Impact of COVID-19 on schools and STEM outreach in Wales

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Abstract

The COVID-19 pandemic that began in early 2020 was accepted to be a major threat to education around the world, including the UK. Areas of socioeconomic deprivation were at particular risk of increased education inequalities, leading to further marginalisation and widening of the attainment gap.

As a STEM outreach initiative operating in eight schools in South Wales, S4 is well placed to explore and document the complex consequences of the pandemic on five key issues:

i. implementation of critical workers policy;
ii. effect of cancelling formal exams;
iii. consistency of messaging from schools to pupils about remote learning;
iv. support for pupils and families with regards to pupil mental health and safety;
v. effects on disadvantaged groups, specifically those eligible for free school meals, and the long-term impacts on vulnerable groups.

Although the critical workers policy was put in place swiftly, schools reported huge problems with cancelling formal exams and assessments, a lack of consistency of messaging with minimal time to react and great staff stress as institutions struggled to support pupil mental health and safety as well as provide them with school meals. COVID-19 has had a dramatic effect on education within Wales, but it has also highlighted unacceptable inequalities within the pupil population that deserve urgent attention.

Introduction

"It has set our pupils back in terms of their development and learning significantly and still continues to do so."
STEM Teacher, Key Stage 3.

SARS-CoV-2 (COVID-19) has thrown the world into turmoil, both from a business and a social perspective (van Lancker & Parolin, 2020; Weems et al., 2020). The potential impact on education has been modelled to be severe, for both school pupils and young people in higher education (Schleicher, 2020). School closures are even predicted to affect child development and health (Hoffman & Miller, 2020), and have additional knock-on effects on workforce productivity and economics (Sadique et al., 2008). At the height of the first COVID-19 'wave' up to 1.5 billion pupils across the globe were not in education (Alradhawi et al., 2020; Saladino et al., 2020; Watson, 2020), with 84.8% of learners across 172 countries affected because of school closures (UNESCO, 2020b).

Few have questioned closing schools to mitigate and control the pandemic, despite the radical changes that these measures have meant to our social networks. However, these changes have had *severe* consequences on mental health both children and adults, affecting motivation and engagement and increasing anxiety (Kumar &

Nayar, 2020; Talevi et al., 2020; Watson, 2020). Young people have been greatly impacted by the disruption to their education and changes in exam processes, amongst a plethora of changes in their lives more generally during the pandemic (Hoffman & Miller, 2020; van Lancker & Parolin, 2020).

Social impacts of disruptions to education in Wales in the 2020/21 school year

Rapid and widespread school closure took place in Wales during Spring 2020, with the following key dates:

- 20th March 2020: schools closed for a 14-week lockdown (Senedd Research, 2020), during which time teachers converted to 'emergency remote learning' (Marchant et al., 2020)
- 29th June 2020: phased approach began, with limited capacity (Senedd Research, 2020).
- 18th March: exam cancellations in Wales were announced (Welsh Government, 2020c), with GCSE and A-level candidates receiving grades based on evidence which include teacher assessed grades (Welsh Government, 2020d).

  September 2020: schools entered a phase whereby teachers were managing their in-school classes, teaching remotely to isolating year groups at home and also managing their own transitions in and out of self-isolation as symptomatic and positive tested pupils sprang up around them (Welsh Government, 2020a).
- 23rd October: two-week 'firebreak' (Welsh Government, 2020b) and high levels of year groups and 'bubbles' being sent home to self-isolate after coming into contact with a positive case of COVID-19 in school (Swansea Council, 2020).

Overall, pupil attendance between September and December was quite variable with highs of 93% and lows of 70% (OECD, 2020; UNESCO, 2020a; van Lancker & Parolin, 2020).

As well as impacting on learning, school closures meant that many families could not easily access various social welfare services. This left young people from low-income families at risk of differential treatment, with children lacking the home resources, nutrition and support they may have had at school (Sharp et al., 2020). Indeed, it has been suggested that the effects are visible now, and the learning gap between pupils from lower and higher socioeconomic demographics has reportedly widened over this period (Marchant et al., 2020), reinforcing inequalities in young people's education (Armitage & Nellums, 2020; van Lancker & Parolin, 2020). A more holistic approach, however, questions the magnitude of how these effects will play out over time (Marchant et al., 2020). Concerns over the impact of COVID-19 on education are particularly acute for exam year groups, who historically have been told how *important* exams are for career development.

We consider these issues in this report, including how schools in Wales reacted to COVID-19 in socioeconomically deprived areas and the challenges and consequences for school staff and pupils. Our outreach programme was a useful communication platform for connecting with schools in the Swansea region.

The outreach programme - Swansea University Science for Schools Scheme (S4)

A core objective of S4 is to widen access to science education in low participation demographics through outreach (workshops, shows, summer schools, taster days, mentoring programmes), with the long-term outcome of increasing socioeconomic diversity in STEM education and careers in Wales. Our STEM outreach programmes are free of charge, designed and taught by university research scientists in campus-located, accessible, and inclusive outreach spaces, by a gender-diverse staff.

How did S4 adapt to the changes caused by COVID-19 mitigation measures?

In response to COVID-19, S4 altered its delivery model in order to continue providing STEM learning to all participants. A dual pronged approach was adopted, using both online and printed resources. Online content such as live lessons, science classes and experiments was released. Paper workbooks and packs were sent out that both complemented the online resources but could also be used as standalone resources. These materials were sent out to partner schools to share via their online class sessions.

Our dual approach was critical as access to digital learning was, and still is, highly polarised, with young people consequently not having equitable learning opportunities. Printed resources gave those disadvantaged pupils access to the same materials and specifically addressed the growing disparity between these groups. Notably though, in an attempt to minimise cross-contamination, not all schools allowed transfer of physical copies of work, making any digital content all the more vital.

Methods

S4 is partnered with eight schools in and around Swansea, in South Wales, and have spoken in details with the teachers about how they have experienced the COVID-19 outbreak. In this work, we describe how three of our partner schools reacted to COVID-19 during the first lockdown (starting 23rd March 2020). We carried out an anonymous survey and also collected direct feedback focusing on key issues.

Survey

The survey focused on overall perceived impact of COVID-19 on teachers and pupils through a variety of open ended and closed questions and was released to our eight partner schools. Participation was voluntary. Questions focused on teachers' experiences during the COVID-19 pandemic and their impressions of the impact on pupil learning and engagement with their schools (see appendix 1 for full survey). 24 teachers responded, from three schools (anonymised as School A, B, and C – see Table 1).

