Open Education 2030
Call for Vision Papers
Higher Education

Hybridised OER and Rotation Based Learning

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The power of information lies in its transforming potential through derivative works, applications and reuse; a 2030 vision of European HE must train students to be research users as much as producers, enfranchising a new generation of knowledge workers to deliver high-yielding projects in academia, industry and the wider world.

Traditional approaches within higher education focus almost entirely on the student as a **research producer**. Little attention is given to training students to see themselves as **research users*;*** the resulting research output from the academic community thereafter reflects this skewed perspective.

In this vision paper, we outline why an overt emphasis on the producer, at the expense of the user, role within the higher education system is detrimental to the viability of the resulting research output. We propose a new educational model to address this issue, employing a novel approach we term **rotation based learning (RBL)**, which harnesses Open Educational Resources (OER) to deliver in-person education in a digitally advancing research landscape, coordinated over a broad geographical region.

We outline how such an approach can:

- be used to **foster extensive research networks**;
- drive **interdisciplinary collaboration**;
- deliver **continuity of education provision** in open techniques and digitally assisted research, with the aim of supporting large-scale changes in research culture;
- enable the research community to **keep pace with the digital age** in the face of ever-accelerating technological developments;
- **secure a research legacy** of accessible, repurposable data and information in the sciences, arts and humanities that provides a **firm foundation for future enquiry**.

In the interest of providing a contextual example, we examine the inaugural pilot of an RBL instance, the **Open Science Training Initiative**, which was successfully delivered at the University of Oxford in January 2013 [1]. Having explored these teaching methods in practice, we go on to showcase some hypothetical "case studies" which demonstrate how this model can be adapted to a range of teaching scenarios and environments in different disciplines as part of our vision for Open Education 2030.

Our proposals, which we shall now motivate and describe, focus on higher education as a gateway to training future generations of knowledge workers who are skilled in producing viable information outputs at the research levels of academia, industry, governance and commerce. To this end, we now return to the theme of the research producer/user roles and examine how the imbalance between the two impacts upon academic output.

1. Motivating a balanced focus on research producer and user roles

Assessment patterns in higher education traditionally require the submission of work by each student, which is then assessed and graded by a tutor or lecturer before being returned to the student with feedback. Although this approach helps the educator to ascertain student aptitude and comprehension, it focuses solely on the student as knowledge producer.

Higher up the academic hierarchy, so-called "*publish or perish*" attitudes entrench this perspective further, placing researchers under considerable time pressures to publish regularly in highly rated journals, sometimes at the expense of innovation and utility [2,3]. Peer review in its current form cannot provide a full assessment of the transparency or validity of all the findings in a given paper. Greater emphasis needs to be placed upon the knowledge dissemination and utility accomplished by the research [4]. Provision needs to be made for training upcoming academics in how to achieve this.

Undue emphasis on the research producer role fuels one of the major problems facing scientific research at the present time: that of **reproducibility**. Many findings from peer-reviewed literature cannot be recapitulated by other scientific teams following the methods and details provided in the accompanying paper. Begley & Ellis [5] detail two studies in cell biology, each of which attempted to reproduce results from 50-70 landmark papers in the field. Reproduction was only possible 11% and 25% of the time respectively. Begley & Ellis note that "*some non-reproducible clinical papers have spawned an entire field*" and call for increased openness and data sharing in science as a partial solution [5].

Such fundamental problems call for a transition from the research producer model of education, to one which acknowledges the value of communicating findings to potential information users. This will require a significant cultural shift and students must learn at an early stage of the educational ladder how to produce high-utility research through adept communication of a **coherent research story (CRS)** which facilitates maximum dissemination. A CRS not only encapsulates the written research, but the bibliographic data, experimental data, figures and/or computer code which contributed to its production.

If we can train students to be information producers ***and*** users, we can establish a generation of researchers and knowledge workers that deliver highly viable research outputs. This should provide a greater return on research funding, both academically and economically.

We have established that a 2030 vision for Open Education across Europe needs to adopt a dual perspective of information production and use. What other features should it incorporate? An in-depth study by JISC and the British Library in 2012 fielded responses from 17000 PhD students, discussing their research methodologies, the training they required and the aspects of their education experience they would like to change [6].

According to the report, modern research students:

- have a strong inclination towards "*face-to-face support and training*" and favour subject-specific teaching over generic content;
- hold many misconceptions about open access publishing, copyright and intellectual property rights;
- are slow to utilise the latest technology and tools in their research work, despite being proficient in IT;
- are heavily influenced by the methods, practices and views of their immediate peers and colleagues.

