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Rebecca Gridley and
Victoria Schussler

Ceramic Lockdown Stories: Remote Teaching in a Pandemic

ABSTRACT

The COVID-19 pandemic has had profound impacts on teaching conservation, for which access to cultural heritage artefacts and conservation laboratories are critical components of training. University College London's (UCL) move to online delivery during the 2020–21 academic year necessitated the development of new activities that could be conducted safely at home to meet fundamental pedagogic goals. Home-teaching kits and digital artefact dossiers were developed to facilitate independent student learning guided by module aims and programme curricula to replace practical sessions. Each project facilitated fundamental summative and formative knowledge-creation related to the interpretation and identification of ceramic and adhesive materials. Preparation of module kits and dossiers was time consuming and required clear communication and additional UCL financial support. Despite these challenges, student response was enthusiastic and foundational learning goals were met. As UCL commits to blended in-person and remote learning post-pandemic, these resources will be refined to maximise student learning.

AUTHOR

Caitlin R. O'Grady
Lecturer in Conservation and Affiliate Tutor
University College London Institute of Archaeology
London, United Kingdom
caitlin.r.ogrady@ucl.ac.uk

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INTRODUCTION

Following the declaration of the novel coronavirus COVID-19 (SARS-CoV-2) as a pandemic in late January 2020 (World Health Organization 2020), most countries initiated mandatory lockdown or stay-at-home measures to reduce viral transmission. In anticipation of the United Kingdom's first national lockdown introduced on 20 March 2020 (Prime Minister's Office 2020), University College London (UCL) shifted the remaining two weeks of teaching to online delivery, and all non-essential staff were required to work from home (UCL 2020c), necessitating the complete migration of content delivery and practical learning to online platforms. The rapid and dramatic shift had profound impacts on teaching in conservation, for which most graduate-level curricula blend theoretical and practical learning, requiring access to cultural heritage artefacts and conservation/scientific laboratories (van Lookeren Campagne 1999; Hutchings 2011; Chmielewski 2014; Foskett and Thompson 2017). Close inspection of artefacts allows students to develop fundamental skills related to observation, experimentation, deductive reasoning, and critical analysis (Marie 2010; Sparks 2010; Henderson and Parkes 2021, 4). Access to laboratories, equipment, conservation materials (including controlled chemicals), and personal protective equipment (PPE) ensures students can safely inspect, analyse, and treat artefacts (Alcántara-García and Ploeger 2018). Remote teaching necessitated developing alternate strategies to meet curricular goals through formative and summative learning.

Fry (2001) defines 'online delivery' as the use of the internet and other digital technologies to develop educational materials, provide instruction, and manage programmes. While digital technologies are not new to higher education (Adedoyin and Soykan 2020) and conservation education in particular (Dardes 2002; Russell and Leverton 2013; Lambert, Debulpaep, and Nikolić 2017), the extent to which individual institutions and lecturers engaged with them prior to the pandemic varied considerably (The Quality Assurance Agency for Higher Education 2020, 2; Pedersoli Jr. 2020, 4). Success in implementing remote learning depended on the degree to which institutions could administer access and training for academic staff and students in the effective use of digital platforms, facilitate rapid approval to modify module delivery, and offer online provision (lectures, activities, advising support, etc.) equivalent to pre-pandemic in-person instruction. Individual access to digital platforms was also key (The Quality Assurance Agency for Higher Education 2020, 4; Howard, Khan, and Lockyer 2021, 9). The abrupt switch in instructional activities posed logistical challenges with significant learning curves. Swift adoption of these new technologies was dependent on the sizes and financial resources of institutions (Europa Nostra 2020, 9). However, most important was a necessary attitude shift for administrators, instructors, and learners regarding the quality of online instruction offered and its perceived value as a surrogate for face-to-face teaching (Ribeiro 2020). This necessitated adopting frameworks whereby faculty, staff, and students engaged with technology, supported collaboration, and worked together to meaningfully respond in the face of extreme uncertainty (Foresman 2020).