Table 1 Summary of survey respondents

School Name	Number of pupils	Percentage Free School Meals	POLAR4 Quintile[1]	Support Category
School A	988	29.4	2	Green
School B	1026	24.6	3	Amber
School C	1220	21.9	2	Green

Feedback from teachers on critical issues

We focussed on the following critical issues:

(1) Implementation of critical workers policy;
(2) Effect of cancelling formal exams;
(3) Consistency of messaging from schools to pupils about remote learning;
(4) Support for pupils and families with regards to pupil mental health and safety;

[1] See here for background on the POLAR metric: https://www.officeforstudents.org.uk/data-and-analysis/young-participation-by-area/about-polar-and-adult-he/

(5) Effects on disadvantaged groups, specifically those eligible for free school meals, and the long-term impacts on vulnerable groups.

Results

Survey results

Support varied between schools, with most teachers pointing to both face-to-face (18 of 24 teachers) and online materials being available. Non-interactive online material was offered in almost all cases (23 of 24 teachers), followed by interactive online material (19 of 24 teachers). Nine teachers stated they were offering individual support online, and one teacher said no support was available.

There was a stark variety in the preparedness that teachers felt towards online learning, teaching and assessment (Fig. 1a) and none of the teachers who responded felt that their pupils were entirely prepared to engage with online learning (Fig. 1b). In fact, their answers suggest that they thought their pupils were mostly unprepared (Fig. 1b). One teacher said:

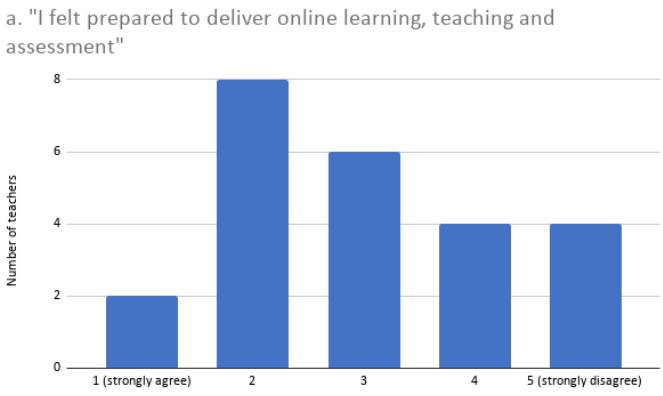
> *Some pupils have not engaged with online lessons and therefore this will have a negative impact on their learning and on the assessments they will eventually undertake and could possibly have an effect on their grades at the end of the academic year.*

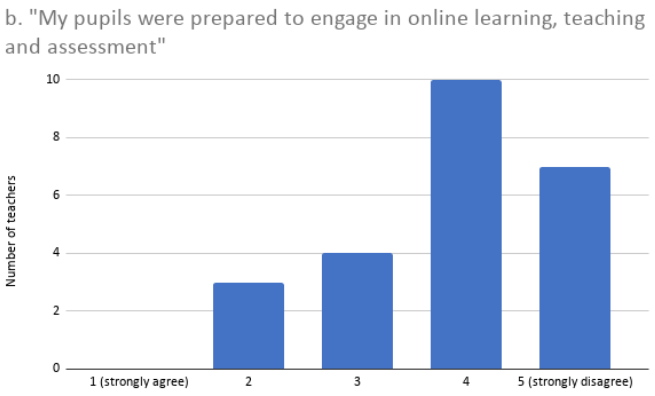
Not all teachers felt confident to deliver their material online (Fig. 1c), but most felt that their school was supportive in facilitating the move to online learning (Fig. 1d).

Although working knowledge of the technologies available to support online teaching, learning and assessment was very variable (Fig. 1e), teachers mostly felt these were easily accessible (Fig. 1f), and 67% of teachers were willing to experiment with different methods of online learning, teaching and assessment (Fig. 1g). Although schools were supportive of the teachers, there appeared to be a lack of appropriate devices:

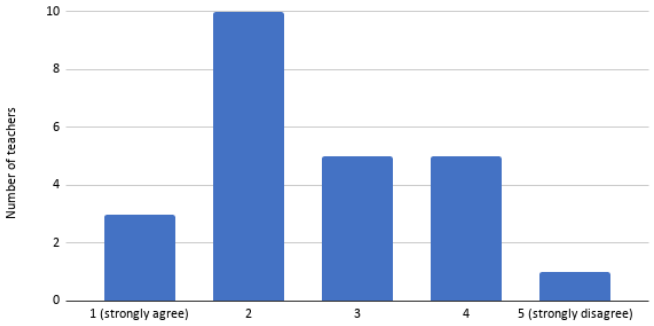
> *[We] had to use personal devices during lock down. Still, months on only a very small percentage of teaching staff have been given government funded work devices - many still having to (against regulations) use personal devices when working from home.*

Figures 1a to g. Answers of respondents to specific statements rated on a Likert scale of 1 to 5, where 1 means "strongly agree" and 5 "strongly disagree".

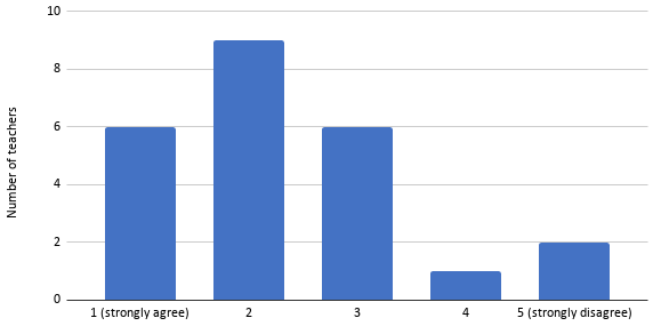




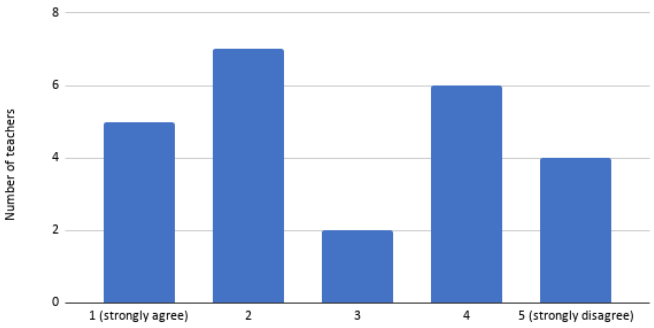
c. "I felt confident in my ability to facilitate online learning, teaching and assessment"



