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A return to in-person public engagement at STFC

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Abstract. Since 2020, UKRI/STFC's Scientific Computing Department (SCD) have developed several remote-first public engagement activities, drawing on its long and rich history of delivering face to face public engagement and outreach, as part of the wider STFC programme. With COVID-19 restrictions lifted in the UK, STFC has been able to resume in-person public engagement, both on site and in public places. However, this has not meant a complete return to exclusively in-person engagement, but rather, recognising the clear benefits of remote engagement to meeting our strategic public engagement aims, STFC has produced a blended programme for 2022/23, with a mixture of in-person, remote and hybrid events. This paper presents how the remote activities have evolved since their initial creation, how the remote activities have become part of a blended programme and how the in-person activities in place since before the pandemic have been improved as a result of developing the remote activities.

1 Introduction to STFC and Public Engagement

The Science and Technology Facilities Council (STFC), part of UK Research and Innovation (UKRI), is responsible for supporting, co-ordinating and promoting research, innovation and skills development in areas ranging from the largest astronomical scales to the tiniest constituents of matter [1].

STFC's Scientific Computing Department (SCD) has a long and rich history of delivering face to face public engagement and outreach, both on site and in public places, as part of the wider STFC programme [2-4].

Following on from the COVID-19 pandemic, STFC recognised the clear benefits of remote engagement to meet their strategic public engagement aims [5], e.g. improving their reach with diverse audiences. As such, STFC has produced a blended programme for 2022/23, with a mixture of updated in-person, remote and hybrid events. This paper covers some of the PE activities undertaken by SCD, and how they have evolved and improved as part of the 2022/23 programme.

2 Evolving remote engagement

2.1 Remote[3]

Remote[3] (*Remote* sensing by *Remote* schools in *Remote* environments) is an STFC funded project [6], initially targeted at remote Scottish schools, where children design and build a LEGO Mindstorms "Mars Rover", to be subsequently remotely tested at the Mars Yard at STFC's Boulby Underground Laboratory [7].

In March 2020, Remote[3] was ready to launch the first series of school activities when this plan, like so many other things, was derailed by COVID-19 lockdowns. However, Remote[3] utilised its already established network of remotely engaged schools to pivot and adjust into a new programme of webinars and coding challenges.

In 2022, the Remote[3] team were able to re-launch their initial school club engagement plans – making use of the lessons used over the COVID-19 lockdown period in order to facilitate improved webinars and Zoom workshops to support teachers, students and mentors. As well as this, the workshops developed over the lockdowns have also been run in person at events such as the Electromagnetic Field Festival in the UK.

Remote[3] is now in its second year of challenges, with plans underway for the third, and continues to learn, develop, and build upon the remote experience gained over the COVID-19 lockdowns.

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Fig. 1. Several of the LEGO Mindstorms Rovers at STFC's Boulby Underground Laboratory. Photo by Will Furnell.

2.2 Virtual Data Centre tours

Virtual tours continue to be a part of SCD's PE efforts, offering those unable to come to site the opportunity to experience the data centre.

These tours have evolved since their first conception, which involved running a 3D Model of the data centre over Zoom. This model was originally created for operational purposes in the SketchUp [8] modelling software, which can be seen in Fig. 2. Rendering this model in real-time over Zoom was beyond the hardware resources of the typical staff laptop. This resulted in an unfair burden on the staff with access to more powerful, often personal, machines.

To resolve this, the virtual tour was rebuilt using Pano2VR [9], providing a "street view" of the data centre and allowing enrichment of the tour with information widgets at interest points, as seen in Fig. 3.

This new virtual tour is also browser based, which is much less system intensive to run and great for streaming over Zoom – which means more people can deliver virtual Data Centre tours.

Being browser based also means the virtual tour can exist as a standalone, explorable, resource that can be shared [10].

