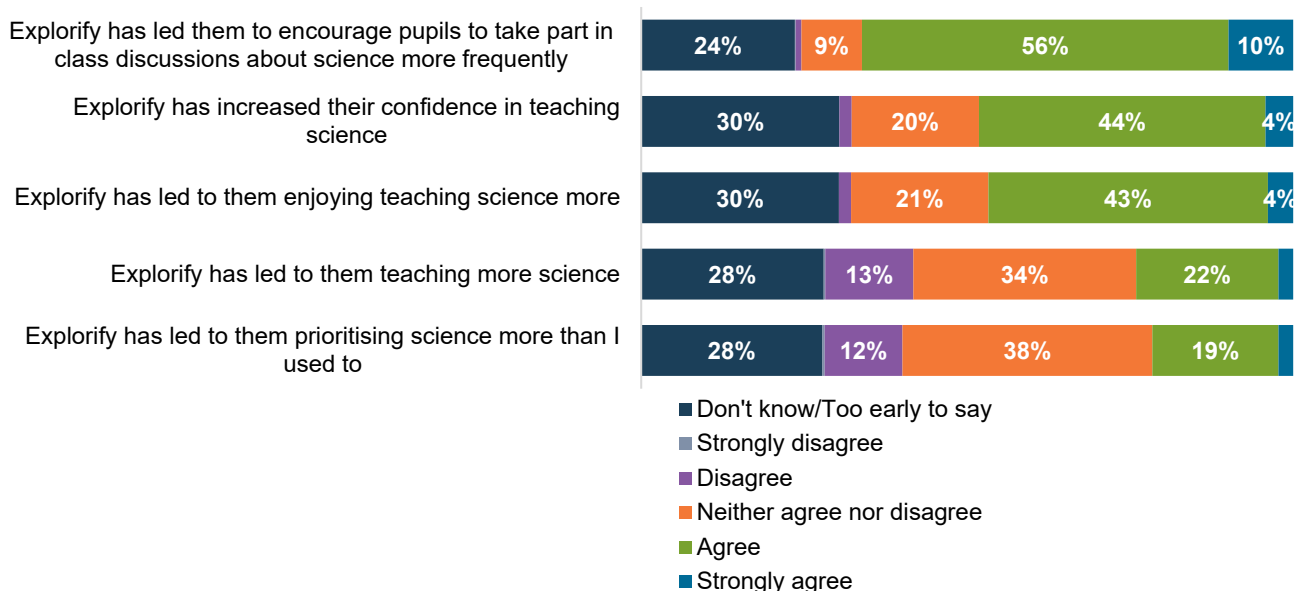
Across most impacts (shown in Figure 31), a higher proportion of science leaders strongly agree with these statements than non-science leaders. Regular Explorify users are also more likely to strongly agree than infrequent users.

Figure 31: Proportion of respondents who state 'strongly agree' to the impact of using Explorify. Base= 1,915-1,923 (respondents who have used Explorify during the pandemic).



Two-thirds of science leaders (66%) who know teachers in their school are using the resource agree or strongly agree that using Explorify encourages teachers to engage their whole class in discussions. Around half (48%) agree or strongly agree that it has increased teachers' confidence and a similar proportion (47%) agree or strongly agree that using Explorify leads to teachers enjoying teaching science more. Around one-quarter (24%) agree or strongly agree that Explorify leads to teachers teaching more science.

Figure 32: Impact of using Explorify since the outbreak of COVID on teachers and their teaching. Base= 793-799 (Science Leaders who have recommended Explorify to other teachers and seen at least some of them use it).



The survey also included an open question which asked teachers who had used Explorify during the pandemic to state, in their own words, what other impacts Explorify had on their science teaching. Just under half (45%) of those providing a response stated that it aids in the planning or improving the delivery of lessons and described this having a positive effect on pupil engagement in their lessons. Around one in ten (12%) describe experiencing an increase in their own scientific knowledge when using the resource; the format and style of this information made the delivery of lessons through Explorify less challenging for both

them as teachers and pupils. One in ten teachers (9%) thought it had no additional impact, but this was generally because they were already confident about their science teaching, whilst others had only limited experience of using Explorify and were therefore unable to identify any impact yet. Other responses include it helps with pupil assessment (7%) or reduces planning time for lessons (2%).

The previous chapter outlined a variety of reasons why teachers who were interviewed chose to use Explorify, these frequently related to the impact it had on either them or their pupils. Around two-thirds of teachers highlighted further ways in which Explorify had an impact on their teaching practice.

Explorify supports teachers with their lesson planning and gives them new ideas about ways to cover topics.

It certainly has an impact on me as a teacher. One of the first things I do when I'm planning my topics for this half term is have a look at what's on Explorify that I can use and then build around it.

Senior leader

The content is already 'pupil-friendly' which also means they do not need to spend additional time creating content for lessons or making content suitable.