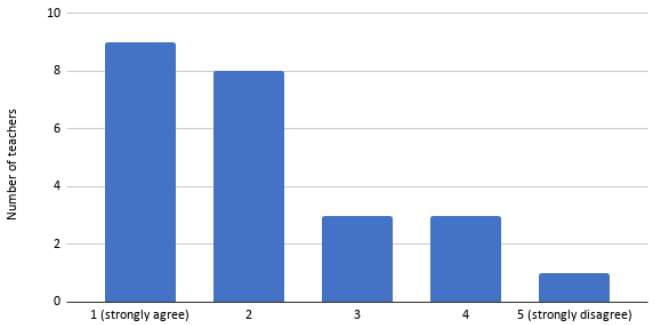
d. "My school was supportive in facilitating the move to online learning, teaching and assessment"

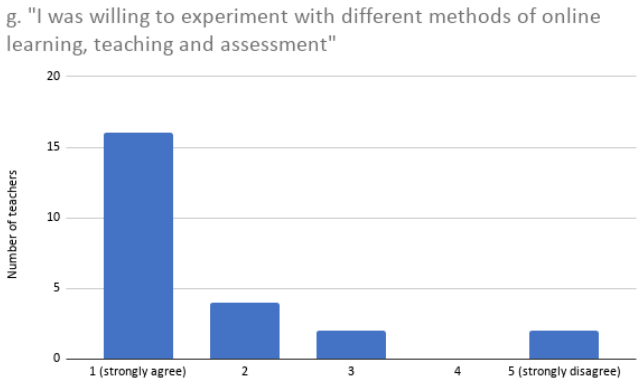


e. "I had good working knowledge of the technologies available to support online learning, teaching and assessment"



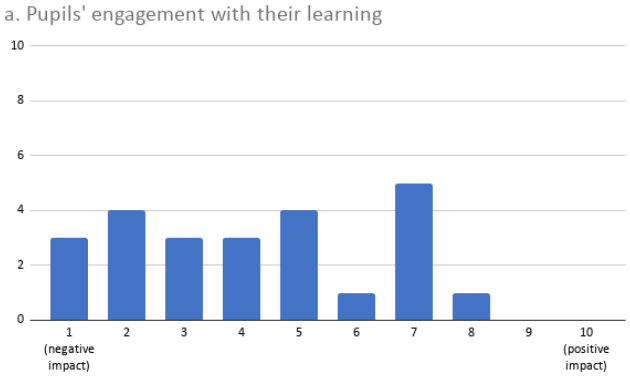
f. "I could easily access appropriate technologies to support online learning, teaching and assessment"

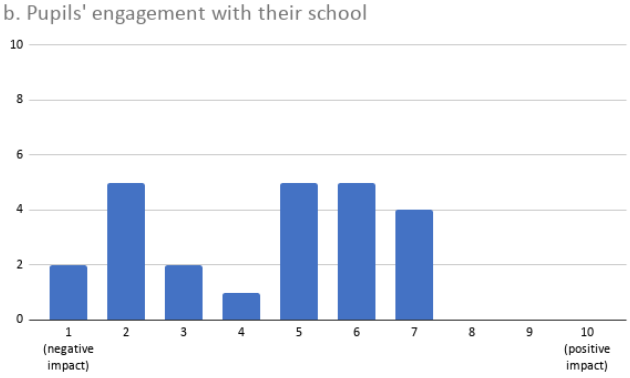


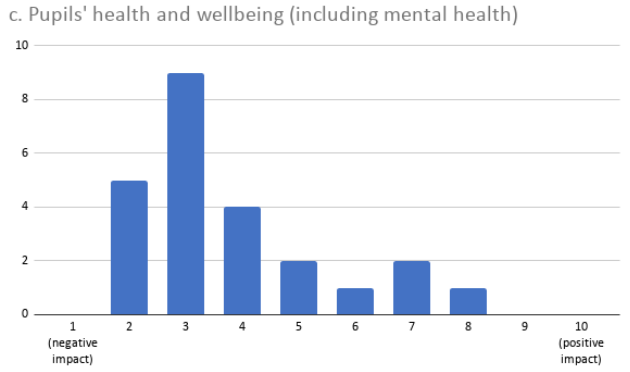


Although responses varied, none of the respondents felt that the move to online learning, teaching and assessment had a completely positive, nor negative impact on pupil engagement with learning (Fig. 2a) and engagement with their school (Fig. 2b). Results from this question are summarised in Figure 3.

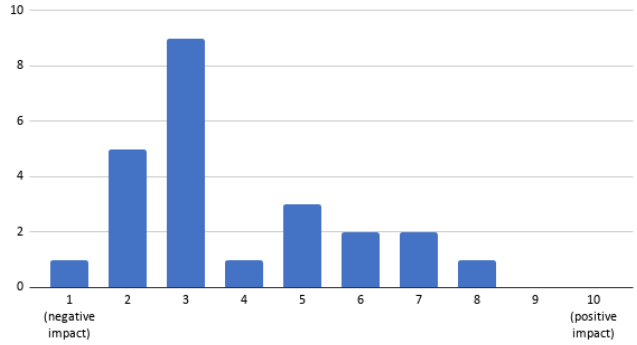
Figures 2a to g. Respondents answering, "How do you think the move to online learning, teaching and assessment has impacted the following areas?" on a Likert scale of 0 to 10, where 0 means "negative impact" and 10 "positive impact".



