

The Medicine Cabinet

A Multi-Dimensional Learning-Resource Matrix for Curricular Education

MHC EdTech Testbed no. 5. Tenth draft, HH 28/02/2022



Introduction

This document outlines another component of an interlocking set of DiSc Lab pilot projects which bring together academic expertise from across the four Divisions of the University, materials from across the full range of GLAM institutions, and technical expertise from in and outside the University to pursue a series of inter-related objectives.

The specific objective of this project is to pilot the transformation of Cabinet - Oxford's rapidly developing platform for teaching with objects and images - from a resource restricted to university-level teaching into a multi-dimensional matrix of learning resources capable of serving secondary as well as tertiary education.

More specifically still, the project will foster curriculum-driven learning by working with schoolteachers to craft materials adapted to delivering established GCSE-level curricula.

- First, the project will harvest materials from collections in Medical Sciences, the Botanical Garden, the Pitt-Rivers Museum, the Ashmolean, and elsewhere.
- It then will transform those collections into materials for teaching a network of topics to students at the introductory, intermediate, and advanced undergraduate levels and the taught postgraduate level.
- Third, it will create a further set of materials targeting existing syllabi at the GCSE level.
- Fourth, it will link the GCSE and introductory, intermediate, and advanced UG materials together to create vertical as well as horizontal pathways through curricula at multiple levels.
- Fifth, it will test and refine the educational materials themselves and the user experience of navigating the various levels through feedback from schoolteachers responsible for those syllabi and students at various levels.

- Sixth, it will develop a B to B business plan based on profit-sharing with commercial textbook publishers.
- This provides the matrix, finally, for further experimentation with enriched storytelling capabilities in an open digital platform to co-create and utilise the research-cloud, AI, data science environments and digital humanities best practices.

This test bed proposal is supported by the pump-priming funding of the [Oxford-Singapore Human-Machine Collaboration Programme \(HMC\)](#) - Innovation Pillar - [Test Bed Portfolio](#). It is utilising the innovation ecosystem development budget line which supports pilots, test beds, proof-of-concepts in collaborative platform development. The test bed enables cloud-based data lake establishment and cross-departmental/cross-divisional, Oxford lab-driven research collaborations. The funding for this test bed will be transferred from the MPLS OX-SG HMC holding pot to the History Faculty. ([£25,000 for the 15 February 2022 - 31 May 2022 delivery period](#)).

Motivation

Levelling up education

Perhaps the greatest challenge confronting education in the UK is levelling up educational provision. The highly stratified system of private education has created a sharply tilted playing field which compounds the barriers confronting students from disadvantaged backgrounds. Universities can help level this playing field by creating simplified versions of their own next-generation undergraduate teaching resources for use in the upper years of secondary school (in the UK: GCSE and A-Level). Such materials can also be used to address educational disparities in the global south, in the first instance via English-language secondary-school teaching worldwide. This project pilots technical infrastructure for meeting this goal.

Meeting the challenge of Access

For Oxford and other elite universities, the analogous challenge is one of Access.¹ Oxford, famously, recruits students disproportionately from privileged backgrounds. The University's Strategic Plan is committed to recruiting a student body more representative of the general population. One key part of this agenda is to 'raise attainment in schools', particularly those which do not benefit from extra private educational spending. The high-quality GCSE-level educational materials generated by this project will assist this goal. Another key part is to inspire young people with the thought that they could thrive in the Oxford environment. Linking GCSE-level material to UG-level material will assist this goal by exposing curious and inquiring young people from whatever background to highly engaging learning materials developed in Oxford from Oxford collections for the use of Oxford

¹ O'Sullivan, K, Robson, J, Winters, N (2019) "'I feel like I have a disadvantage': how socio-economically disadvantaged students make the decision to study at a prestigious university", *Studies in Higher Education*. Taylor and Francis. DOI: <http://doi.org/10.1080/03075079.2018.1460591>

students. This project therefore represents a fresh and cost-effective approach to meeting this key challenge.