Explorify makes it easy for teachers to access the information that they need to support their teaching and to do so quickly due to the additional information included with the resources. This ensures teachers fully understand a topic before presenting ideas to their class. This information also enables them to cover topics in more depth. This in turn leads to teachers feeling more confident teaching topics that they would otherwise feel unable to.

As a primary teacher who has no scientific knowledge it certainly gives me the confidence to talk about either dynamic and thrust force and these kinds of things, because it's not relying on my knowledge, it's a resource that is created by knowledgeable science people.

Science Leader

One senior leader described how the information is particularly useful when preparing materials for pupils with SEND and those for whom English is an Additional Language. Teachers find the additional information provided through each activity, for example, is useful if they engage in any 'pre-teaching'.

Teachers describe how pupils' enjoyment of Explorify further impacts on their own confidence and encourages them to continue to use Explorify in class. As teachers use it and become more familiar with it, some have used it in different ways or used more of the website. One described "using it more thoroughly" and another as "thinking more deeply" about things when using the resource.

But I noticed this lockdown that Explorify, if I scroll down, there's a really beautiful child-friendly paragraph underneath explaining what an electrical current is. They're so beautifully written, that actually those bits I now use more.

Teacher

Teachers also describe how using Explorify allows them to be more responsive to pupils and allow pupil-led discussions. When discussions in class veer off topic, teachers can quickly and easily access Explorify activities which allow them to follow where pupils lead – again ensuring teachers feel confident. One teacher described Explorify as helping them reclaim an "exploring kind of mindset" that they had instilled when they were training.

I know it's sparked other debates and other conversations which then they've wanted to learn about, which we have then followed, 'Oh, that's a great question, a great idea,

we'll go with that', whereas I think if I didn't have Explorify, I wouldn't necessarily give them as many opportunities for that discussion, or to go down the other routes.

Science leader

Teachers also report an impact on their own ability to ask the right questions, develop the discussion and steer the debate with questioning. They seek to reinforce and review the learning that has taken place by asking questions before, during and after a lesson.

Teachers without a scientific background can use it to feel more comfortable and confident teaching a broader range of science topics, whilst those with more experience can use it to refresh their knowledge and use the resources as a starting point for more exciting and engaging lessons.

I can cover more because I'm more confident and I'm more coherent with the information that Explorify is giving me, and the way it's worded.

Teacher

It's just made us, you know, sort of structure our lessons in a much better way. And it's also, it's enriched our teaching because the resources are just such good quality.