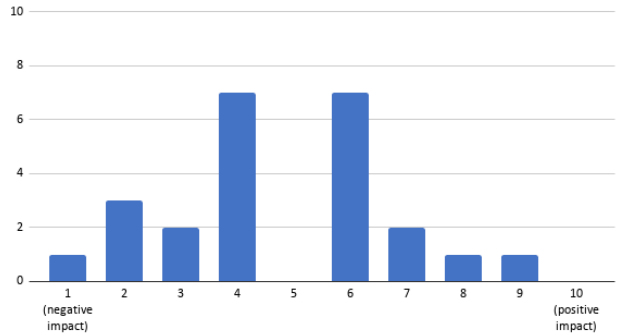




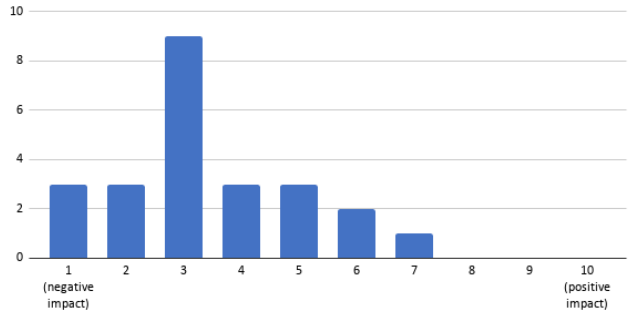
d. Teacher health and wellbeing (including mental health)



e. Formative assessment (i.e. to support learning and progression)



f. Summative assessment (i.e. to formally assess learning outcomes)



g. The pupils' onward progression in education

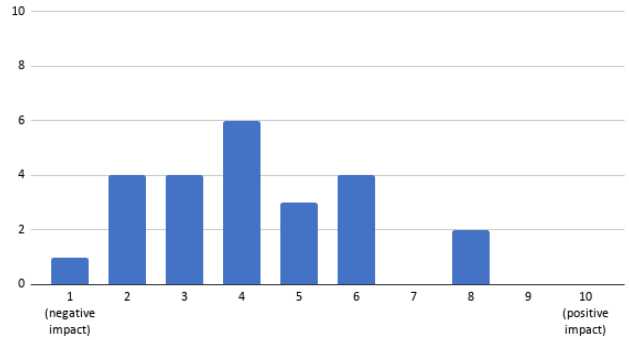
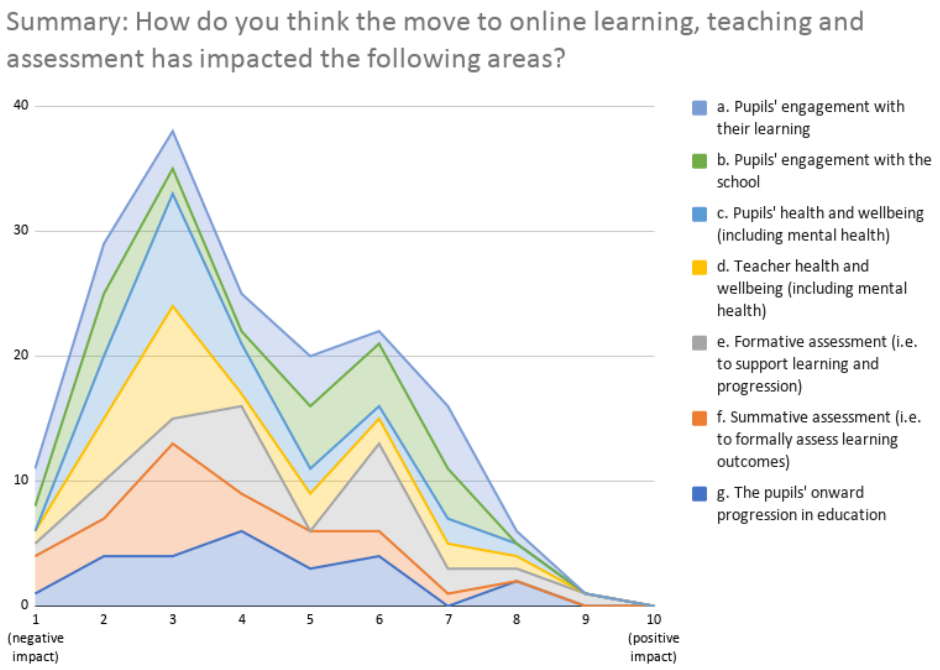


Figure 3: Summary: How do you think the move to online learning, teaching and assessment has impacted the following areas?



Although in their responses teachers tended to focus on negative effects of the pandemic on engagement, they also noted complex effects:

> *Students feel that as they are not in school, they don't have to do the work and have not taken on board the risk that they will fail the courses they are taking due to a lack of evidence for examination boards.*
>
> *The same with pupils it is a real mix bag of response - some will engage online others have zero intention of doing so in the same way that if they were in school they wouldn't be interested either. It has also been a strain on some pupils with a lack of consistency of being in and then out and then being in again.*
>
> *Online learning emphasises the lack of independent learning, pupils don't have the patience or skill to simply read the question and access the success criteria to support them as they want a quick finish to the task. At home it is very easy to ignore your feedback and not improve on work.*
>
> *Those who are always keen in class are also keen in school, and will always try their best regardless of situation.*

Teacher and pupils' health and wellbeing appeared to be slightly below normal, with appreciable variations (Fig. 2c, 2d). The increase in stress was highlighted by teachers:

> *Changed boundaries in terms of relationships and expectations - greater expectation from pupils that I am available immediately or outside of school day as they think I'm online and available. Both pupils and I find it harder to switch off mentally and have a clear divide between home and school.*
>
> *Increased stress levels as having to choose between looking after my own children and teaching. When my own children are self-isolating I have to teach them and provide full teaching day at the same time.*

The impact on both formative and summative assessment seems varied, though none of the respondents felt there was a positive impact on either of these (Fig. 2e, 2f). One teacher responded:

> *Paperwork packs have been provided where learners have no access to technology, but this leaves a massive gap in terms of formative and summative assessment of these learners.*

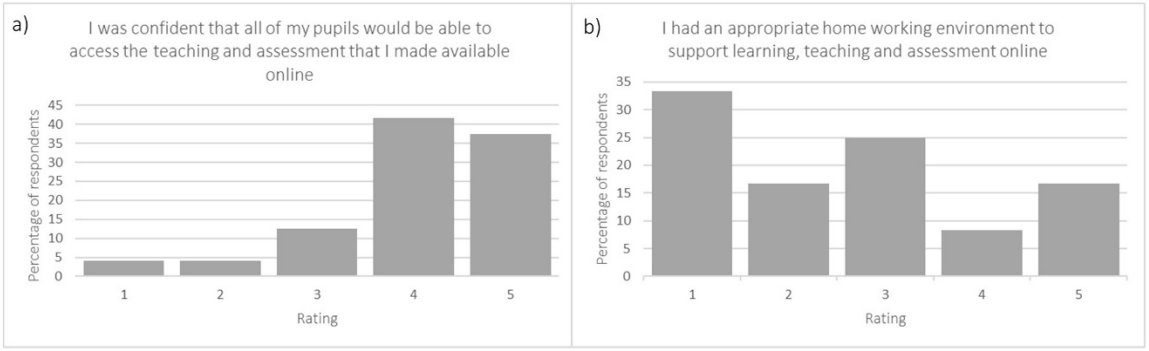
Overall, there appears to have been a negative impact on the overall progression in pupils' education (Fig. 2g), with one teacher referring to "huge gaps in learning and depth of understanding".

