

Impacts of COVID-19 on UK environmental science engagement projects

Laura Hobbs, Carly Stevens and Rowena Fletcher-Wood

Abstract In February–March 2020, ‘Investing in the Future of Science’ collected data on environmental science engagement among UK school-aged children. The UK then entered its first COVID-19 national lockdown. Larger or wider-reaching projects appeared more likely to retain staff to report impacts in a second survey, exploring how the pandemic changed environmental science engagement. While some were able to adapt to new ways of working and even expand reach and develop new skills, no projects reported only positive impacts; most indicated negative effects and ongoing uncertainty. However, adaptations demonstrated positives that could be taken forward post-pandemic, strengthening provision and building resilience.

In February–March 2020, ‘Investing in the Future of Science’ scoping research (Hobbs and Stevens, 2021) surveyed practitioners to create a national overview of United Kingdom environmental science engagement projects for school-aged children. The day after the survey closed, the government declared ‘Now is the time for everyone to stop non-essential contact and travel’ and, one week later, the UK entered its first national COVID-19 lockdown (see Institute for Government (2022) for a timeline). Many science outreach projects around the world changed, adapted, started and ended in response to the pandemic (e.g. Padma, 2021; Ufnar, Shepherd and Chester, 2021; Yonai *et al.*, 2023); the survey results serendipitously provided a snapshot immediately before the pandemic impacted activity, and the project was extended to collect more data. Amidst adaptations such as moves to online learning, furloughing of staff, and restricted movement and face-to-face contact, data collected during COVID-19 provided insights into the changed and changing environmental science engagement landscape for school-aged children.

Methods

Hobbs and Stevens’ (2021) survey was updated to add questions about impacts of the COVID-19 pandemic. The data collection period, August 2020–March 2021, opened after the first UK lockdown

ended, and continued during the second and third lockdowns, including periods of school closure (Figure 1).

Based on original methods, the survey was disseminated using relevant UK science communication mailing lists, UWE Bristol’s Science Communication Unit channels and, where possible, direct mailing to previous respondents. Respondents were asked to name the project they were reporting and its hosting institution, and indicate which environmental science areas (as defined on the Natural Environment Research Council website; NERC, 2020) were communicated. Information was requested, for pre-pandemic and/or pandemic circumstances as appropriate, relating to settings engaged in, reach, target audiences, delivery styles, charges, origination/ending and changes caused by COVID-19, potential expansion and pandemic-related insights around producing learning resources. Skip logics directed respondents to relevant questions depending on project status and whether information was provided in the previous survey.

Fifty-five responses were recorded, of which 28 were suitable for analysis. Four provided institution type and location only. Twelve projects (one delivered by Laura Hobbs and Carly Stevens and analysed in the same way as other projects in both studies) had completed the pre-pandemic survey. Data were

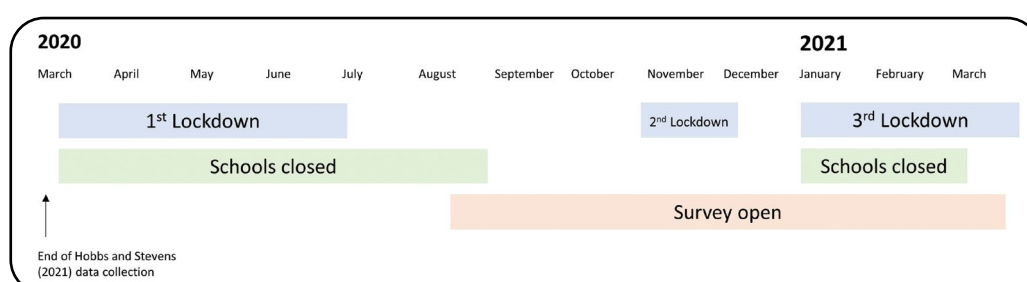


Figure 1 Representative timeline of UK national lockdowns, school closures and survey response window. Timings of mitigations after Institute for Government, 2022

collected for another six that existed pre-lockdown; the remaining six started after March 2020. Analysis was completed using descriptive statistics only, to avoid presenting potentially misleading inferential statistics beyond this specific cohort. This is intended to provide a snapshot of available information on UK environmental science engagement with school-aged children during COVID-19 restrictions.