Throughout the pandemic, the challenge was, and continues to be, how education is managed in the face of uncertainty. As Henderson (2018) notes, the concept of uncertainty is a necessary component of teaching preventive conservation that provides a mechanism for agile and swift response to the unknown. During the pandemic, managing doubt and an undetermined future became essential in daily activities, as well as all aspects of education. This was particularly the case as the UK (and many other countries) entered a series of lockdowns that continued into 2021. Many conservation programmes and universities, like UCL, anticipated a return to normal instruction multiple times: first during the summer of 2020, then in fall 2020, and again in January 2021 (Wharton, Delgado, and Golfomitsou 2021, 4). Unfortunately, a confluence of actions and inactions in implementing effective controls against COVID-19 resulted in an extended period of uncertainty regarding postgraduate education, and online delivery continued into the 2020–21 academic year. Given the strained relationship between uncertainty and control, tolerance and validation of emotional responses to the pandemic remained (and remains) critical to facilitating teaching that engages learners (Henderson 2018, S111; Stopyra 2020). For conservation graduate/postgraduate programmes, these needs were met through various mechanisms, as educators and students collectively adapted to a new normal (ICCROM, Athabasca University, and IIC 2020; Pedersoli Jr. 2020; Bhatty and Sermoneta 2021; Museums + Heritage Advisor 2021; Wharton, Delgado, and Golfomitsou 2021).

UCL INSTITUTE OF ARCHAEOLOGY PANDEMIC CURRICULUM PLANNING

For UCL's move to online delivery, new activities were developed to meet the needs of a conservation curriculum that incorporates both theoretical and practical learning. This was particularly true for the UCL Institute of Archaeology's (UCL-IoA) Master of Art in Principles in Conservation (MA-Cons) and Master of Science in Conservation for Archaeology and Museums (MSc-Cons) degree programmes. During the first 2020 lockdown (March through July), UCL-IoA conservation faculty no longer had access to physical university resources aside from what they had been able to take home. Whilst the teaching term ended in March, faculty spent subsequent months in the academic year liaising with students to support their remaining coursework. Several policies were adopted to mitigate any detriments to UCL students based on access, socioeconomic disparities, and mental health that would academically disadvantage them due to the emergency changes to assessments and teaching (UCL 2020a; 2020b).

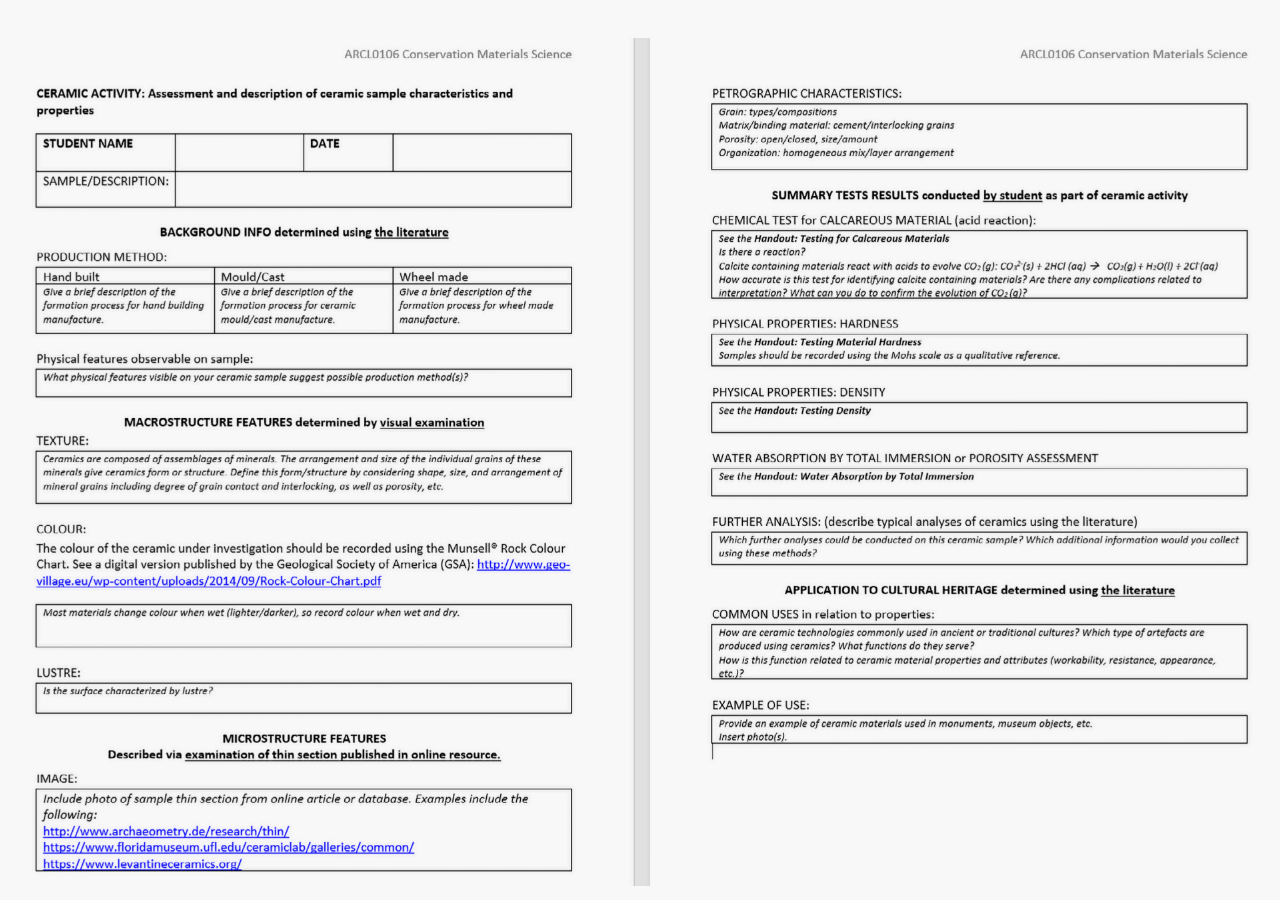
IoA faculty also advised students in developing MA-Cons and MSc-Cons dissertation topics that were feasible to implement using limited resources (e.g., online and electronic library publications). Simultaneously, staff created teaching plans that incorporated varying levels of remote learning in anticipation of possible lockdown extensions. The UCL Information Services Division (UCL-ISD) produced a series of online training modules ('DigiConnect') to facilitate faculty learning and comfort with remote teaching technologies (S. Karia, Personal communication, 2 July 2020). The UCL-IoA digitised documents and administrative mechanisms to prevent disadvantages in resource accessibility (UCL 2022). Simultaneously, 2020–21 academic planning focused on learning activities that could be conducted safely at home and without access to laboratory infrastructure, whilst still meeting fundamental pedagogic goals.

