

TECHNOLOGY FOR OPEN
EDUCATIONAL RESOURCES

INTO THE WILD

REFLECTIONS ON THREE
YEARS OF THE UK OER
PROGRAMMES

JISC cetis
centre for educational technology
& interoperability standards



Into the wild
Technology for open educational resources

Reflections on three years of the UK OER Programme

Edited by Amber Thomas, Lorna M. Campbell, Phil Barker and
Martin Hawksey.

Into the Wild – Technology for Open Educational Resources

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FOREWORD

Between 2009 and 2012 the UK Higher Education Funding Council funded a series of programmes to encourage higher education institutions in the UK to release existing educational content as Open Educational Resources¹. The HEFCE funded UK OER Programme was run and managed by the JISC and the Higher Education Academy. The JISC CETIS "OER Technology Support Project"² provided support for technical innovation across this programme. This book synthesises and reflects on the approaches taken and lessons learnt across the Programme and by the Support Project.

- The Higher Education Funding Council for England, (HEFCE)³ distributes public money for higher education to universities and colleges in England, and ensures that this money is used to deliver the greatest benefit to students and the wider public.
- The Joint Information Systems Committee (JISC)⁴ supports higher and further education by providing strategic guidance, advice and opportunities to use information and communications technology (ICT) to support research, teaching, learning and administration. JISC is funded by all the UK post-16 and higher education funding councils.
- The Higher Education Academy (HEA)⁵ works with universities and colleges, discipline groups, individual staff and organisations to help them deliver the best possible learning experience for students.
- The Centre for Educational Technology and Interoperability Standards (CETIS)⁶ are globally recognised as leading experts on interoperability and technology standards in learning, education and training. They work with clients and partners to develop policy and strategy, providing impartial and independent advice on technology and standards across a wide range educational issues including open educational resources.

This book is not intended as a beginners guide or a technical manual, instead it is an expert synthesis of the key technical issues arising from a national publicly-funded programme. It is intended for people working with technology to support the creation, management, dissemination and tracking of open educational resources, and particularly those who design digital infrastructure and services at institutional and national level.

The book is the result of a two and a half day writing session facilitated by Adam Hyde of Booksprint⁷.

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INTRODUCING THE UK OER PROGRAMME

The UK OER Programme¹ was run by the UK Higher Education Academy and JISC, with funding from HEFCE, between 2009 and 2012. The Programme built on previous work undertaken by JISC, and the expertise of the JISC CETIS Innovation Support Centre. This book explores the technical issues surfaced by the programme and the JISC CETIS OER Technical Support Project during this three year period.

JISC Programmes 2002-2009

JISC has a long history in developing and promoting innovative technical approaches to learning resource management and discovery that can be traced back to programmes such as Exchange for Learning² (X4L, 2002–2006), which focused on the creation of reusable learning resources, and tools to facilitate their production and management; Re-purposing and Re-use of Digital University-level Content³ (RePRODUCE, 2008–2009) which encouraged the re-use of high quality externally produced materials and facilitated the transfer of learning content between institutions; and the Digital Repositories⁴ (2005–2007) and Repositories Preservation Programmes⁵ (2006–2009) which aimed to establish technical infrastructure within institutions and across the sector. (For an overview of learning technology initiatives funded by various bodies across UK educational sectors prior to 2002, see Open Educational Resources – a historical and international perspective by David Kernohan and Amber Thomas, 2012⁶).

These programmes were informed by a strategic and technical vision that was expressed through initiatives including the e-Learning Framework⁷, the e-Framework⁸, the Information Environment Technical Architecture⁹ and the Digital Repositories Roadmap¹⁰. The Information Environment Architecture for example sought to “specify a set of standards and protocols intended to support the development and delivery of an integrated set of networked services that allowed the end-user to discover, access, use and publish digital and physical resources as part of their learning and research activities.”¹¹

For example the aims of the 2002 Exchange for Learning (X4L) Programme were to:

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- “use and develop the best available tools to explore whether repurposing content can become a popular, sustainable way of producing e-learning materials for the future;
- increase the numbers of people in institutions with the necessary skills to repurpose learning objects;
- expose and begin to tackle the challenges associated with repurposing learning objects; and
- begin to populate a national repository with learning materials as well as case studies and exemplars showing how these have been achieved.”¹²

In order to achieve these aims the programme gave projects a strong steer to use educational technology interoperability standards such as IMS QTI¹³, IMS Content Packaging¹⁴, ADL SCORM¹⁵ and IEEE LOM¹⁶. CETIS developed a mandatory application profile of the IEEE LOM for the programme and formal subject classification vocabularies were identified including JACS¹⁷ and the Dewey Decimal Classification System¹⁸. Projects were strongly recommended to deposit their content in the national Jorum repository¹⁹ (also developed as part of the X4L Programme), institutions were required to sign formal licence agreements, and access to content deposited content in Jorum was restricted to UK F/HE institutions only.

An OER timeline²⁰ mapping these initiatives was created for JISC CETIS.