Most of the teachers we surveyed were not confident that all their pupils would be able to access the teaching and assessment made available online (Fig. 4a):

> *… minimal uptake because of so many technical difficulties on pupil side - inadequate devices unable to open or cope with lessons and lesson resources given.*

Many also felt that they themselves did not have an appropriate home working environment to support their teaching (Fig. 4b).

Figure 4a to b. Response of respondents to specific statements rated on a scale of 1 to 5, where 1 means "strongly agree" and 5 "strongly disagree".

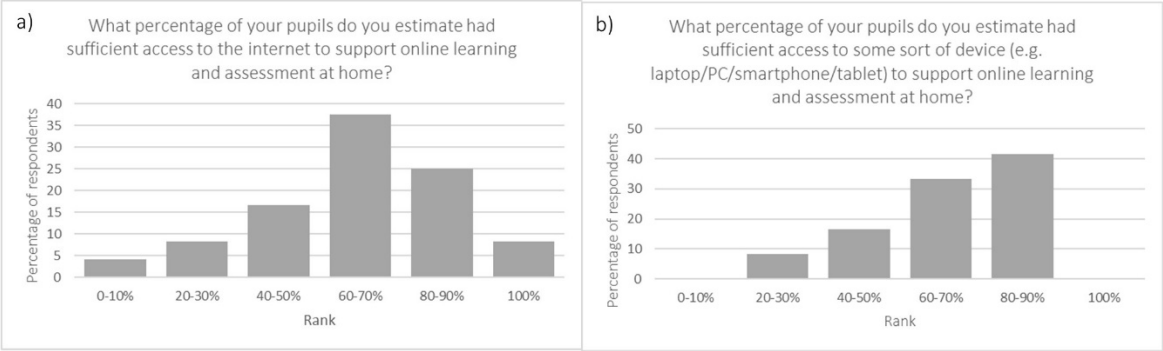


The teachers estimated that between 60 and 70% of their pupils had sufficient access to the internet (Fig. 5a), and 80-90% of pupils had access to some sort of device (Fig. 5b) to support online learning and assessment at home. However, teachers felt that access was not the only obstacle to engagement:

> *Unfortunately, just because a student has access to a device doesn't mean that they are willing to engage in learning.*

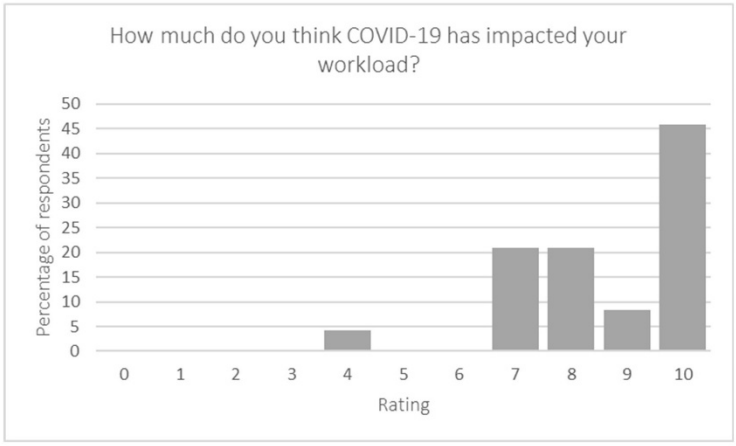
> *I see pupils in low income areas with expensive smart phones and x boxes etc., so access isn't an issue.*

Figure 5. Survey respondents' percentage estimates of pupil access to materials and devices.



Almost all teachers stated that COVID-19 increased their workload substantially (Fig.5).

Figure 6. Survey respondents rating how much COVID-19 has impacted their workload on a scale of 0 to 10, where 0 means "decrease to workload" and 10 "increase to workload".



Feedback on critical issues

We recorded substantial feedback from our three selected schools (with base data shown in Table 1). We outline key findings below.

1. Implementation of the critical workers policy

School A was receiving small numbers of students. This school was well staffed and supported to remain open. It was also considering moving to a hub school model within the few weeks following the initiation of lockdown.

School C organised rotas and communicated with feeder schools well. Initial difficulties were in gauging the level of need for childcare provision. The school initially provided childcare to key workers, but the level of cover was low between the primary staff and school staff (on an 8-week rota). The school communicated well with staff and had been particularly considerate to staff with young children, staff with health issues or that were carers. School C reported that this was not the case for teachers in other schools who were made to go to school weekly, causing stress and pressure with regard to childcare, especially where there was a high risk for exposure (with no protection) to COVID-19, and the home environment involved vulnerable parents.

2. *Effect of cancelling formal exams*

Cancellation of formal exams caused huge stress and pressure, and its impact on pupils is considered immeasurable. School C had a wave of messages and emails from students panicking about grades and worrying about how the situation was going to impact their future education and acceptance into university.

Teachers from School C described the challenge of predicting grades for pupils taking GCSE double science. These grades were averaged from papers sat in all three sciences and added to coursework marks, so it was difficult to award a grades because a pupil may excel in one science but not the other two. The school relied on year 10 grades and the Uniform Mark Scheme (UMS) to predict their year 11 outcomes, and teachers then went through each student's performance in each subject and tried to feedback/ justify changes regarding tests and mock exams. Even so, it was difficult to agree on grades for some pupils.

> ***Example**: A pupil who had passed year 10 Biology, but failed Chemistry and Physics was determined to do well in 2020 in order to pursue Biology in further education. The pupil therefore asked to re-sit year 10 Chemistry and Physics and was already completing past papers and attending revision sessions in March. From a departmental perspective, the school had to decide on grades, justified from year 10 UMS and from the pupil's year's work, considering whether this person could raise him/herself 40 marks to another grade boundary, for a pass overall in Double Science. The school decided that it was 'not probable'.*

There were many pupils in a similar situation throughout the UK, and it was difficult to know how much their pupil's subsequently missed work would have changed their final marks. Many pupils admitted that their priorities were elsewhere during mock exams and unit tests, but they maintain that they would have worked hard for their exams. The school had several pupils who felt that they had worked hard for five years to have their final possible achievements taken away from them. This pandemic has highlighted substantial problems with basing a curriculum around final exams and specifically teaching to pass exams. The school not only missed the final term for all year groups but also the impact for the next year. When the school reopened, pupils who were in year 10 at the time were behind by at least 2 units, these being taught in the latter part of year 10. The same principle was true for year 12 pupils. The coursework for years 11 and 13 is notoriously difficult to complete in the time given anyway, as elements such as coursework and the Welsh Baccalaureate 'squeeze' the time available for GCSE and A Level lessons.