These findings highlight the need for **subject-specific training** in higher education, utilising a **hands-on approach to learning** and promoting an **integrated approach** to data, licensing and open methodologies as part of the natural research process.

2. Introducing Rotation Based Learning

We now describe a novel pedagogical approach, which we term Rotation Based Learning. The outline below provides a pattern for training PhD scientists, but is amenable to adaptation for other subjects, group sizes, ages and teaching objectives.

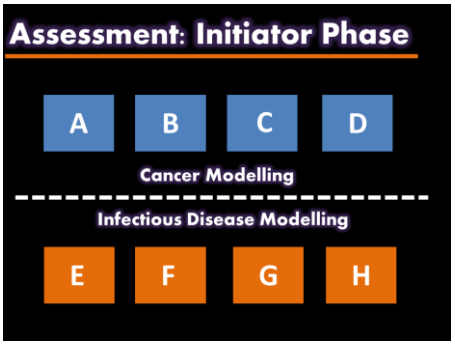

Figure 1: Group formation and topic allocation for RBL Phase 1

The student cohort is split into separate groups. If delivering a course in an interdisciplinary setting, efforts should be made to distribute subject backgrounds across the groups. **No communication is permitted between the groups at any stage during the exercise**: this provides the stimulus for reproducible research and encourages students to view their own work from the perspective of a potential user.

Phase 1 is the **Initiator** phase. Groups are allocated one of two subject areas and given a list of pre-selected, published papers from the relevant literature. Each group must select one of these papers as their focus and subsequently attempt to reproduce its results, delivering code, data and a written report, all appropriately licensed. They are informed from the beginning that their work will be graded not only on its research quality, but also on the extent to which it delivers a CRS and correctly implements techniques in open scholarship and data management.

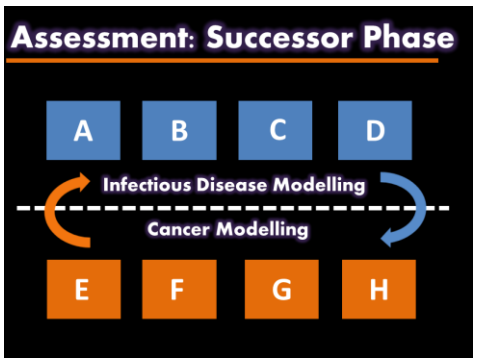

Figure 2: Rotation of themes for RBL Phase 2

Phase 2 is the **Successor** phase and requires the projects to be rotated. The inherited project must first be verified by the successor group (for example, validation of code, data sets and figures) before the work can be extended, in the manner of a novel research project. The end of Phase 2 again sees a full submission of a CRS with suitably licensed components.

Throughout Phases 1 & 2, the cohort receives daily mini-lectures examining core transferrable skills such as data management, licensing and academic publishing. Each addresses skillsets which should be developed through first-hand application to their rotation projects. Short, daily supervisions with each group enables the course leader to take an active part in the students' learning process and identify future research stars, as well as providing an open forum for students to question their own methodologies and draw directly on the research experience of the educator.

A pilot scheme utilising this RBL approach was run at the University of Oxford in January 2013, involving a cohort of 43 pre-doctoral postgraduate students from a range of backgrounds in the physical and life sciences. Entitled the **Open Science Training Initiative**, the two week, full-time course delivered subject-specific instruction in computational biology, integrated with hands-on training in digital and data management skills and received excellent feedback from students and course demonstrators alike [1]. Student productivity and work quality was significantly improved compared to the traditional, single project approach used in previous years. By integrating general lectures in academic culture, open science and digital research techniques into the subject specific programme, students not only learned new skills but consolidated them into their working practices through direct application. Indeed, 100% of respondents to the exit questionnaire agreed that the course had contributed to their awareness of scientific working practices, while 91% would be happy to implement open practices in their work, either by themselves or with further guidance.

This teaching model could be modified easily to suit the needs of undergraduate educators;

turned into a remote access course online; or modified to suit the demands of arts and humanities faculties. We refer interested readers to the Section 4 case studies for illustrative examples of such adaptations.

University-based instances of RBL would utilise local expertise and permit educators to pitch material at a suitable level for their students. Nonetheless, its true potential is realised when hybridised with Open Educational Resources to facilitate collaborative working, foster research networks, and to deliver the same integrated "skills training" in different institutions.