Following a successful bid for emergency UCL funds to support practical learning (O'Grady 2020), home-teaching kits and digital artefact dossiers were created to facilitate students' independent offline learning guided by module objectives and programme curricula. Activities to aid students in developing conservation knowledge, critical thinking, and practical skills were introduced into six core courses required by the MA-Cons and MSc-Cons degree programmes, replacing pre-pandemic practical sessions. The kits mailed to students included reusable equipment, single-use PPE, and conservation materials, as well as samples to support offline assignments covering materials science, technology/manufacture, degradation mechanisms, preventive conservation (including mount making), and practical conservation treatment. To ensure safe working from home, staff submitted required risk assessments that were reviewed and authorised by both departmental and UCL faculty. Finally, given pandemic-related issues with supply chains and mail processing, there was a desire to minimise both the volume/maximum weight and variety of ordered materials included in kits. The multi-step organisation and creation of individual kits and dossiers were extraordinarily time consuming.

When it became clear that face-to-face instruction would not resume in January 2021 as expected, faculty quickly finalised and implemented additional remote teaching solutions for the following term, including the use of digital artefact dossiers as a replacement for analytical projects. The following discussion reviews offline learning activities developed for ARCL106: Conservation Materials Science, a core module in the MSc-Cons programme.

ARCL0106: CONSERVATION MATERIALS SCIENCE

The ARCL0106 module provides students with an understanding of material chemistry, properties, and structure, as interpreted through the lens of culture and instrumental analysis. Lectures focus on pre-industrial material technologies, material deterioration processes, and their relationships to the observed condition of objects. Prior to the pandemic, students implemented analytical research related to historical ceramic-repair materials using equipment in the UCL-IoA conservation and Wolfson Archaeological Science laboratories. Conducted in two phases (analytical proposal and analytical report), this coursework facilitated student learning around challenging-to-teach scientific threshold concepts, including the interpretation of analytical data within the context of historical conservation treatment materials, summarised in an analytical report (Murray, Anastassiades, and Hill 2017, 4–6). Through these projects, students built their experiential mental catalogue of artefacts and degraded repair materials typically encountered during treatment. Further, they developed skills related to proposing, implementing, and interpreting scientific research using a range of non-destructive (data collected in situ) and destructive (prepared sample required for analysis) instrumental techniques to analyse adhesive and loss compensation materials. These projects were designed to provide practical experience incorporating technical and non-technical information gleaned from the literature, existing documentation, and analytical data, whilst contributing to existing research at UCL (O'Grady 2017). When considered within the