Qualitative information from 65 open-text responses is reported below in relation to specific questions, and also reviewed as a dataset to further explore respondents' experiences. Following Braun and Clarke (2006), data were reviewed for familiarisation and coded in NVivo 1.6.1. Themes were identified and reviewed, with prevalence counted at the individual occurrence level. We are 'insider researchers' on this topic, which, while bringing benefits, also carries risks of over-familiarity, affecting objectivity, and assumed understanding (e.g. Unluer, 2012; Aburn, Gott and Hoare, 2021). Therefore, data were reviewed inductively, that is, without using a pre-existing coding framework or existing researcher analytical preconceptions, and themes were identified at an explicit, rather than interpretative, level; analysis considered only what the respondents wrote, rather than interpreting what shaped this content (Braun and Clarke, 2006).

Results and findings

Responses naming 28 projects were received from 26 institutions (Figure 2).

Projects were based in England, Scotland and Wales and operated on local to international scales. Of the six projects starting since March 2020, one arose because of COVID-19 and five changed because of it.

Representation of environmental science areas

All five environmental science areas were represented in surveyed projects (Table 1). Open-text responses were not used to indicate that scientific areas covered by pre-existing projects changed compared to those reported pre-pandemic.

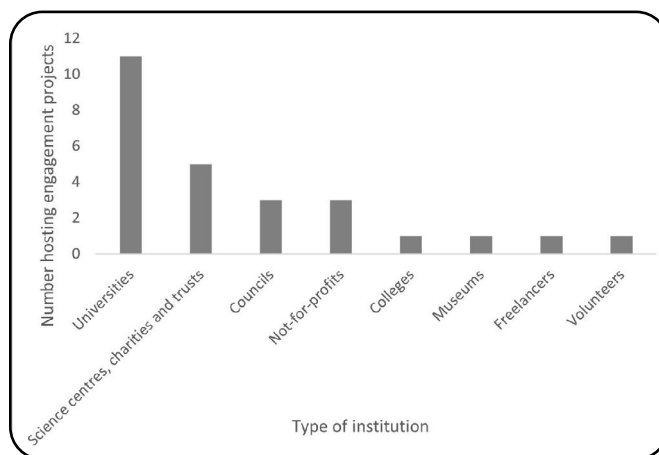


Figure 2 Types of institution hosting responding projects (n=26)

Projects established pre-lockdown

Pre-lockdown, reporting projects (n=16) were most often working with 3000+ children per year; only one project reached ≤250 per year. In contrast, of the 54 projects that responded to the pre-pandemic survey 30% and 28% reached ≤250 or ≥3000 children in schools each year, respectively. Age groups spanned pre-school to school-leaving age, with the modal age of 7–14 years. The majority worked with children in schools during school time and/or at public events. One was working only in schools, three did not work with schools, while others used a combination of means for reaching children, which included schools. Pre-lockdown engagement with schools, and that reported in Hobbs and Stevens (2021) for comparison, is shown in Table 2.

Schools were important access routes for other settings; for example, more than half of the projects were communicating environmental science at public events and site visits during school hours, and almost half at extracurricular clubs. While working in schools during school time mirrors that reported in the previous survey, projects working with community groups, and communicating science for children at public events both within and outside of school time, were more prominently represented, notably so for events outside school hours.

Table 1 Representation of environmental science areas across reporting projects

Area	All projects (n=22)	Projects established pre-lockdown (n=16)	Proportion of new projects (n=6)	Difference between pre-existing and new projects
Atmospheric	64%	56%	83%	27%
Earth	64%	69%	50%	-19%
Freshwater	18%	19%	17%	-2%
Marine	36%	31%	50%	19%
Terrestrial	59%	69%	33%	-35%

Table 2 Pre-pandemic activity with schools, as a key indicator, in the current study and reported in Hobbs and Stevens (2021) for comparisons

		Current study (n=15)	Hobbs and Stevens (2021) (n=54)
Number of schools engaged with per year	Range	≤10 to 100+	≤10 to 100+
	Mode	100+	≤10
Number of engagements per school per year	Range	≤3 to 7–10	≤3 to 10+
	Mode	≤3	≤3

Four projects used online delivery during school hours and five online methods outside school hours. One project noted that their work was mainly run digitally, with some site visits.