Enhancing curriculum-driven learning

The standard measure for 'attainment in schools' is examination performance. One means of raising examination performance is enhanced material for curricular study. This means targeting the 'surviving needs' of students and teachers: accelerating their mastery of the curriculum is a means to an end.

Putting teachers first: a B2B proposition

The primary target for curriculum-driven teaching is the teacher, not the student. If the teacher is not attracted to our resources, they will not direct the student to use them. If instructed to use them, the student will do so provided that they are better than the wretched ones otherwise available. At this level, The Medicine Cabinet represents a B to B business model because it targets teaching professionals and the institutions in which they operate. It is also B to B in proposing a partnership with textbook publishers (below).

Demonstrating the value of the humanities

The public value of the university as an institution is under attack across the Western world. All disciplines need new ways to demonstrate their value to sceptical publics and politicians. A third motivation for this project is to help showcase the quality of university teaching by refashioning UG teaching materials for use at the school level and in heritage institutions.

Goals

The central goal of this Edtech testbed is to create the crucial precondition for attaining all these objectives: namely, devising an infrastructure for vertical pathways through material on many different educational levels - from GCSE and A-Level through undergraduate and taught post-graduate - as well as horizontal pathways at each of these educational levels.

In other words, this project aims to pilot the creation of multi-dimensional networks of curated pathways through an increasingly dense matrix of material on Cabinet.

Piloting means of achieving these goals will require work at three different levels.

Content creation

Content creation will take place through three basic steps:

- First, we will identify points of intersection between networks of 'star content' on Cabinet aimed at Oxford undergraduates and existing GCSE and A-Level curricula.
- Second, we will develop expositions of that 'star content' at multiple different levels, including those suitable for school use.
- Third, we will link the school-level material to the university-level material.

In this way, intellectually ambitious students from under-privileged and non-traditional backgrounds will be drawn to explore university-level material in their subjects and encouraged to think that they might thrive in an elite university environment.

Platform development

Platform development will then reconsider how Cabinet could be overhauled to facilitate the creation of vertical pathways through treatments of a given curricular topic at multiple educational levels as well as horizontal pathways through the material at any given level. Relevant steps include:

- Gather examples of technology relevant to the challenge of curriculum-driven learning.
- Study and eliminate difficulties in multi-level content creation and integration.
- Study user interaction with vertically organised materials and optimise navigational aids through the three-dimensional matrix.
- Consider how content creation and navigation could be further enhanced through the use of AI, ML, XR, data lakes, etc.
- Consider the need for different visual presentation and interaction of material at different educational levels.
- Consider best means of training new contributors in devising curricular materials operating at multiple educational levels.
- Address social issues of economic inequalities, language issues, geographical access.
- Begin generating proposals for further funding necessary to scale the content creation as well as platform development once proof-of-concept has been achieved.

Business model: the search for an appropriate model as a major research outcome

From a business standpoint, the obvious business model for this service may appear to be a password-protected B2C subscription model. But this obvious solution is vulnerable to two fatal objections.

1. One issue relates to the ‘customers’. A pay-per-view or subscription model is contrary to the fundamental goal of ‘levelling up’ an educational system severely skewed in favour of the privately-educated children of prosperous parents. We cannot address that challenge if we are charging students or schools to access these digital resources.
2. The other issue relates to the ‘content providers’. Academic experts routinely contribute their expertise for free, or nearly for free, provided that that expertise is also given away for free. If a service provider is extracting profit in order to distribute their material to fee-paying users, then the content providers will demand a share of these profits and the resulting transaction becomes commercial rather than altruistic. The economics of this project depends entirely on highly educated world-experts giving away the best of what they have, not for the kind of *per diem* which

a top lawyer or consultant would charge, but for free. If we undermine that principle, the whole value-generation chain collapses. That is why this problem *has* to remain deeply rooted in academic values and institutions: otherwise, we kill the goose who lays the golden egg and will produce nothing whatsoever. This is precisely why this method of generating academic value has not been attempted already. Analysts schools in conventional economics fail to understand that brilliant academics are not motivated primarily by financial incentives. If they were, they would not be academics: they would apply their big brains and punishing work ethics to something more profitable. To understand where the value is generated, you need to set aside established economic orthodoxy, think like an academic, and banish the profit motive from the core of this project.