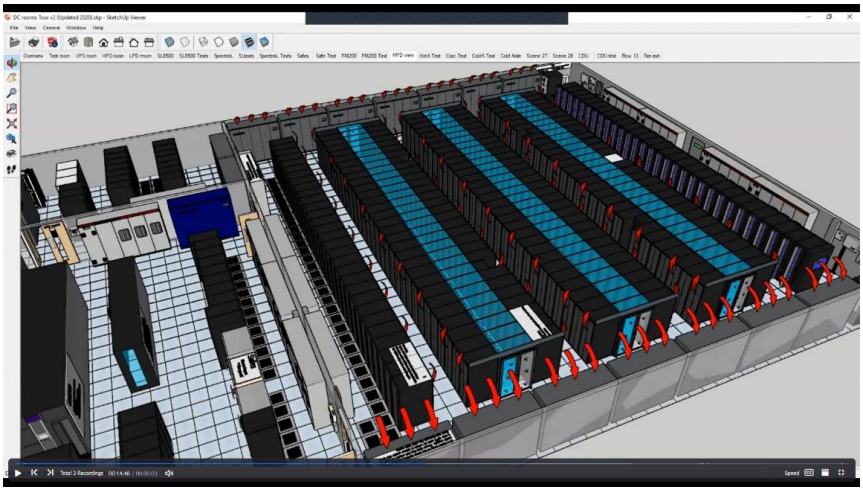

Fig. 2. The original, SketchUp based, virtual tour.

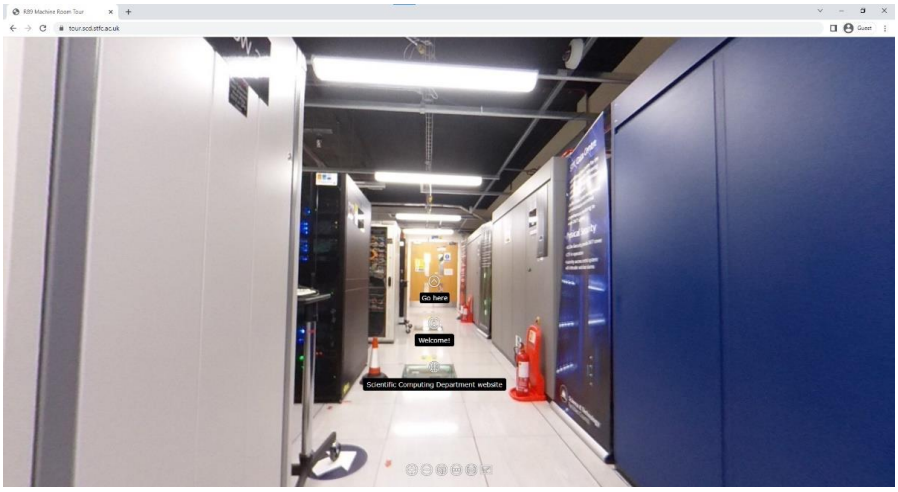

Fig. 3. The newer, Pano2VR based, virtual tour.

2.3 Remote Python Workshop for Work Experience Students

Over the pandemic, the formerly in-person Python Workshop, designed to provide the incoming work experience students with an introduction to Python, has evolved to be delivered in a fully remote fashion.

The in-person workshop was limited to ~15 attendees, typically from the area local to one STFC site, out of ~100 interested work experience students. The remote format, using a JupyterLab [11] instance hosted in the STFC Cloud to run Notebook based lessons [12], has allowed the workshop to reach an audience that is up to five times as large as the in-person version and much more geographically diverse. The remote format also enables SCD to include students undertaking work experience at the other STFC sites for the first time.

The remote workshop has continued to receive excellent feedback from attendees. The recent 2023 workshop reached a remote audience of over 100 students.

3 Improving in-person engagement

3.1 Ada Lovelace Day

SCD runs a yearly space themed Arduino challenge day to mark Ada Lovelace Day [13]. Since 2014, this has been an in-person event with ~40 school children in attendance. In 2021 and 2022, this event was run as a hybrid event with both participating students and supporting staff on site and remotely.

During both hybrid events, all participants received the same introduction to what an Arduino is, a careers talk from one of SCD's recent graduate staff members and a tour (either in-person or virtual) of the SCD data centre. For support with software and hardware, remote staff were placed into breakout rooms with the remote participants. The new hybrid nature enabled the event to reach over double its usual audience, by allowing an additional 60 students to take part remotely.