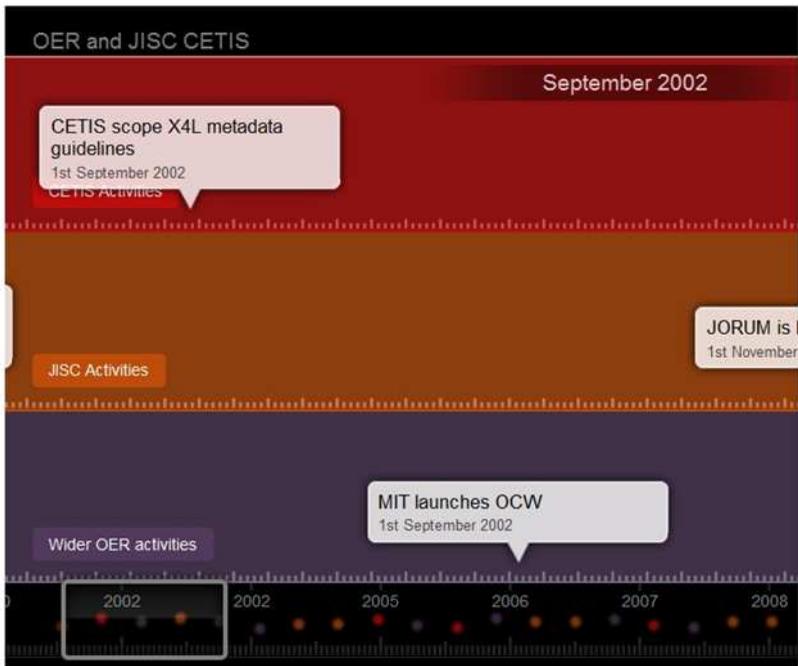


Figure 1 OER Timeline produced by Lou McGill for CETIS Other Voices Blog 2012

These early programmes and initiatives met with varying degrees of success across the different sectors of the UK F/HE community. While the X4L programme defined the way that JISC and partners would deliver programmes aimed at systemic cultural change, the programme evaluation was clear that significant barriers around the online sharing and reuse of educational resources remained:

“X4L has demonstrated that the principal benefits of reuse and repurposing are generally understood and accepted in the communities involved in the programme. However, the concept of reusable learning objects is still not proven or generally accepted in mainstream practice across the FE and HE sectors. That said, X4L has identified and explored many of the key barriers to reuse and repurposing, including the pressures of time and resource constraints on staff, concerns about professional integrity and academic independence, cultural resistance to sharing, and tensions between community collaboration and institutional competition.”²¹

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In addition, while there has been considerable progress since 2000 in developing open access institutional repositories and promoting the deposit of scholarly works, journal papers and e-theses²²; there was arguably less success in using repositories to support and facilitate access to teaching and learning materials. Indeed one of the final conclusions of the 2006 - 2009 Repositories and Preservation Programme Advisory Group, which advised the JISC repositories programmes, was that teaching and learning resources had not been served well by the debate about institutional repositories seeking to cover both open access to research outputs and management of teaching and learning materials as the issues relating to their use and management are fundamentally different.

Furthermore, in 2009 the findings of the RePRODUCE Programme suggested that projects had significantly underestimated the difficulty of finding high quality teaching and learning materials that were suitable for copyright clearance and reuse.

From 2006 onwards, JISC CETIS was tasked with providing the technical framework and guidelines for programmes and initiatives within the e-learning domain. This involved the identification of systems, technologies, open standards and vocabularies that programmes mandated and projects were required to implement.

Evolution of OER

The term Open Educational Resources (OER) was first introduced at a conference hosted by UNESCO in 2002²³ and was promoted in the context of providing free access to educational resources on a global scale. There are many subtly varying definitions of OER, however on a basic level open educational resources may be described as freely available digital materials released under open licence, that can be used and re-purposed for teaching, learning, and research.

In 2001, while JISC were scoping the X4L Programme, the Hewlett foundation were supporting MIT in launching the OpenCourseWare (OCW) movement which proposed to make almost all of its 2,000 courses, in the form of lecture notes, problem sets, syllabuses, exams, simulations and video lectures, freely available to the general public on the open web. Faculty chairman Steve Lerman told the New York Times:

“Selling content for profit, or trying in some ways to commercialize one of the core intellectual activities of the university [...] seemed less

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*attractive to people at a deep level than finding ways to disseminate it as broadly as possible.*²⁴

This position was amplified by the then MIT President, Professor Charles Vest:

“This is a natural fit to what the Web is really all about, [...] We've learned this lesson over and over again. You can't have tight, closed-up systems. We've tried to open up software infrastructure in a variety of ways and that's what unleashed the creativity of software developers; I think the same thing can happen in education.”

That same year, the Center for the Public Domain²⁵ provided support for Creative Commons, a new nonprofit organization that set out to enable the sharing and use of creativity and knowledge through free legal tools. In December 2002 Creative Commons launched their first set of free copyright licenses²⁶. These copyright licenses provided a simple, standardized way to allow the public permission to share and use creative works.

Three years later in 2005 the Open CourseWare Consortium (OCWC)²⁷ was founded with the support of the William and Flora Hewlett foundation²⁸. OCWC drew together a number of other institutions that had followed the MIT OCWC model. Early members included many North American institutions, but also consortia from China and Japan.

The first large scale OER initiatives in the UK were launched in 2006 and 2007 respectively. In October 2006 the Open University launched OpenLearn²⁹, which aimed to make a selection of OU materials available worldwide for free use and to build communities of learners and educators around the content using a range of tools and strategies. OpenLearn provided not only a collection of free course material but also a set of tools to help authors publish and support collaborative learning communities.

In September 2007 the University of Nottingham developed U-Now³⁰ a collection of open educational materials openly licensed for anyone to use. These materials ranged from complete modules to smaller-scale learning objectives, and highlighted a range of teaching and learning activities from across the institution.

The following year in 2008, CETIS published a whitepaper on global OER developments, Open Educational Resources – Opportunities and Challenges for Higher Education³¹. This influential paper covered current and future trends in

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OER development and aimed to stimulate debate and develop a forward looking research agenda. Topics covered included a discussion of the conceptual and contextual issues of open educational resources, a review of current OER initiatives, and discussion of emerging trends, with respect to future research and activities.