Acknowledging the strength of these two objections does not require us to banish the profit motive entirely from this project. It merely requires that profit cannot be harvested *directly from the educational end user*: it must come from somewhere else. Profit may need to be generated somewhere, to sustain systems and the growth of content, but it must come from elsewhere.

We therefore propose to make the search for an appropriate business model one of the main research outcomes of this testbed. Rather than beginning from the position that we know what the business model will be, we acknowledge at the outset that we do not know. Our first task is therefore to establish the parameters of an adequate business model. Our second is to study all the alternatives to find one or more ways of financing exponential growth and sustaining the project at scale.

The outcome may involve developing multiple business models to fund various aspects of this enterprise. For instance, one promising solution is a B2B partnership with a major publisher of textbooks for the relevant syllabi. Cabinet can offer the publisher a brand new value proposition: namely, the opportunity to link traditional, copyrighted commercial textbooks, in hard-copy and digital form, out to a steadily accumulating set of open-access, highly visual, interactive, and innovative digital materials on Cabinet. The offer of a unique partnership with Cabinet will increase the value of the copyrighted, commercial materials; and in exchange Cabinet should receive a share of the increased proceeds. The OUP is the obvious partner with which to explore this proposition. Additional business models will also be explored.

Operational model

Define the operational model for a password protected subscription model, with different levels of access to curated materials in a dynamic web application. E-marketplace capabilities to create profiles, course structure with vertical and horizontal multimedia and collaboration process building blocks, import/export processes. Integration with online education platforms via APIs to Canvas, Weblearn, Google Classroom, etc.

Research scope

Thematic focus

The thematic focus of this testbed is designed to complement the other proposals in this package of intersecting DiSc Labs: namely, the focus on broad themes central to the human condition and therefore to work across the University and its collections.

Disease and death are defining aspects of the human condition. Preserving health, combating illness, and postponing death are therefore central to every culture. This vast arena for pan-historical study and cross-cultural comparison merits greater centrality to formal study and public engagement with the humanities. This is partly because it is amongst the most physical of subjects, requiring the capacity to engage with physical objects in more than two dimensions, and with sequences of images over time. Like any really universal subject, it is also far too large for any one museum, library, centre, or university to cover alone. What is needed is an open-access platform on which an interdisciplinary scholarly community can collaborate in assembling dispersed material from far and wide in two, three and four dimensions, and shaping it into multiple pathways at multiple different educational levels. Our immediate intended outcome is to pilot means of populating such a platform.

Target curricula: History of Medicine, 1000-2000 at GCSE level

Two courses provide opportunities for grounding the project in established GCSE -level curricula.

1. The better of the two is the AQA course on '[Health and the People: c1000 to the Present Day](#)'.

Medieval and early modern topics include

Part one: Medicine stands still

- Medieval medicine: approaches including natural, supernatural, ideas of Hippocratic and Galenic methods and treatments; the medieval doctor; training, beliefs about cause of illness.
- Medical progress: the contribution of Christianity to medical progress and treatment; hospitals; the nature and importance of Islamic medicine and surgery; surgery in medieval times, ideas and techniques.
- Public health in the Middle Ages: towns and monasteries; the Black Death in Britain, beliefs about its causes, treatment and prevention.

Part two: The beginnings of change

- The impact of the Renaissance on Britain: challenge to medical authority in anatomy, physiology and surgery; the work of Vesalius, Paré, William Harvey; opposition to change.
- Dealing with disease: traditional and new methods of treatments; quackery; methods of treating disease; plague; the growth of hospitals; changes to the training and status of surgeons and physicians; the work of John Hunter.
- Prevention of disease: inoculation; Edward Jenner, vaccination and opposition to change.

