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EDUCATION AND TRAINING
IN CONSERVATION

Using complexity to deliver standardised educational levels in conservation

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Abstract
Descriptions of conservation practice typically tend to focus on the range of activities undertaken by conservators and on the quality of the outcomes achieved. Using case studies, this paper examines the conservation tasks that can be explored within teaching, from undergraduate through to postgraduate level, and describes how these can be used to help practitioners effectively develop and achieve the competencies required in the sector. In higher education, the need to show this developmental framework explicitly, capturing progressive challenge in an auditable way when all of the students are doing 'conservation', is an increasing pressure. By setting out this progression in terms of complexity and using the language employed in education to describe an increasing sophistication in conservation practice the sector as a whole creates the opportunity to offer descriptions of the degree of sophistication of expert practitioners. This may be useful in workplace discussions, as colleagues sometimes struggle to understand the complexity underlying proficient practice.

INTRODUCTION: THE PRACTICE OF CONSERVATION

The qualities of a skilled and professional conservator are recognisable internationally. A professional conservator has a strong theoretical understanding of social values and of their duty to society and the protection and interpretation of cultural heritage. A conservator is able to deliver on their mission by having a sound understanding of the material and tangible properties of the cultural heritage materials on which they specialise. They combine that understanding with a conversation with owners, users or other stakeholders about the meanings and values embodied in a site, object or collection. The conservator combines all of this knowledge into an assessment of significance that underpins a conservation strategy and delivery.

Having understood the tangible and intangible values associated with their object and with the agreement of key actors, the conservator implements activities, preventive or interventive, to enhance the value of the object. Conservation is a broad discipline and professional practice may involve investigation, the removal or addition of materials, reducing instability, enhancing interpretation and ensuring a useful form of access. Conservators are also responsible for providing advice or taking action to help owners and other stakeholders to maximise the experience of the object whether now or in the future. This generic approach to professional practice is recognised in documents such as the CEN standard for the conservation process (BSI 2017) and applies universally regardless of specialism.

As professional conservators and educators, we aim to benchmark teaching against professional descriptions of practice. Indeed, the UK's professional body for the conservation profession highlights on their Conservation Training web page which courses teach to their Professional Standards (Icon 2020). Conservation teaching must therefore ensure a correlation with this scope and values-based competency framework.

LEVELS IN EUROPEAN HIGHER EDUCATION

Higher education degrees in Europe are defined across all disciplines by standardised levels that are expressed in terms of core words, attributes and forms of achievement, which are captured by qualification descriptors (Table 1). In the UK and in many countries in the world, conservation is taught at both undergraduate and postgraduate level. In Europe, the levels of these degrees are defined numerically, with levels 4–6 representing

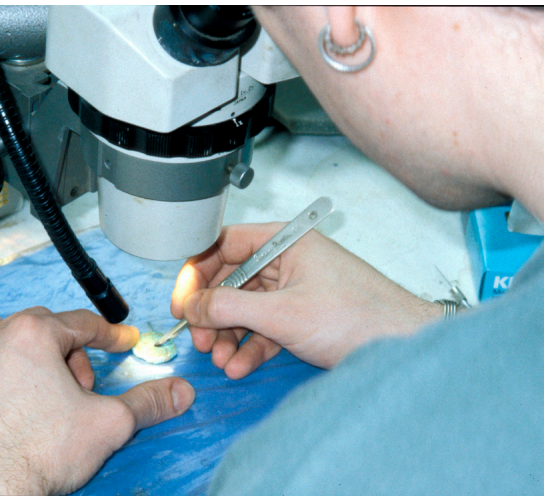

Figure 1. Microscopic cleaning of a coin

an undergraduate degree and level 7 a postgraduate one. Each of these numerical levels is standardised across the full range of academic and vocational qualifications, from architecture to zoology, and across many nations. Given their widescale adoption, they are not subject to negotiation.

> The fundamental premise of the UK frameworks for higher education qualifications is that qualifications are awarded on the basis of demonstrated achievement of outcomes (expressed in terms of knowledge, understanding and abilities) and attainment rather than on years of study. (QAA 2014)

Another critical factor in education in the UK is that the measure of attainment is not related to the complexity of the teaching offered, but to the complexity of the outcomes students are able to deliver. Although contact with staff, time in class and laboratory and self-directed learning are guided by universal measures of credits, simply attending these classes for a specific duration does not in itself entitle a student to a qualification. This outcomes-based approach to qualifications is well aligned with the UK's Institute of Conservation approach to defining conservation practice using a competency-based qualification framework.