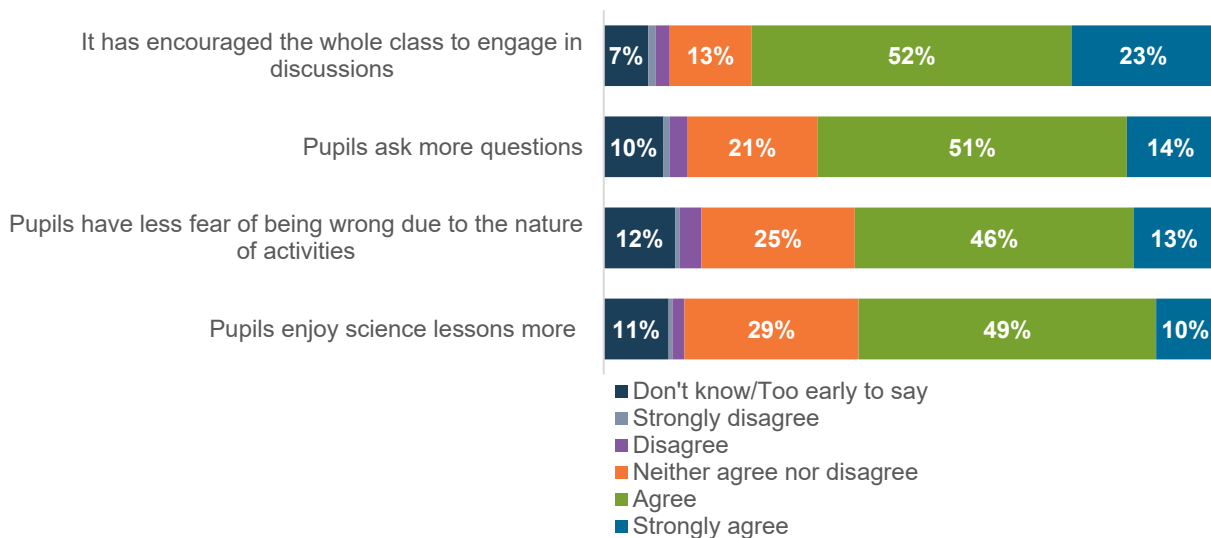
Science leader

7.2 Explorify also has an impact on pupils

Impacts when using Explorify

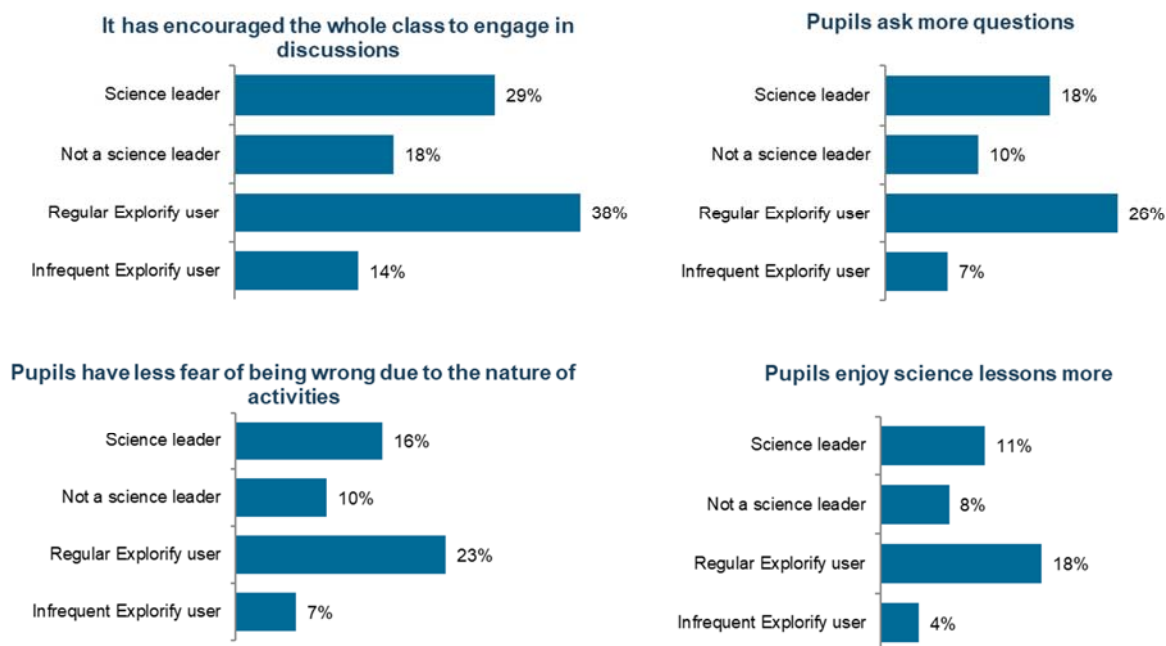
Over three-quarters (76%) of teachers who use Explorify agree or strongly agree that it encourages the whole class to engage in discussions. Almost two-thirds (65%) agree or strongly agree that pupils ask more questions when using Explorify and over half agree or strongly agree that pupils have less fear of being wrong (59%). Over half state that pupils enjoy science lessons more because of Explorify (59%).

Figure 33: The impact of using Explorify activities with pupils since the outbreak of COVID-19. Base=2,269-2,280 (teachers who have used Explorify in the classroom since the outbreak of COVID-19 only)



A greater proportion of science leaders, and the most frequent users of Explorify, agree or strongly agree with all these statements when compared to other teachers.

Figure 34: Proportion of respondents who state 'strongly agree' to the impact of using Explorify activities with pupils since the outbreak of COVID-19. Base=2,269-2,280 (teachers who have used Explorify in the classroom since the outbreak of COVID-19 only)



Survey respondents were asked in an open question, to describe any additional impacts they had observed on their pupils. Nine out of ten respondents (who provided an answer) described positive impacts of Explorify with just 4% suggesting that Explorify had had no impact on their pupils and 4% stating it was too early to make a judgement. Around one-third (32%) identified that pupils are enjoying science more when using Explorify. Over one-fifth (22%) described how Explorify increases discussions between pupils and increases engagement in science lessons. The positive impacts were frequently attributed to the format of Explorify, the quality of the materials and their ability to 'spark' discussions. Around one-in-ten respondents (12%) thought that Explorify activities had raised pupil confidence with comments that the format of 'Odd One Out' and 'Zoom In, Zoom Out' allowing less-confident pupils to share their ideas without fear of being wrong.

The images provoke quality discussion and the range of resources available means that I do not need to search for high quality images that connect perfectly to curriculum content. The images I have used in class have prompted quality discussion and helped to introduce and use scientific vocabulary.

Science leader (responding to the survey)

During the teacher interviews, the most common impacts on pupils included involvement in class discussions and overcoming their fear of being wrong.

Engagement in science and encouraging class discussions

Explorify has led to teachers encouraging pupils to engage in more class discussions. Not only have the number of opportunities increased but teachers describe how pupils are more willing to take part because they are curious and excited about the images and videos shown to them. This leads to better engagement in lessons as pupils enjoy the activities and are excited about what they are being shown.

They love the videos of showing things developing and changing over time they just find it fascinating. They all become excited in a similar way about what they're seeing.