ARCL0106 Conservation Materials Science

CERAMIC ACTIVITY: Assessment and description of ceramic sample characteristics and properties

STUDENT NAME		DATE	
SAMPLE/DESCRIPTION:			

BACKGROUND INFO determined using the literature

PRODUCTION METHOD:

Hand built	Mould/Cast	Wheel made
Give a brief description of the formation process for hand building manufacture.	*Give a brief description of the formation process for ceramic mould/cast manufacture.*	*Give a brief description of the formation process for wheel made manufacture.*

Physical features observable on sample:

What physical features visible on your ceramic sample suggest possible production method(s)?

MACROSTRUCTURE FEATURES determined by visual examination

TEXTURE:

Ceramics are composed of assemblages of minerals. The arrangement and size of the individual grains of these minerals give ceramics form or structure. Define this form/structure by considering shape, size, and arrangement of mineral grains including degree of grain contact and interlocking, as well as porosity, etc.

COLOUR:

The colour of the ceramic under investigation should be recorded using the Munsell® Rock Colour Chart. See a digital version published by the Geological Society of America (GSA): http://www.geo-village.eu/wp-content/uploads/2014/09/Rock-Colour-Chart.pdf

Most materials change colour when wet (lighter/darker), so record colour when wet and dry.

LUSTRE:

Is the surface characterized by lustre?

MICROSTRUCTURE FEATURES
Described via examination of thin section published in online resource.

IMAGE:

Include photo of sample thin section from online article or database. Examples include the following:
http://www.archaeometry.de/research/thin/
https://www.floridamuseum.ufl.edu/ceramiclab/galleries/common/
https://www.levantineceramics.org/

ARCL0106 Conservation Materials Science

PETROGRAPHIC CHARACTERISTICS:

Grain: types/compositions
Matrix/binding material: cement/interlocking grains
Porosity: open/closed, size/amount
Organization: homogeneous mix/layer arrangement

SUMMARY TESTS RESULTS conducted by student as part of ceramic activity

CHEMICAL TEST for CALCAREOUS MATERIAL (acid reaction):

See the ***Handout: Testing for Calcareous Materials***
Is there a reaction?
Calcite containing materials react with acids to evolve $CO_2(g)$: $CO_3^{2-}(s) + 2HCl(aq) \rightarrow CO_2(g) + H_2O(l) + 2Cl^-(aq)$
How accurate is this test for identifying calcite containing materials? Are there any complications related to interpretation? What can you do to confirm the evolution of $CO_2(g)$*?*

PHYSICAL PROPERTIES: HARDNESS

See the ***Handout: Testing Material Hardness***
Samples should be recorded using the Mohs scale as a qualitative reference.

PHYSICAL PROPERTIES: DENSITY

See the ***Handout: Testing Density***

WATER ABSORPTION BY TOTAL IMMERSION or POROSITY ASSESSMENT

See the ***Handout: Water Absorption by Total Immersion***

FURTHER ANALYSIS: (describe typical analyses of ceramics using the literature)

Which further analyses could be conducted on this ceramic sample? Which additional information would you collect using these methods?

APPLICATION TO CULTURAL HERITAGE determined using the literature

COMMON USES in relation to properties:

How are ceramic technologies commonly used in ancient or traditional cultures? Which type of artefacts are produced using ceramics? What functions do they serve?
How is this function related to ceramic material properties and attributes (workability, resistance, appearance, etc.)?

EXAMPLE OF USE:

Provide an example of ceramic materials used in monuments, museum objects, etc.
Insert photo(s).

Figure 1. ARCL0106: Conservation Materials Science summary worksheet developed for assessment and description of ceramic samples' characteristics and properties • Courtesy of Caitlin R. O'Grady

context of multiple lines of evidence, these data become more meaningful than when assessed on their own.