Table 1. Keywords and phrases from Bloom's Taxonomy (revised version) and QAA (2014)

	Key phrases
Level 4	Knowledge of the underlying concepts and principles Evaluate the appropriateness of different approaches to solving problems
Level 5	Knowledge and critical understanding of well-established principles Understanding of the limits of their knowledge, and how this influences analyses and interpretations based on that knowledge
Level 6	Systematic understanding of key aspects, acquisition of coherent and detailed knowledge Appreciation of the uncertainty, ambiguity and limits of knowledge Frame appropriate questions to achieve a solution – or identify a range of solutions – to a problem Have the learning ability needed to undertake appropriate further training of a professional or equivalent nature
Level 7	Systematic understanding of knowledge and a critical awareness of current problems and/or new insights Deal with complex issues both systematically and creatively, show originality in tackling and solving problems

THE CHALLENGES

The combination of the universality of conservation practice and the need for distinctive levels of teaching in higher education leads to a challenge for conservation educators. If each conservation project, however simple, requires a universal approach, how can this be broken down into the four levels (4–7) defined within the UK Qualifications Framework? If a graduate from a UK undergraduate degree (level 6) can expect to gain employment as a practicing conservator, albeit in an entry-level role, what is different in their work from a master's (level 7) graduate? Can students undertake 'real' conservation in their first undergraduate year and, if so, how is it different from the 'real' conservation of subsequent levels? How can educators best build up conservation practice over the whole course of a degree, rather than confine new students in slightly barren theoretical

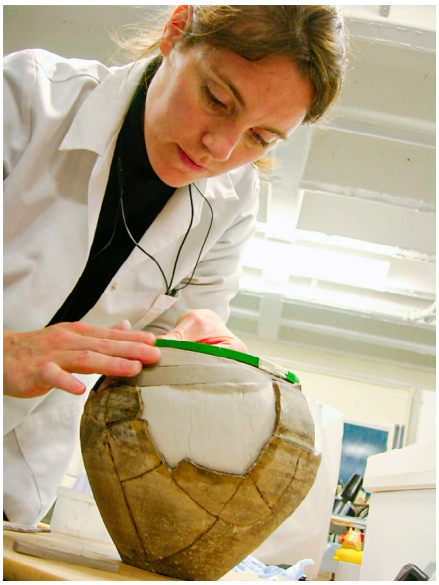

Figure 2. Gemma Aboe conserving ceramic

years with the occasional foray into repairing modern plant pots before unleashing the real objects at the final phase of study?

Within higher education, scrutiny of course quality and student progress are increasingly being undertaken for audit and accountability purposes by educators unfamiliar with a specific discipline. Considering this academic perspective, fellow educators can find it hard to accept that there is sufficient distinction in conservation teaching when students appear to be undertaking broadly similar tasks. These similarities are exactly those established elements of conservation practice and international standards: assessment, documentation, treatment strategy, treatment implementation, evaluation, etc. This inability to recognise the gradation from entry level to proficient may also be fed by a false elitism that undertaking tasks involving mechanical skills is in some way a lesser academic pursuit than more traditional essays and exams. Here, the effort and reflection embodied in a problem-based learning approach to skills development may not be easily recognised by the students themselves (Deslauriers et al. 2019) or those more used to measuring achievement in terms of the number of words written. It is hard for them to conceive of the fact that two students sitting at adjacent benches at the same time doing 'the same thing', i.e. conservation, can possibly be getting an education aligned with the different internationally agreed levels.

These problems also reflect the question of how increasing professional proficiency in conservation is described. As practising professionals, we are aware that conservators can increase proficiency to expert levels, whilst on the face of it they appear to be employed on the same task as entry-level colleagues. We believe that the complexity of the task in hand, rather than the specific task itself, underpins this proficiency and can be used to align holistic conservation practice with recognised educational levels and to measure progress throughout a professional career.

UK EDUCATIONAL LEVELS AND CONSERVATION PRACTICE

Some elements of a conservation task can be broken down for the most entry-level of conservation training. For a level 4 year of study (UG year 1), focussing on a surface clean or a simple analytical procedure may be sufficient. Level 4 typically asks for a student to be able to evaluate approaches to problems and solve problems, as well as be familiar with underlying concepts. However, by level 5 (UK undergraduate year 2) students are expected to be able to demonstrate knowledge and critical understanding of the well-established principles of their areas of study and 'use a range of established techniques to initiate and undertake critical analysis of information and to propose solutions to problems arising from that analysis'. Undertaking a disconnected series of conservation tasks is clearly not enough to match this level. In contrast, to match the levels and to prepare graduates for the reality of a career in conservation, students must address conservation challenges holistically, finding the connection between materials, significance and intervention.