Science leader

We're developing pupils' love of learning, where they're curious about the world, and I think children sometimes can lose that curiosity, and it's a real shame. So, I think things like Explorify have really helped us, kind of, capture that back.

Science leader

This has been particularly important as pupils return to the classroom following lockdowns where their opportunity to speak during remote lessons has been limited or non-existent. The structure of Explorify helps pupils overcome lapses in confidence which have occurred when working on their own during lockdowns.

The language skills dropped for some children because their parents were working, and they just weren't being spoken to. So, it's got them talking, thinking again, and voicing their ideas and not being afraid to voice their ideas.

Science leader

The open-ended questions of Explorify also spark pupil's interest which encourages pupils to question what they are seeing and they then want to share their ideas. The activities encourage children to say what they think but teachers also ensure they can justify their answer and not just say "because" as an answer. This engagement in class discussion further supports pupils critical thinking skills and encourages them to be inquisitive.

Less fear of being wrong

Strongly linked to increases in class discussions is how Explorify helps pupils overcome their fear of being wrong. Teachers use activities such Zoom in, Zoom out and Odd One Out to encourage discussion and debate. The focus of discussions is on pupils justifying their answer, rather than on getting things right. Several teachers contrasted this with other subjects, for example maths, where although the method is important, fundamentally pupils must achieve the correct answer. Being able to approach science in a different way was reported to be freeing for pupils. One teacher described this as 'changing mindsets' and allowing a range of opinions to be 'valid and heard'.

It's got them talking, thinking again, and voicing their ideas and not being afraid to voice their ideas. Because that's what's so lovely about it all, there is no right or wrong answer... That doesn't just have an impact on science, that has an impact on, you know, on them generally. If you can develop children's ability to talk about things clearly and to use reasoning and then to listen to someone else's idea and think, 'Oh yes, I didn't think of that. What about this?' To kind of learn from each other like that.

Science leader

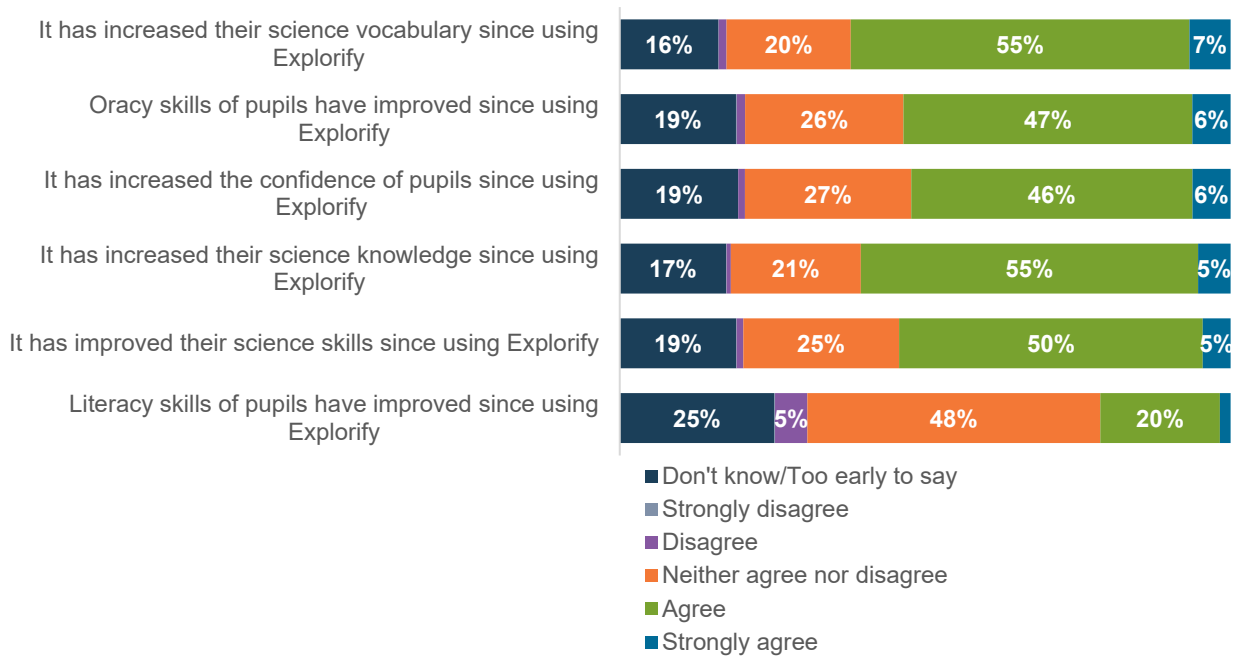
When Explorify is used as a starter activity it sets the tone for the rest of the lesson where pupils are encouraged to speak up without fear of being wrong (as there is no right or wrong answer for some Explorify activities). Pupils are then more likely to make an active contribution during the rest of the lesson. One teacher described this as Explorify creating a "safe space to question". Because Explorify lessens the fear some pupils have of being wrong teachers report it is particularly useful for pupils who are less confident about science or less confident generally and it is seen to 'level the playing field' between pupils. The Odd One Out activity especially was described as being critical to this and pupils are more confident to disagree and debate with others in their class.