The shift to hybrid also resulted in changing the software used to provide a drag and drop programming interface to the Arduinos. A custom version of Ardublock [14] was used previously, but this proved difficult for schools to install on their systems and for remote staff helpers to debug the students' code.

Tinkercad [15] is now used instead. This new programming interface provides:

• A graphical programming interface, shown in Fig. 4, much closer to Scratch [16] a drag and drop programming language used heavily in schools.

• The ability to simulate Arduinos, shown in Fig. 5. This means schools no longer need a physical Arduino to participate. Needing a physical Arduino to participate in a virtual activity would be a barrier to entry, particularly for schools in areas of higher deprivation, who may not be able to source Arduinos. Simulated Arduinos also provide an access point to the activity for students who struggle with the fine motor skills required to work with Arduinos physically and who might otherwise switch off before exploring the coding elements of this activity.

• The ability to create classrooms, shown in Fig. 6 and Fig. 7, allowing staff helpers to see the code and virtual circuit of the students, which has made debugging issues much easier to address.

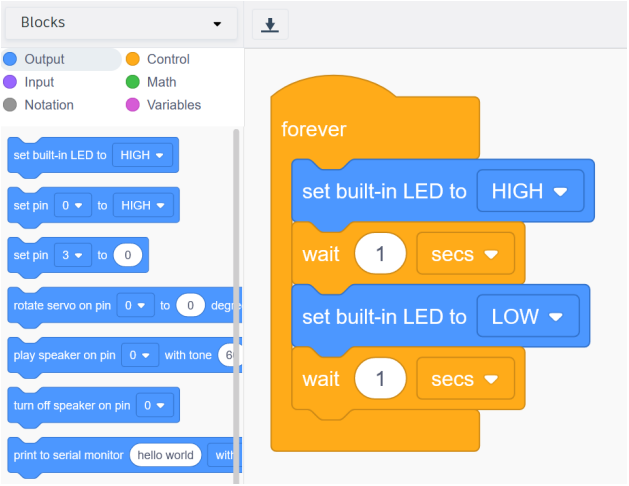

Fig. 4. The Tinkercad graphical programming interface.