At the same time JISC had also commissioned a report on improving the evidence base in support of sharing learning materials. The Good Intentions report³² articulated the advantages and imperatives for sharing learning resources using evidence from the UK and elsewhere. It also identified a number of compelling business cases and developed a set of variations as a result of studying a range of business models.

The UK OER Programme

There were three phases to the UK OER Programme, described collectively here as the Programme. Each phase was planned in response to emerging priorities from the projects, so it shifted its focus over time.

The first three years

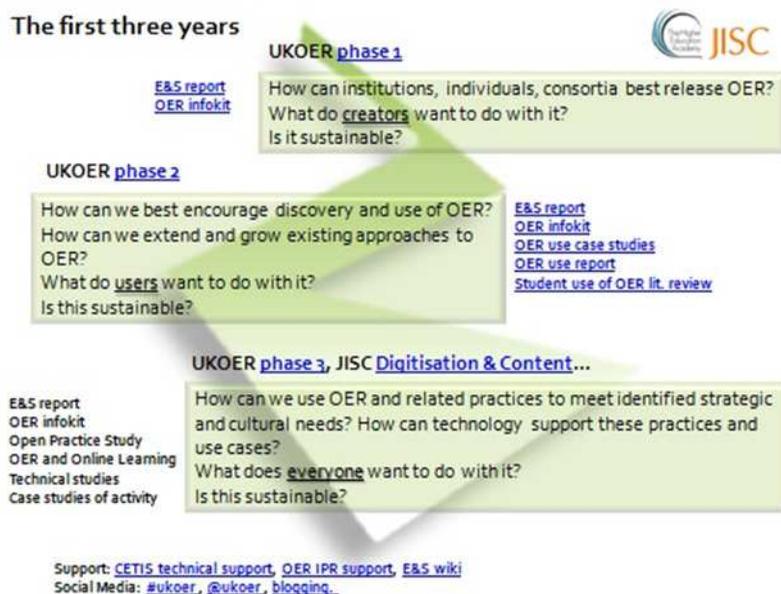


Figure 2 Three years of UKOER, David Kernohan, JISC 2012

OER Phase 1 Pilot Programme

In response to these global developments and national education policy drivers across the UK, HEFCE provided £5.7 million to JISC and the Higher Education Academy in 2009 to launch the first UK Open Educational Resources Programme³³. This Pilot Programme, one of the first national OER initiatives in the world, ran from April 2009 to April 2010 and funded projects to make a significant amount of existing learning resources freely available online, licensed in such a way to enable them to be used and repurposed worldwide. The metaphor commonly used while the programme was being scoped was of "turning on the tap" to get the largest volume of open educational resources out into the public domain. In addition to simply releasing resources, projects were also expected to demonstrate a long term commitment to the release of open educational resources (OER) and to work towards the sustainability of long term open educational resource release via the adoption of appropriate business models. Where possible, projects were encouraged to work towards the modification of institutional policies and processes, with the aim of making OER release an expected part of the educational resources creation cycle. Funding was allocated to 29 individual, institutional and subject focused projects.

UK OER technical guidance

As a part of the UK OER Pilot Programme, JISC also provided support, advice and guidance on all aspects of open educational resource production and dissemination. This included guidance on issues around licensing and intellectual property rights, technology and standards.

In keeping with the experimental nature of the Pilot Programme, and in contrast to previous content creation programmes which mandated the use of specific technologies and standards, CETIS recommended that JISC adopt an "anything goes" approach to the programme. Rather than identifying specific applications, technical models, standards, application profiles and vocabularies, CETIS advocated that the OER Pilot Programme should adopt an open approach to the use of technology and standards³⁴. Projects were allowed to release any kind of content, in any format, anywhere. Although projects were encouraged to use open standards where possible, proprietary formats were also acceptable. CETIS advised projects on the type of information they should record about their resources (e.g. title, author, owner, contributor, date, URL, file format, name and size) but not how to go about recording it. There was no programme specific

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metadata application profile and no formal metadata standard or vocabularies were recommended. The only mandatory metadata that projects were directed to record was the programme tag: ukoer. Projects were also given free rein to use any dissemination platform they chose provided that the content was freely available and released under an open licence. In addition, projects also had to represent their resources in JorumOpen either by linking or through direct deposit with all resources represented in JorumOpen being freely available worldwide and released under Creative Commons licences.

Rather than a radical shift in policy, this approach to technology and standards should be regarded as a reflection of a gradual development in policy, licensing and technology right across the web. These developments are illustrated by the advent of the social web, the appearance of media specific dissemination platforms such as slideshare, YouTube, flickr, iTunesU, interaction through RESTful APIs, OpenID, OAuth and other web-wide technologies, along with increasing acceptance of Creative Commons licenses. As a result, there had been a movement away from the development of centralised education specific tools and services, and towards the integration of institutional systems with applications and services scattered across the web. Furthermore, there was growing awareness of the importance of the web itself as a technical architecture as opposed to a simple interface or delivery platform.

It was hoped that this approach would also provide an opportunity for authentic technical practice to emerge and for pertinent technology issues and problem areas to surface. This open approach to technology and standards and supporting technical diversity generated considerable interest from agencies outwith the UK including as ADL³⁵ and OCWC.

In 2010 and 2011 HEFCE released funding for two further phases of the UK OER Programme and this open approach to systems, technology and standards was deemed to be sufficiently successful to underpin these new programmes.