Impact on science knowledge and broader skills

Explorify not only has an impact when it is directly being used during a lesson but also supports pupils' scientific development and broader skills. Since the outbreak of the pandemic Explorify has: increased pupil's science vocabulary (62% agree or strongly agree), their science knowledge (61%) and their science

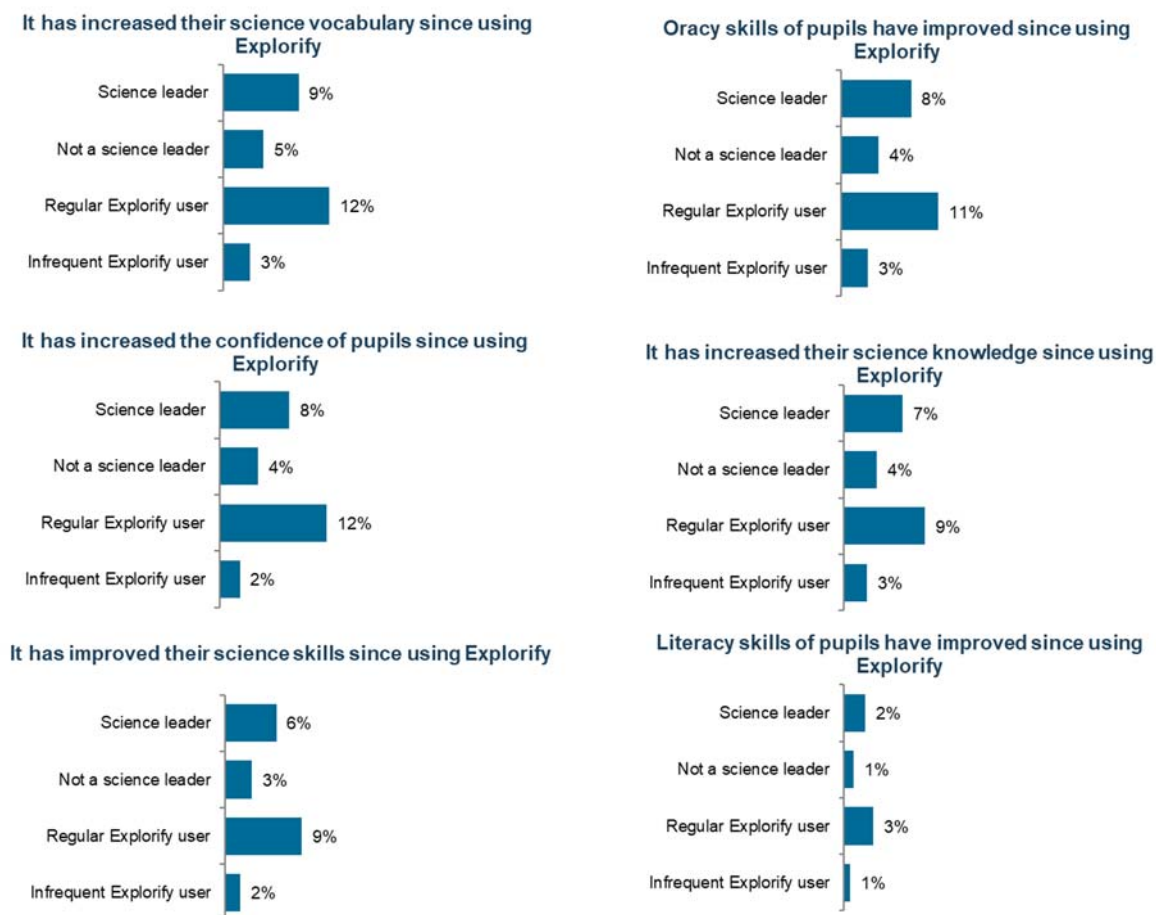
skills (54%). Oracy skills have also been developed as reported by 53% of teachers and an increase in pupil confidence reported by 52% of teachers.

Figure 35: The impact of using Explorify activities with pupils since the outbreak of COVID-19. Base=2,253-2,269 (teachers who have used Explorify in the classroom since the outbreak of COVID-19 only)



As with teacher impacts a greater proportion of science leaders and frequent Explorify users stated strongly agree to the impacts on their pupils.

Figure 36: Proportion of respondents who state 'strongly agree' to the impact of using Explorify activities with pupils since the outbreak of COVID-19. Base=2,253-2,269 (teachers who have used Explorify in the classroom since the outbreak of COVID-19 only)



Science knowledge and skills

The Explorify activities are designed to encourage pupils to ask questions, discuss and debate. Several teachers highlighted how the class discussions prompted by Explorify develop pupils' confidence and abilities to use reasoning, questioning and critical thinking skills. Explorify interests pupils which in turn further encourages them to ask questions promoting curiosity and discussion amongst pupils.