For the 2020–21 academic year, efforts to build these skills via remote platforms included several different types of offline learning, from documentation and data collection to interpretation of collected data. Using kit materials, students investigated physical, chemical, and mechanical properties of unglazed and glazed ceramic samples, as well as industrially produced and natural adhesives that were safe to use in home settings and did not require specialist equipment. These experiments provided students with experience in the execution of simple tests to assess material performance, documentation using USB microscopes, and data interpretation. They were also an opportunity to practise hand skills and techniques used in treatment and to investigate material properties. Each experiment isolates specific properties, enabling students to contextualise their results within the framework of conservation actions and decision making.

The digital artefact dossiers documented ceramics with historical repairs in the UCL-IoA and Petrie Museum of Egyptian Archaeology (PMEA) collections and included visible/ultraviolet (UV) light images and photomicrographs, as well as instrumental data. Students used this data along with extant collection records to propose analytical research related to the artefact's repair history.

Concepts and techniques learnt during these activities can be easily transferred to other cultural heritage and repair materials commonly encountered in conservation. Finally, these projects and results formed the basis of formally marked assignments throughout the year, providing students with the opportunity to further develop their skills in documenting and reporting analytical data to interpret cultural heritage artefact properties and their intervention histories.

Experiment 1: Properties of ceramics

For this experiment, students used bespoke activity sheets that collated research from the literature with experimental data investigating properties relevant to artefact assessment, conservation treatment, and decision making (Figure 1). This activity highlights the connections between ceramic manufacture, technology, and microstructure and material physical, chemical, and mechanical properties. Students were first asked to summarise various ceramic manufacturing techniques (hand building, moulding/casting, and wheel forming) and comment on typical physical features that help identify such methods (e.g., coil joins, mould lines, rilling, etc.). For each ceramic sample in their home kit, they were asked to describe observed features related to structure, texture, colour, and lustre, whilst referring to similar ceramic technologies that might be visible in petrographic thin section.

Students tested various physical and chemical properties of each sample, including hardness, density, water absorption by total immersion as an indication of porosity, and calcareous composition. Understanding these properties is integral for both future conservation treatment decision making and understanding past treatment decisions: hardness and density reflect artefact durability and firing temperature, whilst porosity is relevant for understanding interactions between the artefact and treatment intervention materials (solvents, adhesives, loss compensation materials, etc.). Finally, they tested ceramic samples for calcareous materials using acids typically found in the kitchen (citric and acetic acids) to comply with UCL risk assessments. Students documented their work and experimental results using USB microscopes and wrote descriptive summaries of their observations and conclusions.

Experiment 2: Properties of adhesives

This second series of experiments investigates properties of adhesives, which can be challenging to understand (Seymour 2012; Wei 2014). This activity focuses on understanding the role of physical, chemical, and mechanical properties of adhesive behaviour alone and in contact with substrate materials, whilst aiding understanding of criteria used in conservation decision making. Using bespoke activity sheets (like that in Figure 1) and experiments modified from previous publications (Seymour 2012, 48–50), students investigated natural and commercial polymer formulations. Selected adhesives that could be safely used in home settings in compliance with UCL risk assessments were chosen to introduce students to the breadth of products offered by a single company, whereby commercial names can be challenging to relate to chemical classes of adhesives and whose formulations shift over time. The following adhesives were tested: tapioca starch (amylose and amylopectin), UHU All Purpose (poly(vinyl acetate)) (UHU GmbH & Co. 2022a), UHU Hart (cellulose nitrate) (UHU GmbH & Co. 2022b), and UHU Stic (modified starch: amylose and amylopectin) (UHU GmbH & Co. 2022c).

Students conducted background literature research on adhesive chemical classes (natural and industrial polymers) with reference to their chemical structures and mechanisms of bond formation, as well as related physical and chemical properties (glass transition temperature, solubility, strength, etc.). Students then tested physical, chemical, and mechanical properties including adhesive film formation, wettability, and bond formation. Film-formation experiments required students to assess adhesives on porous (paper) and non-porous (Mylar) substrates to evaluate the importance of viscosity, speed of film formation, film transparency/translucency/opacity, bubble formation, and shrinkage. Wettability tests investigated the importance of adhesive contact angles and the role of substrate hydrophilicity/hydrophobicity. Bond-formation experiments compared tested adhesives by assessing their relative bond strength when applied to long-fibre Japanese tissue by documenting the degree of cohesive/adhesive failure in adhesive and substrate. Students were encouraged to evaluate the relationships between adhesive viscosity, curing time, and substrate penetration. As microchemical spot testing was not possible to conduct safely at home, students referred to the literature to describe tests used to identify the adhesives under study. Finally,