OER Phase 2 Programme

The £5 million OER Phase 2 Programme which ran from August 2010 to August 2011 focused on three activity areas: release, use and discovery of OER³⁶. 23 individual projects were funded and additional reports were commissioned on a range of topics including: patterns of behaviour around the use and reuse of OER and the impact of these behaviours on teaching and learning strategies from institutional, tutor and student perspectives; reflective case studies into the way open educational resources are used in a variety of contexts, including seminars,

lectures and virtual learning environments; and tracking the use of materials released by pilot phase projects. The six "collections" projects were of particular interest as they aimed to use innovative technology approaches to bring together dynamic thematic collections of open educational resources from a range of sources worldwide.

Technical Mini Projects and Data Analysis and Visualisation Project

Underpinning the main funded programme, JISC were also focusing on wider digital infrastructure directions to support open educational resources and identifying specific technical interventions for potential funding. In this context a series of additional small projects were commissioned through CETIS to explore specific technical issues. These included the OER Technical Mini-Projects, awarded to the University of Newcastle in the UK (OER Bookmarking)³⁷ and MIT in the US (CaPRÉT - Cut and Paste Reuse Tracking)³⁸, and the innovative OER data analysis and visualisation project³⁹. The visualisation project was successful in documenting workflows for extracting data using different techniques including consuming linked data in Google Spreadsheets and harvesting OAI-PMH records using Google Refine. Outputs also included methods for cleaning data and reconciling it with other datasets. This included resolving tracking data from the CaPRÉT OER Technical Mini-Project and examining social share statics of Jorum 'ukoer' records.

OER Phase 3 Programme

The third phase of the OER Programme which ran from October 2011 to October 2012 covered a variety of themes and produced a wide range of outputs⁴⁰. Themes included the use of OER approaches to work towards particular strategic, policy and societal goals; support for institutional change; and the evolution of institutional policy to the support of the use, development and cultural acceptance of OER as part of everyday educational practice.

Rapid Innovation

Building on the experience of the CETIS Technical Mini-Projects, JISC also identified a number of areas where there were opportunities to enhance the digital infrastructure to support open content in education by funding small short projects producing technical solutions⁴¹.

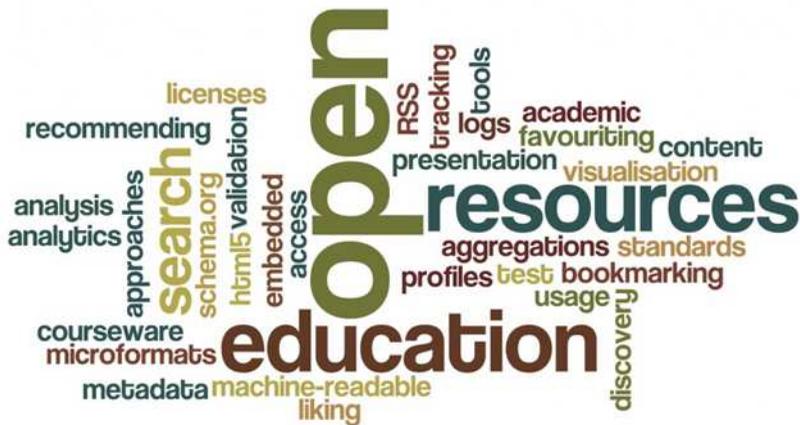


Figure 3 Thomas, A., (2011). Wordcloud of the Call for OER Rapid Innovation Projects, produced using wordle.net

An open call for project based at Universities and Colleges was launched and 15 short technical rapid innovation projects were funded, covering issues as diverse as linked data infrastructure for OER, sharing paradata across widget stores, increasing OER discoverability by improving keyword metadata via automatic speech to text transcription and the use of BuddyPress as an institutional academic profile management tool⁴².

Sister Content Programme

Another JISC programme which approached OER from a somewhat different angle was the £5.4 million Content Programme, running from 2011 - 2013. This programme funded 23 projects in three different strands focusing on mass digitisation, clustering of existing digital content and digitisation for open educational resources. The aim of the digitisation for OER strand⁴³ is to release digitised educational content suitably licensed for use and re-use on an open access basis, and embed it within teaching and learning. Projects were encouraged to place particular emphasis on innovative approaches to the creation and delivery of digital content by working in partnership within and outside the educational sector to maximising the reach and impact of the content created.

JISC CETIS UK OER Technical Support Project

Technical Focus of the UKOER Programme

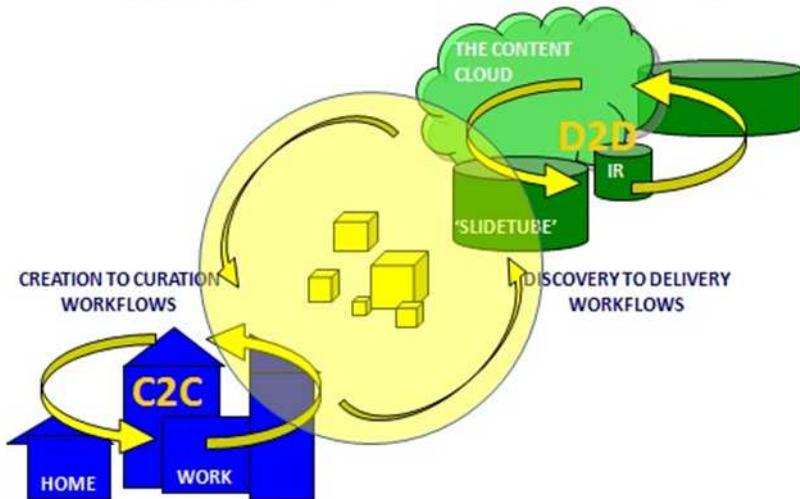


Figure 4 Thomas, A (2009) Technical Focus of the UK OER Programme Diagram

In scoping the OER Programme it became apparent that the biggest technical challenges would be in the way that content was made available on the web. Whilst it sounds obvious how an OER creator can just "put it online", there are many choices to be made if release is to contribute to a healthy ecosystem of open content. In describing these issues, the authors of this book used the analogy of releasing OERs "into the wild" to express the mindset required to understand this evolving space.