Projects most often used practical and field-based sessions. These were also the most common formats in the pre-pandemic survey. Nine were actively targeting under-represented groups. Within these, the most commonly targeted groups were children from low socioeconomic status backgrounds, children from areas with low progression to higher education, women and girls, and children with Special Educational Needs and Disabilities (SEND). Nine worked locally, seven nationally and four internationally, with seven operating locally to the hosting institution only. This compares to 79% operating locally to their institution, 40% nationally, 19% internationally, and 57% locally only (n=47) in the pre-pandemic period.

Projects established during the pandemic

Settings engaged in were mixed, covering public events, engagement during school time, in-person and remote delivery. Half of the six projects reached (or expected to reach) ≤250 children annually; the other three ranged from 251–500 to 3000+ children. Three used online content only with no in-person engagement, while three indicated sessions between half and one hour. Projects engaged with children aged 5–18, most commonly 7–11 years. Four used pre-recorded videos, mostly online, and remote delivery. One used practical classes, and the other delivered STEM (Science, Technology, Engineering and Mathematics) packages to a disadvantaged group.

Four projects specifically targeted under-represented groups: SEND, young carers, children from areas with low progression to higher education, children from low socioeconomic status backgrounds, and women and girls. One project worked only locally, while a second worked locally and nationally. Three worked nationally only, with one operating nationally and internationally.

Overall pandemic activity

Twenty-two projects reached children through schools, with some alternatively or additionally

reaching them either directly through families, other organisations or otherwise; one reported via free text that ‘they are not’ being reached. Limited information was given regarding other methods; comments mainly reflected online means (websites, online resources and events and social media), although one project noted that they had produced outputs, but lacked data on whether they were used. Similarly, projects targeting under-represented groups mentioned that they could not tell who was using their online material, and seven were unable to answer definitively whether there were any changes (four reported no change, while five reported a recognised change). One project reported creating new project strands, but it was unclear whether this impacted their work with under-represented groups. Of the other seven projects adding free-text information, impact was generally negative; as well as not knowing who was being reached online, lack of internet/technology access and literacy for some groups was noted, as was loss of funding to provide more specialised targeting and support.

Expansion was also discussed. Nine projects reported that they were not considering expansion at the time of completing the survey. Among the remainder, expanding engagement style, reaching more children, and disseminating more widely were key expansion areas, while more in-depth evaluation was least-commonly considered. Free-text responses highlighted intentions to develop websites and online work, limited by lack of resources. Hobbs and Stevens (2021) also highlighted funding as a factor limiting expansion and ability to monitor use of outputs.

Fourteen pre-existing projects reported that the pandemic impacted their activities and reach. Five reported both positive and negative impacts to access; nine negative impacts only. None reported entirely positive impacts. All indicated changes to activities, with 11 reporting that reach was affected. Open-text responses indicated that projects that had completed planned activities before lockdown were less affected, while others reported complete cessation of activity, loss of staff and resources, uncertain futures, and significant reduction in annual reach. While some projects were unable

to operate, others managed to adapt. Despite negative impacts, such as time requirements to put adaptations in place and reduced reach (e.g. through moves to social media, outdoor settings, or smaller geographical areas because of movement restrictions), developing more flexible approaches and online delivery expanding geographical reach, helped alleviate negative consequences. Some projects reflected on their practice and materials, developing new skills, principles and offerings, indicating that drastic changes in circumstances can prompt creativity and new opportunities. Seven reported evaluation or dissemination methods changing because of the pandemic, ceasing live delivery, moving to online/digitised delivery, moving outdoors, adapting to reach children at home, losing staff and resources, and collecting evaluation data online instead of in-person, reducing response rates.

Qualitative themes

The most prevalent themes were activity cessation (23 occurrences, including 15 relating to school closures), resource creation or adaptation (19), and access considerations (18). All identified themes are shown in Table 3, with examples of identified content.