Several teachers made links between the improved communication skills they had observed in their classes when using Explorify to pupils being able to develop a broader scientific vocabulary. This has led to an improvement in pupils' ability to talk about science:

It just generates scientific conversation, words that they might not have heard before, and some children know more than others, so you've got your ones that haven't experienced things that are picking up words that they wouldn't have heard of before from other children.

Teacher

A few teachers discussed the improvements they had also seen in pupil's scientific knowledge and their understanding that science is 'all around them'. It also gives pupils exposure to things in the world they have not yet had the chance to see. Staff at one school described how it is important to relate science to real life, especially during the COVID-19 pandemic. Teachers recognise how Explorify draws on real life examples and, in doing so, helps pupils to see how science relates to their own lives.

It's the real-life examples as well that are really good with them because you tended to create this odd fake experiments in science, years ago, but now actually all of your Big Questions, your photos are real, the videos are real. So it's allowing children to discuss and ask big questions themselves.

Headteacher

Explorify presents new scientific knowledge to pupils but also allows pupils the chance to apply prior knowledge. Explorify is a means for them to demonstrate that they have both retained knowledge, and that they can use it in appropriate situations. Explorify also contributes to the creation of highly engaging lessons and teachers have noticed pupils are more confident with new scientific concepts.

It excites them. I think it makes them thinkers, it makes them enquirers, it makes them good communicators because of the language and the things that you can get from the resources. And also thinking you've got the right answer, which is quite nice. You know, it's a very non-threatening approach, open to all levels of ability.

Science leader

A few teachers have noticed an improvement in their pupil's observation skills since using Explorify. These teachers all encourage children to look and listen to the activities and images provided and then share their observations with the class. One teacher observed that pupils become increasingly creative in the descriptions they use as they practice.

"The more I do these topics, the more I do the individual videos with the children, the better I see them become in terms of their observation skills. There's almost a creativity to try and think of why something is different."

Science leader

The discussions and debates stimulated by Explorify also helps teachers identify misconceptions. There are therefore knock-on effects onto pupils' acquisition of knowledge and understanding of scientific concepts because teachers are better able to understand the thinking behind their mistakes.

I think it often shows you the misconceptions that are there that you wouldn't otherwise know. So, this week we did one of the Odd One Out challenges that had pictures of the planets, it had a picture of the Earth and Jupiter and the Moon. And it was really interesting, the misconceptions the children had about how those three things were related to each other.

Teacher

A few teachers also described how Explorify successfully challenges pupils' stereotypical perceptions about the characteristics of scientists, encouraging them to recognise that scientists are 'all around us' and widening their view of the world. They have an enhanced understanding of the different types of scientists that exist and what they do which is opening pupils' eyes to the types of jobs they could potentially do in the future.

The kind of mad scientist in a white coat, with frizzy hair and glasses, the stereotypical scientist, that is their view of science, and inevitably male. Explorify widens their view of science in the world. It also shows them opportunities for science in terms of work...

when they leave school, here's opportunities, this is where science actually happens. Science in food, science in cosmetics, science in animals, all those sorts of things.

Science Leader

Oracy

Around one-third of teachers interviewed described the impact of Explorify has on pupils' oracy skills. Pupils are excited by the activities which results in them being more engaged, taking a more active part in lessons and speaking out. Asking pupils to explain their answer, as Explorify does, encourages pupils to use more words and to listen and learn from what others in the class are saying enabling them to develop their language and vocabulary. One teacher explained how their school was encouraging teachers to create as many opportunities as possible to extend their pupil's use of vocabulary using Explorify's comprehensive explanations about topics.

Some teachers feel that the way they run activities with the requirement to explain their ideas is critical and a few have noticed an impact on the development of pupil's speech and language skills because they are communicating more.

I've encouraged the use of scientific vocabulary for every single thing that they see on the screen. So even, you know, for the videos that you've got, I'll pause it and say, 'Tell me what you know about this.' Especially higher up the school, so we've encouraged the use of scientific vocabulary about whatever the topic might be, so that helps identify gaps in the vocabulary and knowledge, which is great.

Science leader

Pupils need to use a range of vocabulary to explain their ideas and the thinking and evidence behind these ideas, they also need to listen to others and question them. All these activities enhance oracy skills because pupils learn to express themselves, reason, listen to others and respond to questioning.

Several teachers have observed impacts in other lessons from this and see broader impacts of pupil's improving their verbal and listening skills in lessons through the use of Explorify.

Since I've started doing it [Explorify] very regularly, my language and communication assessments are better. I think that it works to across the board help them with their communication and language and I think they transfer that into all their learning.