The following chapters focus on technical issues that the UK OER Programme surfaced in this space, explores their relevance, the approach the Programme took, and where possible, the authors look to future directions.

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DEFINING OER

Programme approach

The OER Programme took a broad and inclusive approach to the definition of open educational resources. The call¹ Briefing Paper on Open Educational Resources² for the Phase One Pilot Programme described learning resources and open educational resources as follows:

What are learning resources?

Whilst purely informational content has a significant role in learning and teaching, it is helpful to consider learning resources by their levels of granularity and to focus on the degree to which information content is embedded within a learning activity:

- *Digital assets – normally a single file (e.g. an image, video or audio clip), sometimes called a ‘raw media asset’;*
- *Information objects – a structured aggregation of digital assets, designed purely to present information;*
- *Learning objects – an aggregation of one or more digital assets which represents an educationally meaningful stand along unit;*
- *Learning activities – tasks involving interactions with information to attain a specific learning outcome;*
- *Learning design – structured sequences of information and activities to promote learning.*

What are open learning resources?

The term Open Educational Resources (OER) was first introduced at a conference hosted by UNESCO in 2000 and was promoted in the context of providing free access to educational resources on a global scale. There is no authoritatively accredited definition for the term OER at present; the most frequently used definition is, “digitised materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research”.³

The UK OER Programme Call FAQ⁴ elucidated this definition further:

Defining OER

Open educational resources can be defined as 'teaching, learning and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, material or techniques used to support access to knowledge'

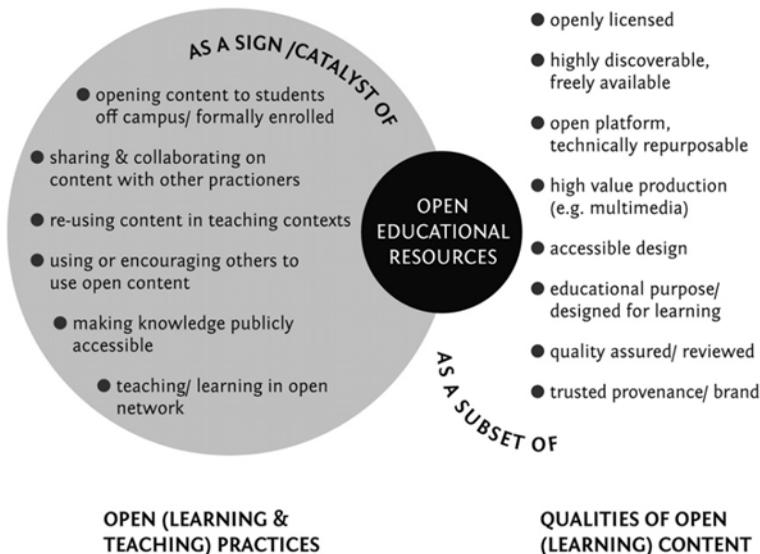
Note, this definition draws on The William and Flora Hewlett Foundation's definition, which has recently been updated to say that the license permits "free use and re-purposing by others".

The inclusive definition of OERs led to the projects producing a healthy mix of online courseware, granular assets, rich media and everything in between.

Issues

Open content and open practice

As the Programmes progressed, consensus developed amongst the Evaluation and Synthesis Team, the Technical Support Team and the Programme Managers that two sets of issues were converging around the concept of OER.



Defining OER

Figure 5 Beetham, H., (2012), *What are 'open educational practices'?*⁵

Clearly the relationship between content and practice is complex and there was considerable variation among the projects as to what degree they focused on one or the other. For example the establishment of the Digitisation for Open Educational Resources strand of the Content 2011–13 Programme⁶ brought the content perspective more strongly to the fore. This discourse became more refined as time went on and in later stages of the Programmes, the phrase "OER practices" gained currency as a description of what people do when they release and use OERs. OER practice was very much a focus of the Evaluation and Synthesis Team⁷ and has been the subject of much insightful commentary, within and beyond the Programmes. Within universities, open practice concepts are developing alongside other open scholarship models. Open access to research outputs and open access to teaching resources, are both forms of academic open practices.

This book focuses on the content side of the model above; the properties and characteristics of OERs and the technologies and digital infrastructure required to facilitate their distribution and use.

OER re-use and repurposing

In a blog post on "Rethinking the O in OER"⁸, Programme Manager Amber Thomas challenged readers to consider the characteristics of open educational resources.