Some very uninspiring teaching resources are available from [School History](#) and [TES](#) as well as textbooks and revision guides from [HodderEducation](#), [AQA](#), and [Pearson](#). Given this level of competition, it should not be that difficult to get these firms bidding for collaboration with Cabinet.

2. The second course, overlapping significantly with the first is Pearson / Edexcel's [Medicine Through Time, c1250-Present](#).
 - The basic existing **textbook** is [here](#): Partnering with the publisher to create further work of this kind is a potential sustainability strategy.
 - Basic syllabus is outlined in a PDF available [here](#).
 - **Further guidance** is available [here](#).
 - Some **introductory videos** from the BBC on the main topics are available [here](#). Breathless, childish, and historiographically extremely crude.

Specific focus: anatomy and botany

In order to produce really high-quality materials, this test-bed will focus some (although not all) of its attention on more specific topics particularly well suited to illustrating the benefits of this approach: namely [anatomy and botany](#). These foci are particularly well-adapted to developing very high-quality materials on Cabinet for topics such as the following:

- **Anatomical engravings.** Andreas Vesalius [On the Fabric of the Human Body](#) (1543): a lavishly illustrated book of 1543 which represents a major landmark in the history of science and medicine and also of printing. Interactive or animated versions of this material could be very engaging for young people. All manner of interesting things could be done with this fabulous book.
- **Anatomical models.** Material from the special collections of the Medical Sciences Division can be deployed for this purpose. An example is [here](#).
- **Anatomical discoveries.** William Harvey [On the Motion of the Heart](#) (1628): another huge landmark, the greatest in the history of English medicine in this period. A classic video can be rendered far more useful for teaching purposes with a little work.
- **Anatomy theatres.** The transition from [medieval anatomical practices](#) to modern ones was immensely facilitated by the invention of permanent [anatomy theatres](#) as sites of scientific investigation and also [collecting](#). A particularly intriguing possibility would be to use Oxford's very close relationship with Padua to obtain a 3D panorama of the interior of the first permanent anatomy theatre opened there in 1595.
- **Botanical gardens.** Oxford's Botanical Garden (founded 1621) was originally called the 'Physick Garden'. That is to say, its original purpose was to study plants from which medicine could be derived. The same goes for the oldest university botanical gardens in the world: they were attached to the leading medical faculties in Pisa and Padua. Since these collections amassed plants from all over the world, this topic expands the history of medicine to a global scope. The single most advanced material on Cabinet currently is a [monograph-length discussion](#) of how one of the most lavishly illustrated books published by the early OUP emerged from the collection of Herbaria (dried plant specimens)

originating in the Botanical Garden. This presents us with an idea opportunity for devising an entire hierarchy of educational materials on this topic, from GCSE and A-level via [introductory](#), [intermediate](#) and [advanced undergraduate](#) to taught [post-graduate level](#). This is very important for redesigning the core system of Cabinet and demonstrating its capacity to serve multiple educational levels.

Activities, Owners, Schedule

Provisional task list

1. Scoping (Feb 2022)
 - a. Identify points of contact between GCSE and UG curricula
 - b. Identify items relevant to those points of contact
 - i. In Oxford collections
 - ii. In collections elsewhere
 - c. Select most innovative and arresting means of dealing with each object
 - d. Identify ready-made materials relevant to those points of contact
 - e. Identify specialists capable of producing authoritative commentaries on selected materials
 - f. Identify pathway to schoolteachers needed for focus groups
 - g. Identify the underlying technical requirements (e.g. metadata to enable verticalization of learning content/data science/machine learning)
 - h. Identify technical specialists needed for delivering 1.c and 1.g
2. Recruiting and commissioning
 - a. Commission imaging and image processing for prioritized objects (1.c)
 - b. Recruit and brief selected academic specialists on those objects (1.e)
 - c. Recruit schoolteachers for focus-group feedback on material produced (1.f)
3. Create and test content (March 2022)
 - a. Advise specialists (2.b) in developing commentary on each point of contact at multiple different educational levels
 - b. Merge images and commentary on Cabinet
 - c. Present draft material to schoolteachers (2.c) for feedback
 - d. Revise draft material in response to feedback
4. Planning (March-April 2022)
 - a. Reconceive Cabinet platform to facilitate multi-dimensional matrices of intersecting pathways:
 - i. Horizontal pathways through material for a specific educational level;
 - ii. Vertical pathways for related topics at multiple educational levels.
 - b. Revised guidelines for best practice for dealing with multi-level topics in line with feedback from teachers
 - c. Document other lessons learned for future reference
5. Testing (May 2022)