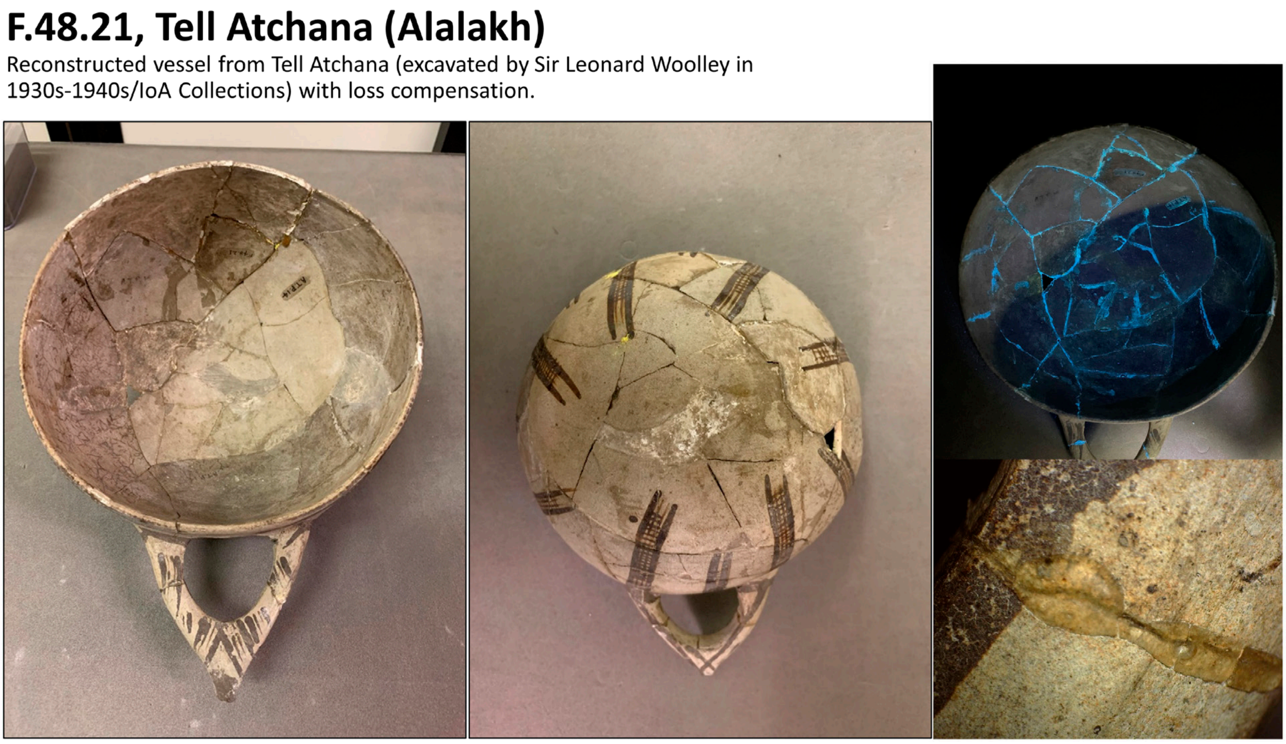


Figure 2. Example of digital artefact dossier information for UCL-IoA F.48.21, including images captured using visible and ultraviolet light, as well as micro-details • Courtesy of Caitlin R. O'Grady and UCL Institute of Archaeology