When teaching across a range of levels, educators need to find a way to move students through zones of increasing developmental challenge,

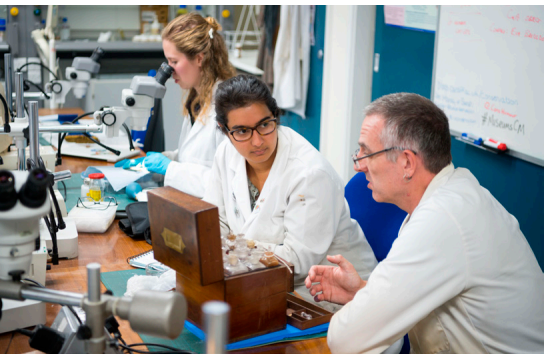

Figure 3. Teaching the conservation of an apothecary chest

match professional scope and fulfil national educational frameworks. In theory-led assessments, this is often done by modelling core words (Table 1) into teaching and assessment activities. For practical conservation projects, these levelling words are less helpful and more difficult to align with practical tasks.

PACR COMPLEXITY

At Cardiff University, conservation teaching is aligned with professional practice in several ways, but a critical tool for managing levels is the concept of complexity described in the Institute of Conservation's (Icon) Professional Accreditation of Conservator-Restorers (PACR) and the novice-to-expert scale from the same document (Icon 2018) that uses Dreyfus-inspired language and descriptors.

This introduces some of the variables that can be manipulated to manage the complexity of the conservation task, helping to take practical conservation challenges and align them with recognisable higher educational levels. The level of technical challenge might be represented by a difficult colour match or surface clean, and there can be complexity in the scale of a specific project, such as the master's student project led by Kristjana Vilhjálmsdóttir in 2018–19 to micro-excavate and stabilise over 3,000 fragments of mediaeval window glass. Complexity may be generated by a project requiring decisions with a range of possible outcomes, such as those involved in conserving a musical instrument that has the option of returning it to playing condition. Some treatments require the careful enactment of well-researched conservation methods, and others require the conception, testing and development of novel solutions.

Through years of teaching, the authors of this paper have observed that student learning is considerably strengthened by working on real objects. The sense of responsibility, connection to ethical frameworks in the cultural heritage sector and real consequences from outcomes requires a different approach than when working on mock-ups or props. Accordingly, as much teaching as possible takes cultural heritage materials as its focus. Teaching follows a problem-based learning (PBL) model (Lister 2000, Henderson 2016) in which students are presented with objects as a challenge and define both the problem and the solution with guidance from staff. The PBL approach by which students are given a whole conservation task with the guidance and supervision of staff is consistent across practical teaching. What varies is the complexity of the object (materials, scale, technical challenge), the options (multiple possible outcomes) and the uniqueness of the project (from well-worn to innovative).

A level 4 project can consist of a simple task such as the conservation of waterlogged leather, in which students are presented with a single material, a simple range of technical challenges, and well-established techniques and approaches (Ganiaris et al. 1982). At this level, students enact largely predetermined treatments, such as gentle mechanical cleaning with soft tools under magnification, and grapple with basic but fundamental concepts such as how clean 'clean' is and how to know when to stop. Interaction with stakeholders is limited to following a set of instructions from owners