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- a. Create a demo with the AWS developer tools (similar to the Coin project 5-10 days of solution architect development)
 - b. Review the Cabinet platform readiness level: alpha/beta, what can be ready for launch to demonstrate the test bed concept. Utilise the help of AWS solutions architect (Master Builder Programme and/or Oxford solutions architect team).
 - c. Test runs with the Education and Continuing Education academic collaborators for feedback and skills development.
 - d. Quality check, bug fixing, opportunities for improvement
6. Evaluation (May 2022)
- a. Standard building blocks (containerisation)
 - b. Process evaluation: user-friendly, privacy, redesign, storage and comoute need
 - c. Optimisation suggestions for the operational model.
 - d. Rewards for collaborators.
 - e. Writing up the final report of the test bed.

Justification of resources

Co-PI: Professor [Erica Charters](#), Professor of the Global History of Medicine, Wellcome Unit for the History of Medicine, History Faculty (Humanities Division).

Role: coordination of academic content in the history of medicine. **Participation confirmed**

Co-PI: Prof [Howard Hotson](#), Professor of Early Modern Intellectual History (History Faculty) and Academic Director, Digital Scholarship @ Oxford (Humanities Division).

Role: Proposal formulation; design of multi-level educational matrix; liaison with DiSc and HMC Edtech testbed series. **Participation confirmed**

Co-I: Professor [Zoltán Molnár](#), Professor of Developmental Neuroscience, and head of the [History of Medical Sciences Project](#). **Role:** liaison with special collections and historical expertise from the Medical Sciences Division. **Participation confirmed**

Co-I: Dr [Stephen Harris](#), Professor, Plant Sciences (MPLS) and Druce Curator of the Oxford University Herbaria (GLAM). **Role:** developing the botanical pathway through this material. **Participation confirmed**

Co-I: Dr [James Robson](#), Co-Director of the Centre for Skills, Knowledge, and Organisational Performance, Lecturer in Tertiary Education Systems, director of the MSc in Higher Education (Education: Social Sciences). **Role:** To inform the testbed with ongoing research on the challenge of access to prestigious universities by disadvantaged students (see footnote 1 above) **P Participation confirmed**

Co-I: [Caroline Williams](#), Director, Open Executive Education, Saïd Business School, University of Oxford. **Role:** to help explore business models. **Participation confirmed.**

Other participants (optional: tbc):

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- [Sophie Goldesworthy](#), Director of Content Strategy and Acquisition at Oxford University, Oxford University Press. **Role:** to consider potential business plan with the OUP
- [Dominik Lukes](#), Assistive Technology Officer, Centre for Teaching and Learning, University of Oxford. **Role:** to consider alternative business models
- Dr [Christopher Morton](#), Head of Research, Curator of Photograph and Manuscript Collections, Pitt-Rivers Museum (GLAM) and Lecturer in Visual and Material Anthropology (Social Sciences Division)
- Dr [Paola Esposito](#), Departmental Lecturer in Medical Anthropology (Social Sciences)

Staff cost: For senior researchers, research assistants £8000

Professional services provider for application development, AI/ML, user experience, £7,000

Technical support from GLAM IT (for AWS cloud and ML tool demonstration), IT Services (e.g. Oxford XR Hub for photogrammetry), contractors (e.g. Cloud Mantra or Cirrus HQ who worked with GLAM IT already), £5000

AWS cloud provision and solution architect support (e.g. James Grant) £5000

Total: £25,000.