3. Hybridised RBL-OER approach

A hybrid RBL-OER approach combines teacher-led RBL with OER course materials shared with other institutions. Such hybridisation would require a central European repository of slides and teaching materials: some relating to the skills training component, others providing subject-specific tasks for the overall course themes. Each set of OERs could be rated by users over time to help educators determine the most popular or user-friendly contributions.

The central repository could provide a facility to assist institutions in linking up with one another if they have registered an interest in running a course on the same theme for similar ages of students. Course leaders could then download the same set of course materials from the system and deliver similar courses simultaneously, enabling the RBL groups to draw on students from both institutions, or alternatively for the groups at one institution to swap projects with one another in Phase 2. We explore this idea in Case Study 4.

Transition to an open working culture will require a significant cultural shift in academia over the coming years. Hybridised RBL-OER can support continuity of training provision across institutions to help facilitate these changes and aid development of a unilaterally well-informed academic community. Furthermore, successful training in data and information curation and release throughout European institutions would contribute significantly to a research data legacy for industry and academia for future generations.

Advantages of the hybrid OER-RBL approach include:

- **Continuity of provision** for skills-based training and progression of research culture within European institutions;
- Opportunities for young students to establish **extensive networks for learning and research** which they can draw on in their future work;
- **Opportunities for talented researchers at smaller institutions** to make a prominent contribution to the European network by feeding their expertise into the repository and/or acting as a collaborative partner in a joint-institution rotation course.

The potential for hybridised RBL to adapt to a variety of settings is best demonstrated through hypothetical case studies, as we show in the next section.

4. Case Studies

The following imaginary case studies showcase a variety of possible applications of hybridised RBL at several different levels of Higher Education across Europe.

Case Study 1 (Undergraduate Education): Adam and Nadya are undergraduate Physics students at a UK university. The course leader for their experimental modules has established an RBL link with another UK institution. For one of their assessments, Adam and Nadya must design an experiment and document all methods and findings in a lab book, critically evaluating their work to ensure the research is well communicated and includes all necessary details. Adam and Nadya's lab writeup is swapped with students at the partner institution.

Both lab teams attempt the other's experiment following their instructions, and produce an assessed critique of the other's work, which is subsequently shared with the original team.

Case Study 2 (Undergraduate Education): Social sciences undergraduates at three European institutions are linked up by their course tutors to collaborate in groups on a study examining attitudes to health care in different countries. The tutors streamline the in-person training in data collection, analysis and licensing for their respective cohorts by using shared OERs. The students collaborate online to develop a questionnaire and subsequently share their local responses with one another via an online system. Projects are then rotated and each successor group has to develop the work further. Their institutions later fund a mini-symposium for the students to meet in person and showcase their projects.

Case Study 3 (Remote Learning): Milo is a Masters-level student in English Literature, who has to study remotely from his home in Portugal. His first extended assessment has already been graded by his university tutor. Milo has drawn on many references during the work and has catalogued these using open bibliographic software. He joins a network of Masters students via an online RBL educational community, for the purpose of discussing and critiquing one another's work. Initially Milo has to complete a MOOC in content licensing to be able to license the writing he contributes. Milo then gains additional course credits at his university by sharing bibliographic data; engaging in discussion with the remote network; and by writing a critical evaluation of the work of Jennifer, a student who lives in Italy and has similar research interests to Milo. In turn he benefits from Jennifer's critique of his paper.

Case Study 4 (Establishing Research Networks): Two classes of PhD students, studying computational biology at institutions in Germany and the UK, are undertaking a pre-doctoral taught year. One of their courses is run as an RBL-style collaboration between their two universities, in which each rotation group includes students from both institutions. Each group must use digital communication and online data-sharing technologies to coordinate their project management throughout the rotation based assessment. Meanwhile, the course leaders draw on the same set of OER lectures in content licensing and data management to deliver daily lectures to the cohort at their respective universities. Students emerge from the course with first-hand experience of: data management, curation and sharing; content licensing; and collaborative working practices. Several of the students capitalise on the opportunity to foster a broader research network with their colleagues from the other institution and produce papers of their research findings for submission to an open access journal.

These hypothetical scenarios demonstrate how RBL variants can be employed in higher education within different disciplines and at different levels, ranging from in-person PhD training, to a geographically diverse, remote-access incarnation.

5. Concluding Summary

Our vision of hybridised rotation based learning with OER can be used in higher education to combine the strengths of local, subject-specific expertise with the diverse perspectives provided by a broader educational network. Globalising the approach to RBL fosters the development of progressive, robust research communities, equipped with the skills to deliver high-utility, high-impact research in a rapidly changing digital landscape.

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