Consider whether the following can be regarded as open educational resources:

1. A PDF.
2. A MS Powerpoint .ppt file.
3. An html page with no licence information.
4. An IMS content package.
5. A PDF licensed as CC BY SA.
6. A jpeg image.
7. A website licensed as CC BY NC.
8. An iTunesU podcast.
9. An OpenOffice document licensed as (c) all rights reserved

In the strictest sense, only openly licensed resources count as OER so only (5) and (7) comply. However there is a school of thought that no derivatives (ND) and non-commercial (NC) Creative Commons licences are not open enough. In

Defining OER

"How Open are So-Called 'Open' Licences?"¹³ Naomi Korn, of the OER IPR Support Project, discusses this issue further. From this perspective, only (5) has a truly open licence. However beyond purely legal definitions, there is also an element of risk assessment to consider. People will frequently disregard licences, if they can use resources under the radar, away from the gaze of potential enforcers. In order to assess these risks the Web2Rights OER Support Project has developed a useful Risk Management Calculator.¹⁴

Open is multi-dimensional

Clearly there is a technical dimension to openness as well as a legal one. Technical questions to consider in relation to openness include:

- What software is required to access a resource?
- Do users have to log in?
- Do users have to pay?
- What software is required to edit a resource?
- What skills are required to edit a resource?

Returning to the list of potential open educational resources above,

- An MS Powerpoint .ppt file (2), is proprietary but ubiquitous, easy to view, easy to edit.
- An IMS content package (4), is non-proprietary but specialist. Users need to have the right software, which may not be commonly available. However with the right software and specialist knowledge the resource is easy to view and edit.
- An iTunesU podcast (8), is proprietary but common. Users must pay for a specific platform to access the content. The content is then easy to play but can not be edited.

Some formats place implicit constraints on re-use. PDFs for example are only available on a no derivatives, share-alike basis; they are intended to be read but not edited.

We need to understand more about how OERs are used in practice, particularly with regards to the importance of editability.

Is "use" good enough?

Learning technology is historically bound up with the search for the holy grail of repurposing: academic finds a resource, downloads it, edits it and uses it with

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their learners. This has been the vision for well over a decade. How often does this happen? How do we know? Studies such as "Good Intentions: improving the evidence base in support of sharing"¹⁵ suggest there is plenty of literature about reuse and repurposing but perhaps less compelling evidence of it actually happening.

However many academics use online content to reflect on and inform their teaching and thinking on a subject. Similarly many academics use CC images from flickr simply as illustrations for slide presentations. This may be just "use", rather than "repurposing" but it is still of considerable value to individual users.

Furthermore it is perfectly valid to reuse resources without repurposing them. Academics are never chastised for failing to write in the margins of a novel, or for not editing a film down to its highlights. The expectation for many teaching and learning resources is that they will be used complete and in their entirety. Furthermore it has become increasingly easy to share resources by embedding, leading some commentators to suggest that, in terms of reusability, <embed> changes everything. If this is the case, then what is wrong with simply reusing an OER as is? Is repurposing an OER really more educationally valid than simply reusing it?

Users do need to be able to cite or quote a resource to use it effectively in an educational context. To cite it they need the url and attribution information, which is another reason for clear licensing content. However it is questionable whether a robust citation model exists for teaching and learning resources of any kind. Provenance is important to evaluating the relevance of the resource, but are citations used to situate resources in the wider context?

Another question to consider is whether and how often a learner is likely to edit a resource. How common is this use case? What if the content that has most chance of being read, played, repeated, absorbed, is the content that is suitable for the learner's personal mobile device? And what if that device is proprietary? Is there a disconnect between the move towards open content and standards and the reality of ubiquitous cheap computing?

What we do and don't know about use

It was hoped that the Programmes would start to answer some of the above questions while at the same time uncovering information about the reuse and repurposing of the OERs produced. However, as described in the Tracking OERs chapter, this data is very hard to capture.

Defining OER

The OER Impact Study Research Report⁹ by the University of Oxford, commissioned by the UK OER Programme, used an iceberg analogy to illustrate visible and invisible reuse.

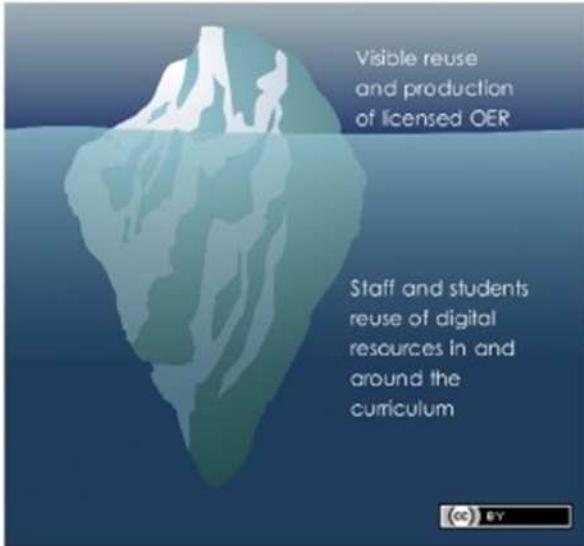


Figure 6 White, Manton et al (2011) *Visible and invisible reuse of digital resources*¹⁶

David Wiley's "OER, Toothbrushes, and Value"¹⁷, blog post is another frequently cited example of this conundrum. The fact that Wiley's post proved to be so divisive amongst the OER community shows that it hit a nerve (excuse the pun).

Following the iceberg analogy, there is general consensus amongst those involved in UK OER Programmes that there is above waterline use and below the waterline use. So reuse of web-based resources does happen, all the time, but it is usually private, mostly invisible to the providers and often not strictly legal.

In terms of the data available, the interpretation has to be either that re-use is not happening at scale, or that it is not happening in ways that can be captured within the current digital infrastructure. As the chapter on Paradata illustrates, new and innovative approaches are being developed in an attempt to surface and record resource reuse. However the conclusion from the UK OER Programmes must be that there is currently insufficient rich data available to inform the decisions of service providers.