3. *Consistency of messaging from schools to pupils about remote learning*

In School A, all students were supported through teams and set weekly assignments. Engagement was slow but gathered momentum. Teachers from School B reported that working in a school in a deprived area has, as the biggest challenge, getting pupils to engage with work, a situation made worse in those pupils that received little parental support. School B also reported that there were several pupils without appropriate devices or internet access so paperwork was sent home. However, with limited contact, it was hard to know the extent to which it was being completed.

Teachers from School B said their focus was mainly on wellbeing and not academic progress, emphasising that more funding needs to go into schools in deprived areas to support 'home learning', providing pupils with ICT and resources for them to access work. Overall, the pandemic has shown internet access to be a *utility*, not a luxury.

4. *Effects on disadvantaged groups, specifically those eligible for free school meals, and the long-term impacts on vulnerable groups*

In School A, free school meal provision was a concern as there are over 900 eligible students within the cluster. The school adopted a 'weekly shop' model where a bag of food to make sandwiches was delivered/collected once a week. This reached many more students than just the daily sandwiches.

At School C, in an enormous undertaking, free school meals (including weekly food packs) were delivered to many pupils at home. This was stressful for the few teachers (and volunteers) coordinating distribution for pupils spread out over large distances over greater Swansea (including those at primary school). There was also a team organised to help support and communicate with the vulnerable pupils and with social services to keep these pupils safe and healthy.

Teachers from School C underlined that the effect of the pandemic on disadvantaged pupils should not be underestimated. For some pupils, school is their safe place, somewhere they can go for encouragement, nourishment and care. This was removed and represented an additional factor beyond their control. One pupil reported before leaving that they were dreading being home for months on end as it was "a toxic place". This, unfortunately, is a reality for many pupils in Wales. Some have no access to electronic devices and and/or no internet access so cannot benefit by borrowing a laptop from school.

Many vulnerable pupils undoubtedly suffered. The school has pupils that care for sick and vulnerable family members, taking-on responsibilities despite their young age. They are worried about the virus, worried about loved ones and possibly even tried to cope with the impact of family members that have contracted COVID-19. Falling behind with school work will no doubt have added to the anxiety. The school organised teams to try and cover all the important aspects of home learning and care for their pupils. The senior leadership team worked tirelessly for the welfare of its young people. Communication with parents and pupils took place across lots of different platforms, websites, Twitter, Facebook, Hwb, Teams and letters sent home. It was particularly difficult in the first few weeks as communication from local education authorities (LEA) and government agencies was conflicting[2].

Schools appeared to adopt very different approaches to home schooling. Some schools set daily lessons following a normal timetable, while others use non-curriculum-based challenges and tasks, concentrating on pupil well-being. From an individual school perspective, it was difficult to know what was for the best with widely differing approaches and advice being given out. Whatever the approach, set work had to be revisited when the school reopened; some pupils without internet access or that were not have been able to work for other reasons were at a substantial disadvantage.

Discussion

Our survey and feedback gathering with teachers from our partner schools have highlighted several key issues. Some were common to all schools, but we also found surprising inter-school variability in the challenges posed by implementing new rules and practices during COVID-19. This variability warrants deeper assessment across

[2] For example, leading up to school closures, the school was told to prepare work for home schooling by Friday 20th March. This was done whilst maintaining teaching. Then, on the 20th March, the LEA said to concentrate on school repurposing and coping with critical childcare. Two weeks were then given to prepare home schooling resources. The school was told that pupils would have Easter term brought forward two weeks and that gave time to organise resources. Then, a week into Easter holidays, the school was told that the LEA had told schools to follow the normal school holidays and to stop setting work.

more schools in Wales to be able to fully understand the problems caused by the pandemic and its mitigation measures. This report outlines a range of ways in which schools experienced and adapted to the pandemic.

Schools implemented a variety of teaching methods to facilitate online learning, the most common method being non-interactive online material. The sudden shift from normal teaching methods strained both pupils and teachers, and it was noted by teachers that online learning and the lack of a structured school day resulted in pupils frequently contacting teachers outside of working hours.

Teachers experienced the pandemic in different ways, and there appears to be variability in the engagement of pupils (Fig. 1b, Fig. 2a, Fig. 2b). Teachers pointed to a lack of independent learning skills, and the strain on the pupils caused by frequently being sent back home to self-isolate.

Teachers talk about two 'groups' of pupils:

1. Pupils who did well beforehand and continued learning online;
2. Pupils who needed extra support in school and struggled more with online teaching ("some … have zero intention of doing so in the same way that if they were in school they wouldn't be interested either")

It seems that pupils' approaches (behavioural and educational) to school were accentuated by the situation – one teacher said: "less interaction from students who were also hard in lessons […] some students thrived online". Another teacher referred to "a tale of two sides", with some teachers embracing the chance for radical change and others struggling to adapt.

Pupils having sufficient access to the materials was a common problem across the schools (Fig. 3a), often due to a lack of internet access (Fig. 5a) or suitable devices (Fig. 5b). Some teachers did feel however that pupils were not engaged even when they did have the necessary devices and reported that sometimes "access isn't an issue". This highlights problems behind the lack of pupil engagement that goes beyond a lack of access to the material, although this is still a primary cause for concern.

Overall COVID-19 resulted in an increase to teacher workload (Fig. 6). Indeed, although they received support from their respective schools, but many still lacked government funded work devices and had to resort to using their personal devices in order to continue working.

Regarding their provision for critical workers, S4 partner schools did not appear to have major concerns once they had overcome the initial difficulties, although it was reported that this may not have been the case for all schools.