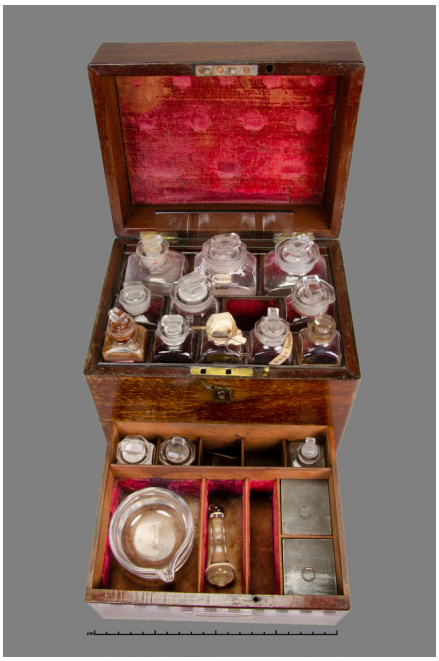

Figure 4. Apothecary chest demonstrating the inherent complexity of the object

and studying the generic needs of archaeological researchers. With the implementation and supervision of simple chemical cleaning techniques there is a very moderate risk of failure. A level 5 practice may involve a single substrate with one or two types of contaminant and a well-established approach to conservation. In these cases, there are usually 'answers' to look for on how others have conserved a similar material as well as publicly available appraisals of well-rehearsed options. Students must evaluate them critically and apply them to their task in hand. In contrast, a level 7 object (master's level practice) may embody much more technical complexity requiring the development of new techniques or methods. Students are expected to operate systematically, showing a critical awareness of the published data, and, in the face of possibly incomplete information in the literature, be able to create a tailor-made solution for their object. Although the examples illustrated in this paper refer to practice, complexity may also arise from issues related to contested histories, clients with requests that the student finds ethically challenging or significant challenges for long-term care related to the post-conservation use or environment.

CASE STUDIES

The following case studies develop these concepts with specific examples.

Level 5 object

Appraise, argue, defend, judge, select, support, value, evaluate

The university has worked with a local museum for several years on a large-scale project to remove old adhesive from one side of a large group of coins. Unfortunately, a past curator had applied an inappropriate adhesive to the coins in order to attach them to a display board, resulting in differential corrosion on the front and back, adhesive residues and attachment of fibres from the backing support. Coin tend to be made of a single material, but their composition can be more complex than it appears at first glance. Copper-alloy coins can have surface enrichment or coatings, or what appears to be copper alloy can be a debased silver coin. Students must confirm composition by research and analysis before they can proceed with a treatment strategy. The options for treatment are limited and established but come with higher degrees of jeopardy. The wrong tool or approach can gouge a surface or remove a coating. These projects require students to 'use a range of established techniques' but also to 'undertake critical analysis of information, and to propose solutions to problems arising from that analysis'. Students are also expected to offer reflection on the limits of their own skills: for example, a student evaluation that states 'the scalpel gouged the coin' will attract a much lower mark in assessment than a student expressing a comment such as 'because I chose the wrong tool and tried to hurry the process, I gouged the coin'.

Level 6 object

Assemble, construct, create, design, develop, formulate, write

A common challenge in archaeological and objects conservation is a ceramic that has suffered multiple breaks and repairs. These different

periods of intervention may have different aesthetic finishes, materials and value in the history of the object. The conservator must decide whether the old repairs should be removed or retained and establish the criteria to be used to evaluate this decision. This requires the student to deploy 'accurately established techniques of analysis and enquiry' to construct a decision-making framework and evaluate the specifics of their object against that framework, balancing dissimilar concepts such as aesthetics, stability, finish and significance. The conservator must exhibit a 'systematic understanding of key aspects of their field of study' and be able to acquire 'coherent and detailed knowledge, at least some of which is at, or informed by, the forefront of defined aspects of a discipline', showing their ability 'to make judgements, and to frame appropriate questions to achieve a solution'. By this level, a student is expected to offer mature reflections in and on their practice (Manti et al. 2011), detailing the strengths and weaknesses of their approach and the research and development they had to undertake to deliver the outcomes.

Level 7 object

At master's level, UK students are expected to show 'a systematic understanding of knowledge, and a critical awareness of current problems and/or new insights, much of which is at, or informed by, the forefront of their academic discipline'. To allow students to demonstrate this, they are assigned objects that embody significant challenges for which there is no established route to follow. An apothecary chest from a pharmacy collection based at Cardiff University, treated by Aly Singh, illustrates a level 7 object. This multidimensional object contained a wide range of materials, some easily identifiable, such as glass and wood, and others unknown or obscure, such as the contents of the containers listed with descriptors such as 'Black Lozenges' or 'Gregory's Powder'. The object had a role to play in illustrating a technical history of Pharmacy and therefore there was no automatic need or desire to remove all traces of the contents, so the decision on how to respond to the contents of the containers was complex. The object was a working object, a tool of someone's trade, and had been used and adapted in use, including some identifiable replacement elements. The conservator therefore had to evaluate the nature of the object over several phases – construction, use and collection – and correlate individual components against this whilst risk assessing against hazards. A goal for conservation was defined in consultation with stakeholders and consideration given to how it could be interacted with in the future. The project included technical and non-technical information supplied to the owners to ensure that the contents could be interacted with safely for both users and object. There was no model for the student to follow; instead, she had to 'act autonomously in planning and implementing tasks at a professional … level'.