Learners and OER

Much of the analysis undertaken around the UK OER Programmes focused on educators' use of open educational resources. However part of the way through the Programme it became apparent that there was no systematic data being collected about learners attitudes towards the use of OERs, either for self-directed learning online, or more formal learning, mediated by educators.

The "Learners Use of Online Educational Learning Resources"¹⁰ report was a systematic literature review commissioned by the UK OER Programme to fill this gap.

The review found a lack of reliable data on learners use of OERs, even though the scope was widened to look for learners use of online resources more generally. Despite many of the OER projects engaging with learners, the review reported that:

"The JISC/HEA OER Programme has so far produced relatively little data on learner use (some partial exceptions are noted). This is to a lesser extent true for all OER literature – but the non-OER literature is much richer."

The review clearly illustrated the state of the evidence base about learners use of, and attitudes towards, "OER". Specific points salient to digital infrastructures included:

- 1. Learners' rationale for searching for online resources: The OER literature is dominated by the large open university and MIT studies. It is debatable how applicable these are to the generality of UK universities and their students. The non-OER literature typically addresses this issue from the standpoint of assessment-driven student behaviour. There is clear room for studies looking at the middle ground.*
- 2. Types of online resources being sought: JISC/HEA OER projects encompassed a wide range of formats and noted the student preference for audio over video confirmed by non-OER work. The project work still seems dominated by supply-side aspects. Non-OER work confirms the commonly held view that today's learners utilise numerous types of media. They hint at the primacy of Wikipedia and journal material, but quantitative information is scarce.*

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3. *Complexity/granularity of resources being sought: OER studies tended to confirm the tension between specificity and potential for reuse (seen since the early days of RLOs). Also, students want narrative structure in, or above, the resources they use. The non-OER literature seems to focus more on students typically seeking a single item per search and hints at the assessment-driven paradigm again – or filling in gaps in an existing narrative, not creating their own. It is tempting to draw the conclusion that the two types of study are in fact addressing two different student populations. Again there is clear room for studies looking at the middle ground.*
4. *How resources found are used: This leads on from the last point. Interestingly the two types of study have more in common here, with the exception of the set of OpenLearn students ‘overloading’ their use of resources with expectations about social networking and assessment. Possibly the topic needs to be refined to distinguish between ‘How resources found are used’ and ‘How services providing resources (and other things) are used’. Depending on how fast portfolios based on the Higher Education Achievement Report come into common use, some convergence is possible.*
5. *Enablers and barriers to use of online resources: It remains true across the wider research that most of the barriers to the use of OER are the same as/or a consequence of more generic barriers to accessing and using technologies for learning. However, the issues of designing learning for the unknown user and the tensions between granularity and the need for scaffolding permeate much of the research. Esslemont (2007) puts it pithily: “There are several interlinked issues related to completeness of content, granularity, copyright, offline access, use, etc., that sometimes limit the effectiveness of material provided. Therefore in order to support the learner we need to understand and support ... the learner’s limitations in terms of content selection, access, use and management of their personal knowledge silos on their desktop.” Other barriers include: young peoples’ reliance on search engines to ‘view rather than read’ and ‘readily sacrifice content for convenience’. Students would like guidance but can be reluctant to*

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work with librarians. Publishers' restrictions on materials can put off students when they cannot access results they find by searching.

- 6. How learners retain access to the resources: In this area there seems to be just one key study – Lim¹¹ on Wikipedia; who reports that slightly more than half of the respondents accessed Wikipedia through a search engine, while nearly half accessed it via their own bookmarks. Some students still like paper and will print out longer texts if given the chance. A few use more sophisticated tools.*
- 7. Provenance information and copyright status of resources being used: Students have inconsistent attitudes to provenance. The experience of the OUNL OpenER researchers is overwhelmingly that students expect the courses to be of a suitably academic level and that the university is the guarantor of quality. Elsewhere many students seem content to take on trust the validity of resources found on the web. Students tend to use Wikipedia for rapid fact-checking and background information and have generally had good experiences of it as a resource. However, their perceptions of its 'information quality' did not reflect this: it appears that the uneasiness associated with the anonymous authorships of Wikipedia has led to non-expert users' underestimation of its reliability. Students are not generally sophisticated in their understanding of things like peer review or currency: they are weak at determining the quality of the information that they find on a website, and may in fact judge the validity of a website based on how elaborate it looks. In a study analysing young adults' credibility assessment of Wikipedia, a few lacked even such basic knowledge as the fact that anyone can edit the site.*
- 8. Beyond these topics, some other issues cropped up:*
 - Students discover online resources in multiple ways: e.g. in the Open Nottingham project survey, 35% of respondents said they had previously used OER and, of these, 67% had found resources through browsing, 56% had used a search engine, 33% had been told of the resources by lecturers and 6% were from peer recommendations.*
 - Numerous studies identify university libraries as a critical conduit to digital resources.*

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- *Learners are found to be predictable in their choice of digital resources, and to rely on tools that have worked for them before.*
- *Almost everyone starts with Google; and wants their digital library to be more like it.*

Libre vs gratis OER

Finally, one of the key criteria for OER is free access. There is some commonality here with open source software and open access to scholarly works developments and also to the free culture movement in arts and cultural heritage sectors around the world. Content that is freely available online, but which is not CC licensed and can not be edited, falls outwith the stricter definitions of OER. This echoes debates in the open source software world about gratis vs libre.¹² How important is access to editable source code, and how important is free-at-the-point-of-use? While all the content released by the OER Programmes was CC licensed and therefore may be regarded as both libre and gratis, in reality, it may not always be easy to re-edit some of the OERs produced.