Outcomes and Impact

Concrete outcomes

Concrete outcomes of this testbed project will include

1. A core set of high-quality *educational materials* arranged vertically, to link curricular material on closely related topics at every educational level from GCSE via introductory, intermediate, and advanced undergraduate, to taught post-graduate.
2. Well-developed architecture for navigating vertically between material at different levels as well as horizontally between materials at the same educational level.
3. The report of a *testing process*, assessing the response of GCSE-level teachers the pilot educational materials and navigational aids described above, including specific proposals for refining content, presentation, and user experience at a further project stage.
4. Specific *proposals for scaling up* this approach by prioritizing areas for further content creation and technical development.
5. The outline of a *business plan* for multi-level curriculum-driven educational materials, beginning with a proposal to join forces with a major publisher of GCSE-level textbooks.

Digital platform outcomes - the FACE value (Herbert 2017, p. 95)

- **Fast:** Can the platform perform its functions quickly, and can your staff customize, change, or upgrade it quickly when needed?

- **Accessible:** Is the platform easy to use by all parties - external and internal? Do you have to have specialist training or technical skills to perform basic functions?
- **Clever:** Is the platform capable of reliably collecting and analysing data to produce insights and outputs that are consistent and actionable?
- **Extendible:** Is the platform capable of connecting to relevant systems, devices, and networks, with the capacity to add more as needed?

Impact

To generate impact by experimenting with new technology, adopting iterative working styles and feeling comfortable collaborating with people with different skills sets, levels of seniority, or partner organizations, we need to make it very clear how the employees will be supported and encouraged along the way. How do I access equipment? How do I find developers or designers? How do I get training? How do we get customers for customer testing? How do I engage with external specialists and companies? To answer these questions, there are two categories of support to consider: authorization and access.

Authorization is about permission to work with others and the recognition people will get if collaboration efforts are successful. Access is about the tools, assets, and resources that are available to them, should they be required. Once both parts are complete, you'll have provided incentive for people to come together and work collaboratively, vastly increasing the number of external changes and variables they'll be able to handle.

1. **Authorization:** Permission and recognition for collaboration. To establish authorization for innovative working, you need to formalize approval of cross-departmental work, simplify processes for working with external parties, and, when successes are achieved, ensure there are mechanisms in place to track and reward contributions from everyone involved. Determine with managers which standard practices should be followed when people work outside their normal roles and structures on 'special projects' so they aren't penalized for putting part of their normal work on hold, and so they get recognition once it's done. It also requires working with your company's own legal team to agree things like a standard non-disclosure agreement (NDA) for working with external companies, and agreeing on ways to streamline contracting and bidding processes for digital work.

2. **Access:** Tools, assets, and resources for innovation. Establishing access to enablers of innovative working is the practical side of encouraging collaboration in your organization. These are the tools, resources, and assets that people will be able to access when coming together to iteratively solve a problem or address an opportunity. Some companies centralize these resources in an 'innovation lab' or central digital hub. These facilities are typically staffed by new employees or contractors with specialist digital skills, and then any new iterative project takes place in the lab, pulling in people from relevant parts of the company as needed. This is a good approach if the culture is particularly conservative and digital skill sets a less developed.

Impact on the audience

1. The *ultimate target* of this project is a general audience, ranging from students at all levels (GCSE-UG) to life-long learners, museum-goers, and the 'incurably curious'. However, this pilot will only target these users *indirectly*, via educators in museums, schools, universities, and their access programmes, and via social media.
2. The *intermediate target* is educators and museum professionals, whose cooperation is needed to develop educational materials and inject them into institutional settings. The pilot will therefore engage extensively with teachers at the GCSE level in particular and feed their advice back into content creation and guidelines for best future practice.
3. The *immediate target* is the colleagues in many fields who can help develop the educational materials needed to reach the intermediate and ultimate targets. We will access these via an Advisory Board, established contacts, user-testing, focus groups, and workshops.