PREPARED FOR THE PROFESSION?

Even with excellent training combined with personal reflection and summer/volunteer workplace experience, a recent conservation graduate will not have the level of skills and maturity offered by experienced professionals (Table 2).

Table 2. Excerpt from Icon's novice-to-expert scale (Icon 2018)

	Knowledge	Coping with complexity
Novice	Minimal or 'textbook' knowledge without connecting it to practice	Little or no conception of dealing with complexity
Beginner	Working knowledge of key aspects of practice	Appreciates complex situations but only able to achieve partial resolution
Competent	Good working and background knowledge of area of practice	Copes with complex situations through deliberate analysis and planning
Proficient	Depth of understanding of discipline and area of practice	Deals with complex situations holistically, more confident decision-making
Expert	Authoritative knowledge of discipline and deep tacit understanding across area of practice	Holistic grasp of complex situations, moves between intuitive and analytical approaches with ease

Some within the profession have identified this skills gap as problematic. With the marketisation of education, concentrating large numbers of students in lecture theatres is economically more rewarding than laboratory-based teaching, so there are financial pressures to move in this direction. Even in the situation where teaching staff invest in time and resource-intensive practical training, a recent graduate cannot be expected to operate at the higher levels of practice. Whilst a well-trained graduate can work on complex items, delivering complicated practical outcomes as defined by the Icon measure of complexity (Table 3), their work results from deliberate analysis and planning and follows periods of intensive research and evaluation of a broad range of options.

Table 3. Examples of typical complex conservation problems (Icon 2018)

1. Require choices between options which lead to significantly different outcomes.
2. Present dilemmas and value-conflicts or require significant value-judgements.
3. Present substantial technical problems, for instance in relation to unstable or degraded materials or the level of risk associated with treatments or strategies.
4. Require a deep level of practical understanding to be applied to the situation.
5. Require the marshalling and management of a wide range of resources.

The intuitive, fluid decision-making that embodies real expertise (Icon 2018) takes hundreds of hours of repeated experiences and reflection to achieve. We cannot unlearn what we already know, and it is therefore nearly impossible for experienced professionals to fully remember what it was like not to know how to make a micro-manipulation to achieve a perfect surface finish or to be able to identify a very short list of appropriate options for a treatment following a condensed period of investigation. Therefore, conservation education must extend well beyond the formal training phase, with internships and recognition of the requirements of entry-level jobs playing an important role. The task of bringing forward the next generation of conservators is a shared one and must go much further than the initial period of education.

The setting of complex tasks to students is part of the pedagogic skills of the educator. Educators aim to create 'zones of proximal development' (Harland 2003) where students are guided through a challenge by being asked to undertake a task that is more demanding than the previous one but realistically attainable. Educators must, however, look beyond their own actions when measuring competence. The competence of a student is measured by their ability to undertake such a task (Henderson and Parkes

2017). Professionals wishing to understand the competence of students from any programme would be well advised to review the nature of the assessments set and the assessment criteria to assure themselves that students have not only faced complexity but have responded competently.

CONCLUSION

Teaching simultaneously across a range of levels in higher education is possible, and one way of approaching this task is to use the complexity of the object (or problem) to differentiate between the learning outcomes at the different levels. The method does require individual guidance and input from the teacher to structure the learning, but the benefits of PBL in this context remain an effective way of student learning. Linking learning outcomes to professional accreditation levels such as the Icon novice-to-expert scale brings benefits for the wider conservation profession.

Defining the language of progression is helpful to those struggling in work to get their qualities recognised. In many countries, conservators question the relatively low salary levels in the heritage sector associated with postgraduate admission requirements. By mastering the language of increasing complexity developed in the educational sector, it is possible not only to map progression through education, but to have the vocabulary to map progression through the profession. This is a useful addition to the toolkit of professional conservators struggling to receive recognition similar to that of other employees for the professional level at which they are operating when outside observers dismiss their role as mere technicians because they work with their hands.

The international conservation profession has yet to decide whether the sector should restrict the level of entry (undergraduate/postgraduate) for professional practice. In some countries, this is subject to social norms with many exceptions. In others, the State carefully regulates the route to public sector conservation work. If undergraduate level work is a route into the profession, then its scope must match professional standards whilst respecting the distinct challenges that each of these types of degree is meant to embody.

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