The cancellation of formal exams was, across schools, judged to be extremely stressful for teachers and pupils alike. Teachers had to identify and justify appropriate grades for all their exam level pupils at extremely short notice. For their part, pupils were stressed because they believed that their results from previous assessments and mock exams might not truly reflect their potential. Many pupils maintained that they would have worked harder for their exams than they had done in their mock exams, and felt they were deprived of that opportunity. Although this response is expected, the intensity of 'last-minute revision' at critical times is a recognised phenomenon (McIntyre & Munson, 2008) . This attitude from some pupils starkly contrasts the finding that cancellations of formal exams can trigger disengagement in pupils (UNESCO, 2020a), providing a mindset that is not conductive to learning or performance.

The three schools reported different priorities regarding remote learning, which may have been driven by the socioeconomic status of their pupils. Some only focussed on keeping in touch and the general wellbeing of pupils, whereas others managed to set work, perhaps because they felt that their pupil wellbeing was less of an issue. Nonetheless, all schools experienced many issues with remote learning, and more support is clearly

needed across the board. Digital poverty was the single biggest issue because this precluded access by certain pupils to school work, resulting in substantially diminished learning opportunities for under-privileged young people, reinforcing the already existing inequalities between peers. Indeed, such inequalities are of considerable concern because they will be disproportionately manifest in pupils in less affluent areas (Armitage & Nellums, 2020; van Lancker & Parolin, 2020).

Free school meal provisions were a concern across all schools, with any meaningful substitution requiring enormous amounts of work by the schools to ensure that adequate provisions were supplied to those in need. The magnitude of this task was another substantial source of stress for the staff and volunteers delivering the food supplies, not least because they clearly appreciated the consequences of not managing to deal with the issue. Concerningly, it has been found that in other schools in the UK, it may not have always been possible to supply pupils adequately with meals (Parnham et al., 2020).

Overall, the teacher feedback detailed many ways in which pupils could suffer throughout the school closures. These ranged from the stark reality that pupils might be allocated grades that did not represent their potential through to the wellbeing of pupils, the vulnerable ones in particular. The school staff's empathy for the pupils was palpable and it resulted in staff and volunteers working tirelessly to mitigate as far as possible the effects of the pandemic on their young people. Their extra work included communication with parents and pupils across many different platforms, including social media, but all this clearly culminated in work-related stress and the additional stress invoked by interacting with a huge cohort suffering particularly as a result of their socioeconomic status. As an outreach programme, S4 strives to catalyse STEM interest, a task made even more difficult when participants are not accessible digitally. S4 used a mixed-methods approach to continue delivering university-led STEM outreach to schools throughout lockdown which included both online and printed materials, in order to avoid reinforcing existing inequalities in young learners.

This continuation of the programme was especially important in the 2020 COVID-19 period because some pupils are likely to have lost access to some school-related learning resources. This becomes particularly relevant within the backdrop of S4's policy of multi year interventions to maximise impact. Worryingly, it is in the socioeconomically deprived schools with which S4 works, and which are the ones that can most benefit from S4's STEM outreach, where the COVID-19 situation has been the most destructive.

Conclusion

The survey exposed a range of concerns held by teachers, the most prominent being the negative effects of cancelling formal exams, the structure of the exam system, and the fear that pupils would not be in a "safe place" during the lockdown. Our partner schools give us the perspective of the most vulnerable young people when it comes to the impact of school closures and, as such, they are a useful source of knowledge on:

- how to better prepare for potential school closures in winter 2021/2022;
- and how to identify those learners who are most vulnerable when schools close and how to keep them safe and ensure a continuation of their learning.

We give four policy recommendations below.

Recommendation 1: schools should carry an engagement review to identify barriers to engagement specifically in home learning. Teachers surveyed here point to more nuance and complexity than simple lack of devices or internet access. Barriers to engagement will be specific to the school and to certain groups of pupils within that school, so a discretionary approach to this type of review is critical.. Teachers found a "one

size fits all approach to teaching and schools" unhelpful: "schools are different and they need to be able to react to their school's needs not the needs of a school three miles away!"

Review of these barriers ahead of autumn 2021 closures would make a big difference and will provide rationale for policy changes within schools (or hubs) to mitigate low engagement in certain 'at risk' groups, such as allocating some 'in-person' places on a compassionate basis to pupils whose education would be under threat if they were pushed back into home education.

Recommendation 2: Get the basics right. Teachers reported that they felt some things should be easy to solve (such as IT support and internet access), and they should have more space to focus on more important issues (such as vulnerable pupils), but felt frustrated when simple things became complicated.The COVID-19 pandemic has made the educational sector starkly aware of issues within the system that will need to be addressed, to ensure the most effective, as well as safe, learning experiences for all pupils across Wales, both during a pandemic and in the subsequent recovery period.

"Excellent lessons have been developed but minimal uptake because of so many technical difficulties on pupil side - inadequate devices unable to open or cope with lessons and lesson resources given. If all learners and all teachers had adequate devices I have absolutely no doubt that learning would have thrived due to the dedication and commitment of teachers to ensure the best possible lessons have been prepared"

Recommendation 3: adaptable systems to ensure the continuation of learning in the most vulnerable. The teachers we talked withmade it clear that they had gone to extraordinary lengths to ensure the wellbeing and continuation of learning of their pupils and that they had run up against a brick wall in certain cases. The detrimental impact on their wellbeing of trying to achieve this was also clear: "some pupils have just not engaged".

Most teachers said the pupils who were hard to engage in lessons were the ones who were hard to engage at home. This is different to the 'stress response', wherepupils who were well supported at home were experiencing high stress and wellbeing impacts. It is feasible to give each pupil a risk rating for wellbeing and engagement and before any closures ensure that interventions are in place for those identified as at high risk. This could include wellbeing sessions for those at high risk of stress, and engagement support for those at risk of disengagement; this should cover both assessment of needs and wider support for independent learning skills.

These risk ratings need to be dynamic and adaptable, since thebility to engage is also transient and very much impacted by the stage of the pandemic closures. Our teachers told us:

1. When schools were closed to all but keyworker learners – engagement followed the same patterns as in school time, learners who were able to engage in school were able to engage at home and those who were "difficult to engage" in school were also difficult to engage at home.

   "Online learning emphasises the lack of independent learning, pupils don't have the patience or skill to simply read the question and access the success criteria to support them as they want a quick finish to the task. At home it is very easy to ignore your feedback and not improve on work. Live lessons or tasks that are fully interactive with audio, video, embedded quizzes etc., don't appear to make much difference to those pupils"

   "some will engage on line others have zero intention of doing so in the same way that if they were in school they wouldn't be interested either. It has also been a strain on some pupils with a lack of consistency of being in and then out and then being in again"

2. When school was back in session for all but with periodic isolation for cohorts – this was the worst time for broad engagement. The at-home isolations were seen as 'holiday' time etc.