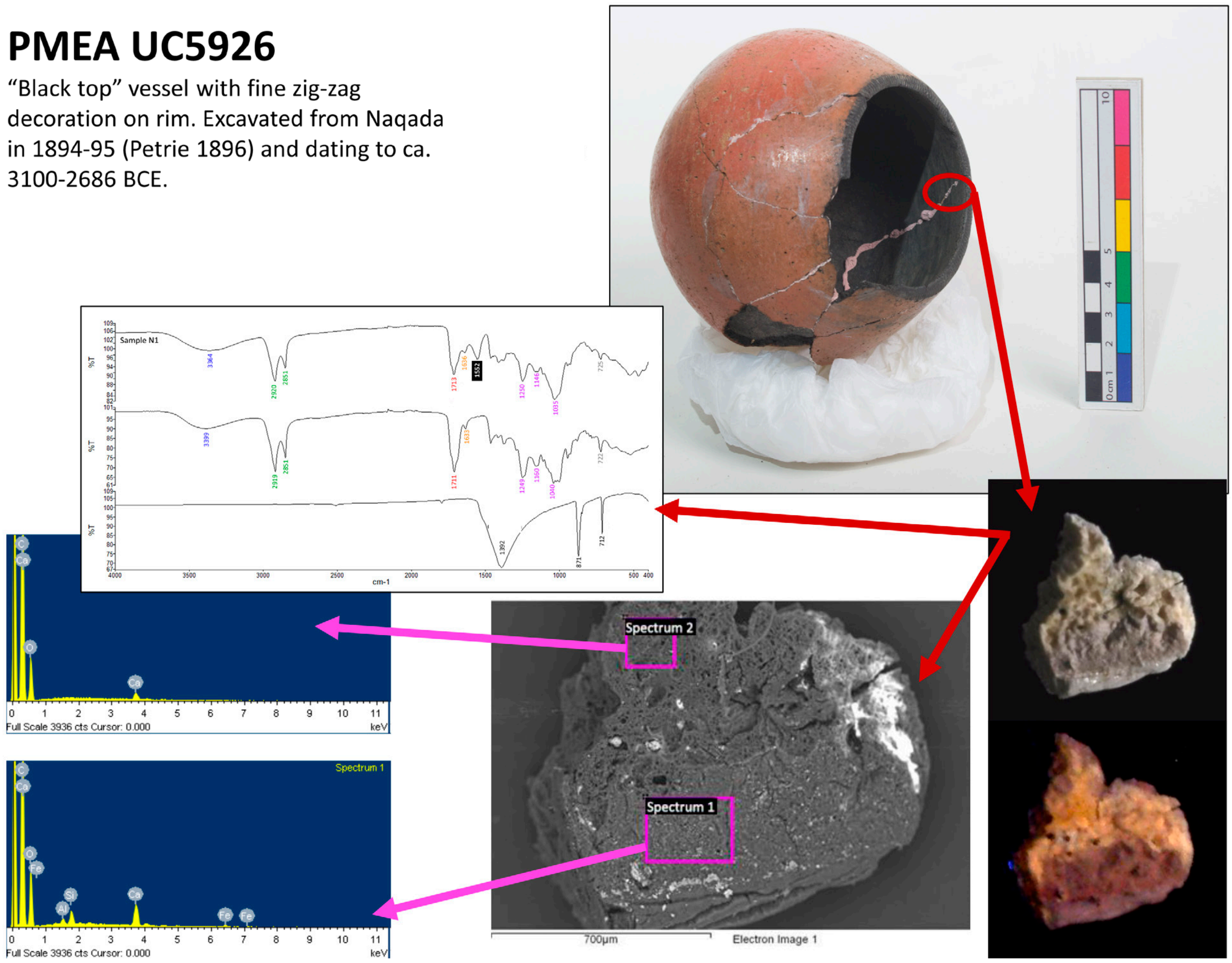


Figure 3. Example of digital artefact dossier for PMEA UC5926 related to SEM-EDS and FTIR analytical images and data collected for a sample of a bulked adhesive fill material • Courtesy of Caitlin R. O'Grady and UCL Petrie Museum of Egyptian Archaeology

they were asked to contextualise these samples within online conservation literature describing adhesive use, properties, and degradation. As with the ceramic experiments, students documented their work and experimental results using USB microscopes and written summaries of their collected data and conclusions.