Discussion

Represented environmental science areas

While there was no indication that pre-existing projects had changed the scientific areas they cover, new projects appear to particularly focus on atmospheric science. Results are not generalisable or comparable because of the small number of respondents and difference in sample sizes between the pre-pandemic ($n=4$) and pandemic ($n=22$)

Table 3 Identified themes; direct quotes have been redacted to ensure anonymity where necessary; prevalence is recorded as individual occurrences

Theme	Prevalence	Example
Cessation of activity	23	'...currently unable to deliver sessions...'
Creation or adaptation of resources	19	'developing (...) packs that can be sent out with easily cleanable or disposable resources'
Access considerations	18	'more interactive and accessible to children working remotely'
Increased digital/online content	16	'adapted programme to be completely online as at-home activities'
Changes to key/target audiences	16	'online activity delivery enabled reach beyond the region'
Reduced reach to children	13	multiple reports of 'huge' decreases; previously reaching hundreds/thousands of children per annum, now reaching none or heavily reduced numbers
'Work in progress'	11	indications of ongoing processes, e.g. 'now transitioning', 'far from complete and very much a work in progress', 'may change going forward', 'trying to adapt'
Project insecurity	7	'future of whole project is now uncertain'
Limited resources	7	references to limited/loss of resources, including time costs, e.g. 'developing suitable, quality materials and resources for online delivery takes time'
Limited evaluation	7	evaluation no longer feasible owing to low online evaluation engagement or loss of staff. Inability to monitor who is using online resources
Loss of staff	5	'resource needed to complete project lost because of contract termination or redundancy'
Limited online success	5	'since lockdown we have reached no children and have little to no engagement with social media campaigns'
Hope for the future	5	'hoping to grow online audience and increase engagement with digital resources'
Skills development	3	development of new skills in working online and video production and presentation. 'Putting our resources online has been a learning experience for us, but overall positive'
Existing digital resilience	1	'we are a digital project so were able to continue through lockdown'

surveys; however this is an interesting indication that, within the reporting sample, marine and especially atmospheric areas gained in focus. This could be due, for example, to funding available, the nature of staff contracts coinciding with expertise and time available for engagement, or a perceived change in importance of topics. Notably, increasing atmospheric topics aligns with attention on air pollution changes during lockdowns, as reported by the BBC (Khuo, 2020) and *The Guardian* (Fuller, 2020).

Geographical and participant reach

It is important to recognise that delivering across larger geographical areas does not always correlate with reaching a higher number of participants; some projects operating locally were reaching 3000+ children pre-pandemic. However, compared to the pre-pandemic survey, reports of local working appear to have decreased, while national and international operation (and reaching 3000+ children and 100+ schools) dominated responses. This may indicate that nationally delivered projects (which may relate to funding model) and those with greater numbers of participating children or schools were more resilient to changes introduced by lockdown than locally focused and smaller ones. Furthermore, new projects were almost all working nationally, suggesting that projects operating locally, and particularly only locally, may have found it more difficult to maintain or establish activity during the pandemic.

Projects reported that operating online enabled them to reach people across a wider geographical range than previously (or not control audiences geographically at all). The more prominent reporting of projects using online methods, and public events outside school time (indicating diversity of access routes rather than reliance on engaging through schools), suggests that those projects already accustomed to reaching their audiences in these ways may have adapted more easily, and therefore reported their experiences, compared to projects working mainly or only in-person with school-based groups.

Impacts on activities and reach

Overall, there was an impression of reduced and changed activity, uncertainty and work cut short. Reports of impacts were mixed, with some projects detrimentally impacted, some adapting with varying levels of success, but no exclusively positive impacts. Uncertainty around project futures was noted across free-text comments, and some projects were unable to operate effectively, having lost staff, resources and access to audiences. While some reached fewer children, others creatively managed

to expand their reach, particularly geographically, through online delivery. However, there were no reported benefits for under-represented groups, with access opening to wider audiences rather than focusing on those with access barriers. Concerns about reaching groups with limited technological options were highlighted in survey comments; projects were considering how to ensure activities were suitably adapted to work with limited access and some were successfully engaging with communities. However, it is important to note that inequity of access to technology for home learning was a national problem. While schemes were put in place by the government, there were difficulties in executing this and the situation did not fully resolve with time (Howard, Khan and Lockyer, 2021). As such, projects with often already stretched resources were operating within a wider context and furthermore, at the time of data collection, adaptations were 'very much a work in progress' and projects were still navigating such challenges. An area for future work is to explore what, if any, solutions projects were able to find, and whether and how learning and adaptations from this time persist into future work.