Teacher

One teacher described how their pupils are using more complete, well developed sentences and a few have seen improvements in listening, and reasoning skills after using Explorify. One teacher has seen language and communication assessment results improve particularly amongst younger age groups.

[there is] No right or wrong answer, which is the beauty, I think, of Explorify, that it's not right or wrong and that gives those children who perhaps aren't as confident and are not the more able, they can just think 'It doesn't matter, I can just have a go at saying something.

Science leader

Broader skills

There were a small number of examples of teachers using Explorify to develop literacy or numeracy skills. One teacher uses pictures from the Explorify website as the basis for creative writing tasks which supports pupils' writing and another describes how Explorify supports pupils' reading comprehension. Other teachers had used Explorify activities to explain mathematical topics such as shapes and sorting. The skills pupils

learn through Explorify such as problem solving and reasoning are needed for numeracy. A few teachers commented on how Explorify helps pupils develop metacognitive skills because they learn something in one lesson and then apply similar skills and knowledge in another, enabling them to link their learning.

Differential impacts on pupils

Most teachers interviewed believe that Explorify is equally useful for all pupils, but some teachers identified particular impacts on specific groups of children. A few teachers, for example, have observed the greatest impact amongst children with SEND. One teacher explained how a pupil with severe SEND is more able to engage in lessons because it places less requirement on them to write (with a greater focus on discussion) allowing them to actively contribute. An open question in the teacher survey was also used by some teachers to highlight how using Explorify has raised the confidence of pupils with SEND.

So, there's not a requirement to sit down and write. Lots of children find that difficult. So that's quite nice that it's very visual and it's an oral activity, so that can support children who find the written work more difficult. And I'm thinking of one child in particular who has quite severe SEN and at the moment she's unable to access lots of areas of the curriculum, but she is able to join in class discussions.

Science leader

Pupils with English as a second or additional language were also reported to benefit. Explorify is visual and practical and therefore allows pupils to understand lessons with a visual aid and provides them with the opportunity to practice their English-speaking skills. As one teacher response from the survey describes:

It makes learning science more accessible especially for SEN and EAL children.

Classroom teacher (responding to the survey)

Several teachers described the importance of Explorify activities in encouraging children to 'have a go'. Teachers described that this was particularly important for children with lower literacy levels, who tend to struggle with writing and recording their findings. It allowed them to benefit from lessons which use Explorify as these pupils are able to contribute to whole class discussions. These pupils can also have fun guessing and discussing their ideas without fear of being wrong. One science leader described Explorify as a 'natural differentiator' because everyone is given the same task, can approach it in their own way, and all opinions are valid and worth expressing.

The lower-ability pupils, because with the 'Odd One Out', there's no wrong answer. So, they're much more confident to speak and to get engaged with discussion, which is absolutely fantastic.

Science leader

8. Conclusions

This section summarises the key conclusions.

COVID-19 has had a significant impact on both schools and individual teachers. Schools have had to adapt to the restrictions caused by the pandemic and deal with a whole host of logistical challenges. Individual teachers have then had to deal with the changes to their role and their own personal situations. Balancing the delivery of both classroom and remote learning has been challenging alongside the wider disruption caused by the pandemic. This all negatively affected the workload of most teachers and senior leaders. Teachers also had to juggle their own personal circumstances with many teaching their class and then their own children.

Schools and individual teachers have had to adapt their approach to teaching at a significant pace with the move to remote learning. Schools were not equipped for this before the pandemic but largely, over time, been able to provide staff with the equipment and skills needed to teach remotely. Teachers had to adapt their teaching approach to successfully teach pupils at home and when back in the classroom. **Teachers thought that their school had done the best they could at short notice during the first lockdown but were more prepared by the time of the second lockdown** with new systems in place and frequent use of videoconferencing to deliver live lessons or regular 'check-ins' with pupils.

Not all pupils had access to remote learning especially in schools with high rates of FSM. Whilst equipment or access to remote learning was a challenge for some pupils, **there was also a heavy reliance on parental engagement.** Parents were often responsible for logging pupils into lessons which required time and skills. Remote learning for science was even more difficult for parents as teachers ideally wanted pupils to undertake investigations at home to support their learning. This required even more time and support from parents alongside the cost of resources. Teachers were mindful of this and tried to keep costs down and ensure investigations were quick and simple but this was not always possible.

Remote learning had a range of challenges and teachers found it difficult to adapt their content and pedagogy for remote learning. Teachers tried to make tasks as exciting as possible to engage both pupils and parents including links to additional resources. Spotting when pupils were struggling, differentiating lessons and assessment were all difficult during lockdowns and had implications when pupils returned to the classroom. Deciding how much work to set remotely was also a challenge – too much could put parents and pupils off but too little would hinder learning.

Teachers were able to identify a small number of opportunities which COVID-19 brought about including improved parental relationships, changes to school practice which will be maintained and new teaching styles.