Digital artefact dossiers: Analysing historical repair materials

Students were provided digital artefact dossiers to interpret scientific data collected from ceramics with historical repairs, including degraded polymeric adhesives and loss compensation materials (Figures 2 and 3). This activity built on skills developed in the previously described experiments, as well as other assignments — which are not described here — focused on the interpretation of portable X-ray fluorescence spectroscopy (pXRF), scanning electron microscopy with energy dispersive spectroscopy (SEM-EDS), and Fourier-transform infrared spectroscopy (FTIR) data collected from artefact repair materials. The dossiers included artefacts in the UCL-IoA and PMEA collections with extant archaeological documentation, minimal conservation information, evidence of past repair campaigns, and, most importantly, scientific data collected in previous years using UV autofluorescence, solubility testing, microchemical spot testing, pXRF, SEM-EDS, and FTIR. Utilising these data sets, students identified research questions and interpreted results related to historical repair materials, their period of application, related conservation decision making, and impact on overall collection stability. This project tests the student's ability to integrate scientific and non-technical data, as well as interpret multiple lines of evidence to create meaningful conclusions that extend beyond repair material identification. Students must consider how repair material selection and application method reflect the history of conservation with reference to research about the co-development of archaeology and conservation as disciplines, and related pedagogy at UCL (O'Grady 2017; 2022). Students submitted a summary report using data presented in the selected dossiers as part of their marked coursework.

UCL-IOA PANDEMIC TEACHING AND STUDENT FEEDBACK

Implementation of remote teaching during the pandemic required flexibility from all parties, as participants adapted to the new curricular activities and familiarised themselves with (often new) digital platforms for lectures, discussions, demonstrations, and one-on-one tutorials to discuss progress on assigned module activities. Whilst students readily engaged with the experiments and digital artefact dossiers, there were some concepts that remained difficult to understand. In particular, the concept of wettability and its implications for interactions with substrates was challenging. The use of prepared commercial adhesives made control of viscosity difficult and complicated interpreting results. Other difficulties arose from lack of physical access to the artefact described in the digital dossiers; students were unable to examine and handle the artefact or remove and prepare samples. Although students exercised critical thinking skills to assess multiple lines of evidence with access to visible/UV light images, magnified details, and analytical data, their inability to probe and test physical, chemical, and mechanical properties of the applied repair materials made it hard to connect with presented information. While assessments of this kind based solely on presented images and previously collected data do have important practical application, the connections were not immediately apparent to the students, a frustration likely heightened by larger pandemic-related worries.

In many cases, these challenges were magnified by varying internet speeds and bandwidth during scheduled activities. Like many other available options, Microsoft Teams, UCL's preferred digital platform, functions as a mechanism to support activities, as well as a repository for module materials, recorded lectures, digital chats, and communication. Despite these advantages, students and faculty found extended participation in remote teaching challenging, which necessitated the breakdown of lectures and activities into smaller sections to minimise fatigue, similar to observations made by other programmes (Pedersoli Jr. 2020, 7; Wharton, Delgado, and Golfomitsou 2021, 5).

Coordinating discussion using live-image capture of samples and demonstrations of specific actions or hand skills also proved difficult.

The effectiveness of prepared activities and learning outcomes was assessed weekly throughout the teaching term, as faculty engaged with students as a group during lectures and discussions and on an individual basis. Modifications to module materials, as well as development of additional resources, improved student retention of threshold concepts. With the small class size of five students, it was possible to discuss in a more synthetic fashion the individual challenges students encountered during assignments. This reflective practice required significant focused attention during a period already marked by extreme uncertainty about the future. However, the ability to teach from home where pets made frequent cameo appearances during interactions with students alleviated some of these stresses for both parties. Students enjoyed seeing my cats and their unpredictable antics, which relieved tensions surrounding discussion of the challenging scientific material.

CONCLUSION

The pandemic has fundamentally altered approaches to conservation education. Online teaching introduced during the pandemic has become integral to blended learning at UCL since the end of mandatory lockdowns. Products developed for remote instruction during the 2019–20 and 2020–21 academic years continue to be offered as part of the curriculum in modified formats. Their creation and subsequent refinement was time intensive and required substantial intellectual focus; their continued use represents a mixture of confidence in their effectiveness and an unwillingness to abandon them, even if they are not perfect. Some activities remain a part of home learning and assessment (artefact dossiers), whilst others are now implemented in the conservation laboratory (ceramics and adhesives experiments). While there is inherent flexibility offered by a mixture of online delivery and face-to-face instruction, its success requires both clear communication regarding activity goals and motivated students who are willing to engage with material in any context. Students from 2021–22 commented that interpreting analytical data was not a practical activity. Rather, they considered that using instrumentation to acquire data was a fundamental practical skill and felt cheated. Overcoming this significant barrier requires thoughtful consideration, particularly when considering student preconceptions about a conservator's work and frequency of hands-on engagement with artefacts, as well as practical versus theoretical activities.

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