A blended learning approach for a crystallography-based undergraduate practical [under COVID-19 restrictions]

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Following a need for increased hands-on experience with technical analytical instrumentation for undergraduate students, the University of Southampton has offered a practical course to third years for the past 10 years. This involves the preparation of crystalline materials, with subsequent analysis including the collection of single crystal X-ray diffraction data and work-up to generate fully refined crystal structures [1].

When the COVID-19 pandemic struck, all face-to-face teaching in the UK ceased, with the academic year concluding online in every aspect. By the start of the following academic year, restrictions were slightly relaxed, allowing limited face-to-face teaching for practical aspects. However, there were still restrictions as to what could be allowed, as well as requiring backup plans should a return to full lockdown occur. Thus we were challenged to adjust our practical so it could be delivered in a COVID-safe manner, with potential for an online backup, whilst still keeping the main learning objectives and aspirations of the original experiment.

After significant discussion, it was deemed safe enough that the students could still use each analytical instrument individually, but with a disinfecting regime implemented. Thus the practical was delivered in Semester 1 of 2020-21, entirely in a socially distanced manner in an undergraduate teaching laboratory. The laboratory is equipped with large screens (and speakers) to allow for the practical leader to present information from a central point to all the students. Each student had a laptop at their bench, allowing them not only to record and collate all experimental results, but also follow along to the various 'online' demonstrations of the software and techniques required for the practical. There was still space to allow demonstrators to walk up and down past the students, but communication could also be performed using the Microsoft TEAMS platform, allowing for sharing of screens and information between students and demonstrators.

As such the overall practical involved a mix of individual, hands-on activities at the bench and scheduled accessing of benchtop analytical instruments, combined with 'online' delivery of data analysis workshops.

Here we will describe the challenges involved and how they were overcome along with some of the simple, but highly effective, changes that were required but actually improved the practical. Some of these new approaches have proved to be popular and transferrable and we will briefly outline their actual and potential use for other activities.

1. Coles, S.J. and Mapp, L.K. Conducting Reflective, Hands-On Research with Advanced Characterization Instruments: A High-Level Undergraduate Practical Exploring Solid-State Polymorphism, J. Chem. Educ. 2016, 93, 131–140.