There was agreement amongst most that **science had continued to be prioritised** in schools with the expectation it was taught regularly with a wide range of topics; although there were some schools where this was not the case. But even when it was still a priority **other subjects such as English and maths were prioritised more.** Where science has not been prioritised this has largely been due to senior leaders prioritising maths and English especially as schools returned to classroom teaching to redress losses in these areas during lockdowns. **During remote learning English and maths was often designated as mandatory whereas science was not allowing a degree of choice for parents and pupils.**

Although generally science was still viewed as important **most agree that science teaching was affected.** For many **less science was taught along with fewer investigations.** It was easier to teach science regularly in the classroom with it being less frequent from home. In addition to the challenges already outlined with remote learning **adapting pedagogy for science remote learning was seen as even more**

difficult. An important element of science is practical learning and investigations alongside discussion and enquiry which is difficult to replicate on-line. Schools do not expect to be able to cover the full primary school curriculum this year or the science curriculum. Teachers had been able to cover most science topics, with the exception of working in a scientific way. Teachers tried to adapt their science lessons to make them fun and exciting to encourage parents and pupils to log in – for some this had been successful although for others it had not.

Many thought that their approach to teaching science had worked reasonably well under very difficult circumstances. Despite the considerable challenges posed by remote learning teachers strove to deliver high quality teaching across most of the curriculum, albeit with modifications.

The **pandemic also had a negative impact on some teacher's confidence** when teaching science and other subjects. They continued to believe science was important to teach but were **less happy with the amount of science they taught.**

Schools plans for the future varied. **Some planned to prioritise other subjects over science,** whereas a smaller proportion planned to increase the time spent teaching science in the future with a focus on increasing the number of investigations. Teachers planned to map pupil's lost learning to enable them to plan the future curriculum to ensure lost learning was covered. A particular challenge here is that **because not all pupils engaged in remote learning gaps in knowledge for some pupils are greater than for others.**

With changes in teaching practice teachers reported that there were gaps in pupils' science knowledge and investigation skills. It also affected pupils' confidence in their skills and contribution to class discussions. Whilst COVID-19 has affected all pupils **teachers describe a differential impact in science for lower attaining pupils, SEND pupils, those with FSM and those who have English as an Additional Language.** More able pupils have also been affected although a small proportion of teachers report a positive impact.

Teachers thought that the impact of pupils not accessing remote learning and having gaps in knowledge was likely to come in later years when they lack the base knowledge of a topic they need for further learning.

Science leaders had less release time for science during the pandemic but many still ensured teachers were supported to teach science. During the first lockdown some teachers had a reduced workload therefore CPD science uptake was higher, this was more variable following the first lockdown but many schools continued to provide access.

Teachers were able to draw upon the support of Explorify throughout the pandemic using it remotely and in the classroom. When remote learning, videos were shared for pupils to watch at home during live lessons. **On average those who used Explorify regularly reported fewer challenges when teaching science during the pandemic.** It is a resource which some teachers think they should have used more throughout the pandemic to support them further.

Most teachers use Explorify as a starter for a science lesson, but some also use it to assess learning or in other lessons. A few teachers thought they approached lessons more creatively when working remotely with Explorify. **Teachers describe how Explorify helps them to deliver a more enjoyable lesson, spending less time on traditional worksheets which is often less appealing to pupils and parents.**

As well as supporting teachers throughout the pandemic its use has an impact on both teachers and pupils. The impact is greater when it is used by teachers regularly. Teachers encourage their pupils to engage in discussions and it supports teachers to increase their confidence and enjoy teaching. **Both teachers and pupils realise they don't need to know the answer to every question** which encourages pupil-led lessons and class discussion.

Science leaders have seen an impact not only on themselves but on teachers in their school and they describe that more science teaching is taught as a result of it being used. **Explorify reduces planning time for teachers, gives teachers new ideas and ensures teachers have the required information to teach each topic.**

Explorify has an impact on pupils through creating exciting and engaging lessons which all pupils can engage with. It sparks discussion and increases pupil confidence. **Pupils also increase their science knowledge and skills alongside improving their oracy** which is transferrable across all of their learning. Due to the visual nature it is seen as accessible for all and has an even greater impact for some groups of pupils such as lower attaining pupils, SEND pupils and those with English as an Additional Language as it is not dependent on written English skills. **Explorify can support teachers and pupils to develop skills which were lacking during lockdown such as improving pupil confidence in investigation and enquiry skills.**

**Wellcome exists to improve health
by helping great ideas to thrive.**

**We support researchers, we take on big
health challenges, we campaign for better
science, and we help everyone get
involved with science and health research.**

**We are a politically and financially
independent foundation.**

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

The Wellcome Trust is a charity registered in England and Wales, no. 210183.
Its sole trustee is The Wellcome Trust Limited, a company registered in England and Wales, no. 2711000
(whose registered office is at 215 Euston Road, London NW1 2BE, UK).