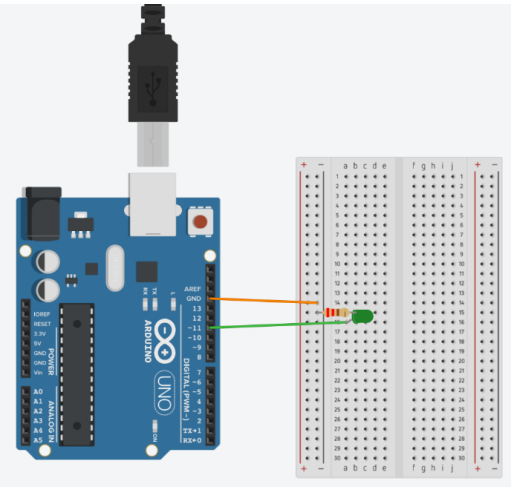

Fig. 5. A simulated Arduino in Tinkercad

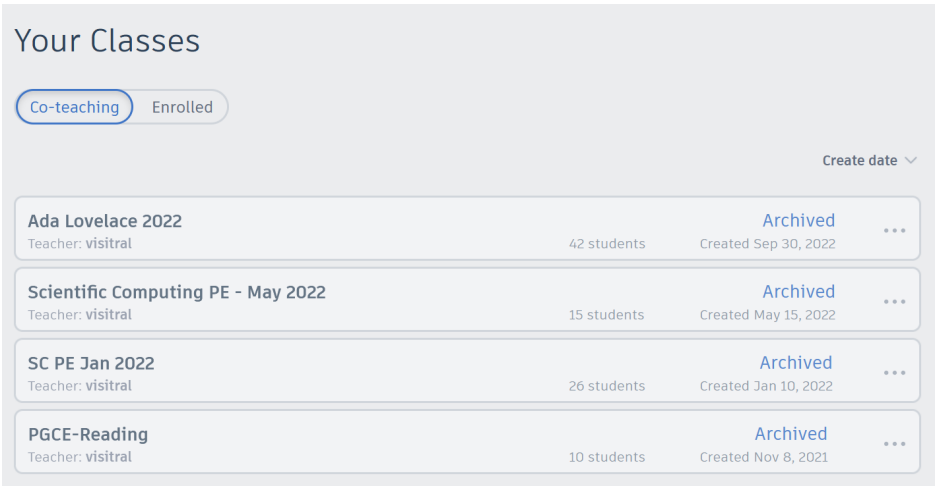

Fig. 6. Classrooms in Tinkercad.

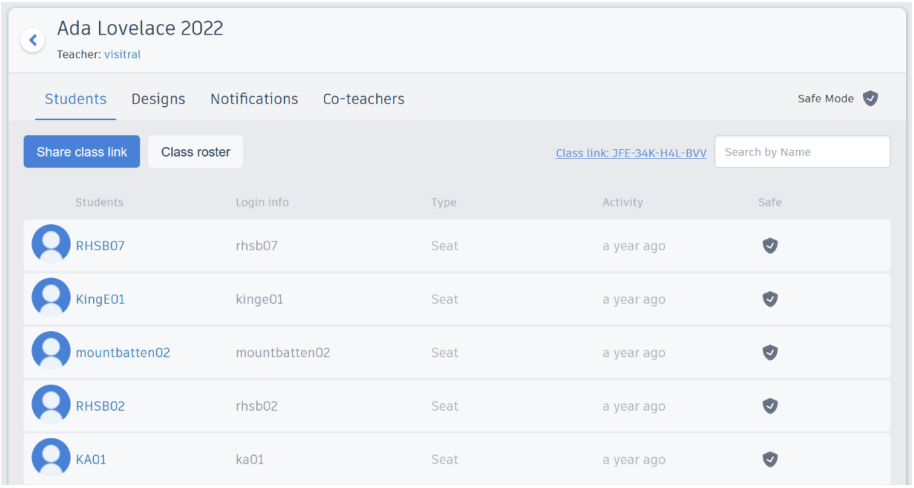

Fig. 7. A single classroom in Tinkercad.

3.2 Particle Physics Masterclasses and IRIS "Big Data: ATLAS" project

The particle physics masterclass, which includes a workshop analysing LHC data, has always been one of the most popular and oversubscribed parts of the STFC Public Engagement programme. Before the pandemic, this workshop relied on specialist software and access to data, which could be provided on site, but during the COVID-19 lockdown it became possible to utilise the JupyterLab instance used for the Remote Python Workshop to enable remote access to the activities, needing only a browser to allow students and schools to participate.

This not only enabled the masterclass to be run during full lockdown, but also enabled the reach of the masterclass to be greatly improved - not only numerically (where it has doubled), but also in terms of the geographical and demographic reach of the event. By removing the barrier of travel to participation, schools where transport was prohibitive (both in terms of time and monetary cost) are now able to take part fully, as well as individual enthusiastic students.

In addition, the LHC Data workshop can now be made available to students after the actual masterclass, allowing students and teachers to continue to explore the data for themselves. This has led to a successful collaboration with the Institute for Research in Schools and the University of Oxford to create a research project for A-Level students, "Big Data: ATLAS" [17].

Fig. 8. Participants at the Particle Physics Masterclass.

4 Conclusion

Remote-only activities that were developed in response to the COVID-19 pandemic have now become part of a blended programme. In-person activities in place since before the pandemic have also been improved because of developing and delivering the remote activities.

This shift has been supported by an evaluation framework, built around the idea of defining formal generic learning outcomes (GLOs), that help ensure the activities continue to be effective and communicate what is intended.

The evaluation of the blended 2022/23 programme has shown it continues to be well received and effective, with:

- 87% of participants giving activities a satisfaction rating of at least 4 out of 5.
- 96% of the public audience reporting the activities encouraged them to value STEM or STEM careers.
- 95% of the school students saying activities encouraged them to consider studying or working in STEM in the future (with 50% saying the event increased the likelihood of them pursuing STEM).

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