Limitations

Notably fewer responses were received than in the original survey, with 55 total responses and 24 sufficiently complete to allow analysis, despite opening for months rather than weeks like the original study. This is perhaps symptomatic of practitioners being furloughed, under increased pressure, no longer in relevant roles, and the closure of projects. The low response rate aligns with other studies, for example, a rate of 1.6% attained in relation to the impact of the pandemic on scientists (Myers *et al.*, 2020). As online data collection dominated during restrictions, survey fatigue arose across disciplines (e.g. Field, 2020; de Koning *et al.*, 2021; Gnanapragasam *et al.*, 2022). The small sample would not be appropriate to attempt to generalise. However, while results can only provide a snapshot of the situation, for reporting projects at that time, they do provide valuable insight both from those able to respond, and through comparison to pre-pandemic survey results.

Building on successes beyond the pandemic

Even after restrictions lifted, accessing cultural and everyday activities via online or hybrid methods persisted in the UK (Li *et al.*, 2022) and hybrid working continues. Some positives were gained from online engagement delivery and digitisation, including:

- wider geographical reach, enabled by working online;

- reduced costs, such as removal of the need to travel to physical locations;
- workforce skills development, as project staff rapidly adapted to new methods of delivery and dissemination.

While virtual delivery does not replace in-person engagement – some experiences cannot be replicated virtually and digital inequity is of wide concern – it can successfully complement it (Padma, 2021; Ufnar *et al.*, 2021; Hartley, Hobbs and Stevens, 2023); learning and experiences from the pandemic can be used to strengthen future provision of UK environmental science engagement. Focus on ongoing development, such as digital production and communication and dissemination of engagement outputs, could help ‘future-proof’ projects against further social shocks, increase project reach and create legacy benefits regardless of future funding, widen practitioner skills in the post-pandemic world and refine and improve offers to schools, which remain a key point of access.

Moving forward, the improved abilities of schools and skills of practitioners to work in such online or flexible formats, the increase in online resources (a benefit that we have seen in our own work as we are now able to direct enquirers to resources that we produced as a result of delivery changes caused by lockdowns, and have continued this practice), and intentions to expand engagement styles, reach more children and disseminate outreach more widely are positive indications for engagement with children in schools. While provision may still be weighted towards nationally operating projects as locally based content is re-established or initiated as we move through a post-lockdown recovery, increased geographical access through widened scope of delivery formats may benefit schools without a local university or in more remote/rural locations (often under-represented). Furthermore, it is clear that environmental science outreach and engagement practitioners are aware of, and working to address, digital inequality, particularly highlighted during lockdowns. Recent NERC engagement funding calls (e.g. NERC, 2023) encourage participatory approaches, listening to community needs and developing ways to engage under-represented groups; ensuring appropriate access should be a core component of future environmental science engagement projects.

We intend to survey practitioners again post-2023 to explore which aspects of the changes brought about by the COVID-19 pandemic have been retained, and how the environmental science landscape looks for the future. In the meantime, the insights above indicate that, despite the sudden, unexpected cessation in activity and subsequent

difficulties for projects, there are some positives to be taken forward to support children to engage with environmental science outreach in schools. Further work will be required post-pandemic to explore legacy impacts, which positive changes have been retained, whether activity has recovered, which elements have reverted to pre-pandemic states, and whether and how specific groups may have been disproportionately impacted once longer-term effects become apparent.

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Laura Hobbs has a PhD in Environmental Science and is a Senior Research Fellow in Science Communication at the University of the West of England.

✉ laura5.hobbs@uwe.ac.uk

Carly Stevens is Professor of Plant Ecology and Soil Biogeochemistry at Lancaster University and has an interest in science communication.

Rowena Fletcher-Wood is a Chartered Chemist and Chair of the RSC Environmental Chemistry Group. She has a PhD in Environmental Chemistry and is a Science Communicator and Academic Manager for Science at Greene's College Oxford.

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