"However, when students are self-isolating or year groups are away from school the take up of lessons is very, very poor. Working parents are unable or unwilling to check that students have completed the work in many cases (but not all). Students feel that as they are not in school, they don't have to do the work and have not taken on board the risk that they will fail the courses they are taking due to a lack of evidence for examination boards. Unfortunately, just because a student has access to a device doesn't mean that they are willing to engage in learning."

"With the isolation periods it has caused periods of intense workload, followed by a lull. Pupil engagement has been low approx. less than 50% over a year group".

Recommendation 4: Embedding digital learning into the day when schools are open so that it is normalised for any future closures. One teacher noted that books not being marked so regularly had led to disengagement and had impacted attendance. We would suggest integrating digital feedback systems into in-person teaching going forward, and exploring ways to get pupils used to using digital platforms in their education to help them learn at home more effectively.

Generally our teachers felt access to devices was not the most significant barrier and point to a lack of independent learning skills. This can be seen as positive finding, as independent learning skills can be taught. Wales can build digital and intdependent learning skills into the new curriculum to prepare for upcoming pandemic closures, and ultimately encourage lifelong learning and active citizenship.

Lockdown and school closures as a strategy to combat COVID-19 has exacerbated the education inequalities that learners in Wales face. While the school staff worked tirelessly to support their pupils despite repeatedly changing, and sometimes conflicting, demands by the education authorities, there were many negative impacts. Whilst those may have been enhanced in our school demographics, we note that the comments from our teachers are very similar to those from teachers in schools with less socio economically challenged demographic. There are clean commonalities of pandemic learning and teaching experience in Wales, learnings from which can be used to better prepare for likely future school closures.

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Appendix 1

Survey Questions

To what extent do you agree/disagree with the following statements?

1. I felt prepared to deliver online learning, teaching and assessment.

	1	2	3	4	5	
Strongly Agree	○	○	○	○	○	Strongly Disagree

2. My pupils were prepared to engage in online learning, teaching and assessment.

	1	2	3	4	5	
Strongly Agree	○	○	○	○	○	Strongly Disagree

3. I felt confident in my ability to facilitate online learning, teaching and assessment.

	1	2	3	4	5	
Strongly Agree	○	○	○	○	○	Strongly Disagree

4. My school was supportive in facilitating the move to online learning, teaching and assessment.

	1	2	3	4	5	
Strongly Agree	○	○	○	○	○	Strongly Disagree

5. I had good working knowledge of the technologies available to support online learning, teaching and assessment.

	1	2	3	4	5	
Strongly Agree	○	○	○	○	○	Strongly Disagree

6. I could easily access appropriate technologies to support online learning, teaching and assessment.

	1	2	3	4	5	
Strongly Agree	○	○	○	○	○	Strongly Disagree

7. I was willing to experiment with different methods of online learning, teaching and assessment.

	1	2	3	4	5	
Strongly Agree	○	○	○	○	○	Strongly Disagree

8. What support was available from your school to deliver online learning and teaching activities (please tick all that apply).
   - ☐ Face to face support
   - ☐ Online material (non-interactive)
   - ☐ Online training (interactive)
   - ☐ Online individual support
   - ☐ No support
   - ☐ Don't know
   - ☐ Other: .....

How do you think the move to online learning, teaching and assessment has impacted the following areas?

9. Pupil engagement with their learning

	0	1	2	3	4	5	6	7	8	9	10	
Negative impact	○	○	○	○	○	○	○	○	○	○	○	Positive impact

10. Pupil engagement with the school

	0	1	2	3	4	5	6	7	8	9	10	
Negative impact	○	○	○	○	○	○	○	○	○	○	○	Positive impact

11. Pupil health and wellbeing (including mental health)

	0	1	2	3	4	5	6	7	8	9	10	
Negative impact	○	○	○	○	○	○	○	○	○	○	○	Positive impact

12. Teacher health and wellbeing (including mental health)

	0	1	2	3	4	5	6	7	8	9	10	
Negative impact	○	○	○	○	○	○	○	○	○	○	○	Positive impact

13. Formative assessment (i.e. to support learning and progression)

	0	1	2	3	4	5	6	7	8	9	10	
Negative impact	○	○	○	○	○	○	○	○	○	○	○	Positive impact

14. Summative assessment (i.e. to formally assess learning outcomes)

	0	1	2	3	4	5	6	7	8	9	10	
Negative impact	○	○	○	○	○	○	○	○	○	○	○	Positive impact

15. The pupils' onward progression in education

	0	1	2	3	4	5	6	7	8	9	10	
Negative impact	○	○	○	○	○	○	○	○	○	○	○	Positive impact

To what extent do you agree with the following statements?:

16. I was confident that all of my pupils would be able to access the teaching and assessment that I made available online.

	1	2	3	4	5	
Strongly Agree	○	○	○	○	○	Strongly Disagree

17. I had an appropriate home working environment to support learning, teaching and assessment online.

	0	1	2	3	4	5	6	7	8	9	10	
Negative impact	○	○	○	○	○	○	○	○	○	○	○	Positive impact

For the following…

18. What percentage of your pupils do you estimate had sufficient access to the internet to support online learning and assessment at home?
    - ☐ 0-10%
    - ☐ 20-30%
    - ☐ 40-50%
    - ☐ 60-70%
    - ☐ 80-90%
    - ☐ 100%

19. What percentage of your pupils do you estimate had sufficient access to some sort of device (e.g. laptop/PC/smartphone/tablet) to support online learning and assessment at home?
    - ☐ 0-10%
    - ☐ 20-30%

- ☐ 40-50%
- ☐ 60-70%
- ☐ 80-90%
- ☐ 100%

20. How much do you think COVID-19 has impacted your workload?

	0	1	2	3	4	5	6	7	8	9	10	
Decrease to workload	○	○	○	○	○	○	○	○	○	○	○	Increase to workload

21. Please use the space below to tell us anything you would like to about how COVID-19 has affected you or your pupils. *

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22. If you used any of S4/s online (webpage-based) or printed (Bumper Science Workbooks) materials to support learner science through either the lockdown or firebreak please tell us how you used our science outreach materials and what you found useful/not useful about our materials. *

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