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RESOURCE MANAGEMENT

Releasing OERs requires that processes and systems are in place to manage the lifecycle of the resources. While resource management could cover the whole life cycle from creation of the resource through to its release and beyond, the nature of the Programme meant a focus on the latter stages, as the primary aim was to release resources that already existed. "Resource management" here refers to managing learning resources, especially the dissemination of those resources (whether open or otherwise). The systems used for resource management may include conventional repository systems such as DSpace and ePrints, repository systems that have been created or adapted for managing learning resources, such as EdShare or IntraLibrary, learning environments such as moodle adapted for open access, and Web2.0 services such as YouTube, SlideShare and flickr.

Why resource management is important

If OER practices are to be sustainable, they need to include good practice in the management of the OERs themselves. There is no single approach to resource management, it depends on the platforms, the institutional system architectures, personal workflows, policy frameworks and so on. There are scaling issues to consider: just "sticking it online" might work for one person but individual approaches rarely scale up to work for teams or organisations. It also depends very much on the skills of the people with responsibility for the content, whether librarians, learning technologists, web officers or academics. By thinking through the way in which resources will be stored and accessed, those producing and releasing OERs can work more effectively.

Programme approaches to resource management

All three UK OER phases focused primarily on the release of existing educational content under open licence and the aggregation of open educational resources into static or dynamic collections. Creating new resources was out of scope for the majority of projects therefore the Programme tended not to surface technical issues relating to content creation and authoring platforms, or issues relating to the interface between content creation and management tools and systems.

The Programme Calls explicitly stated that resources should be shared using existing open web services, including:

- Institutional websites and repositories, ensuring that they are easily searchable by major search engines.
- Web 2.0 services appropriate to the type of resources being shared; e.g. Slideshare for PowerPoint, YouTube for video, etc.
- JorumOpen. (See below.)

In addition, the Programme's technical guidelines reiterated that projects should deposit their content in Jorum, and in at least one other openly accessible system or application with the ability to produce RSS and/or Atom feeds; for example an open institutional repository, an international or subject area open repository, an institutional website or blog, or a Web 2.0 service.

Throughout all three phases CETIS undertook technical review calls to record the technical and descriptive choices adopted by projects. This information is recorded in the CETIS PROD database¹ which is a rich data source of evolving technical practice and issues. UK OER PROD entries comprise: descriptive information about each project (programme, partners, websites, feeds, and related projects); information about the technical approaches used (standards, specifications, Web2.0 applications, tools, transport protocols, audio and video formats); and free text comments used to record further details about the standards and technologies used, and other relevant details. At the end of each phase of the Programme, these PROD records were synthesised and analysed to reveal emerging technical trends and issues.

By and large, the projects adhered to the programme guidelines, choosing appropriate platforms for release.

Issues

As a result of the technical approaches recommended by the Programme, a number of interesting findings emerged.

Technology choices

From very early on in the Programme it became clear from the PROD calls that projects gravitated towards systems and technologies they were familiar with and already had in place. They were not "making decisions about standards", the

Resource Management

standards came as a property of the technologies they chose, with the primary factor in technology selection being availability and familiarity.

While it could be argued that does not represent particularly innovative use of technology, it may also be regarded as a positive indication of the normalisation of OER release, in that it highlights the fact that institutions do not need to invest significant time or money in new technologies in order to make open educational resources available.

That said, projects still used a wide diversity of resource management and dissemination platforms. In the Phase One Pilot Programme, twenty different systems and platforms were used:

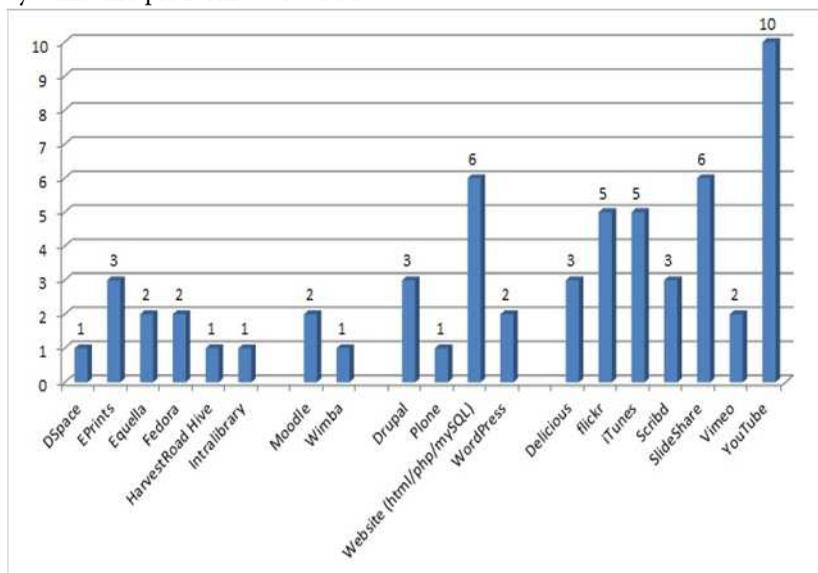


Figure 7 Phase 1 Pilot Programme Platforms Used

The number of different platforms used during the course of the Phase 2 Programme increased further to about thirty:

WordPress

Use of WordPress as a content management and delivery platform has steadily increased across all three Programmes. WordPress was used particularly extensively by the OER Phase Two "collections" projects as a lightweight platform to collect and aggregate OER. The Triton⁶ project used WordPress to aggregate blog posts into PoliticsInSpires⁷. Interestingly this was the only project to treat blog posts as a form of OER. In addition, three projects explored the development of WordPress plugins to support better metadata and licensing and one project adopted WordPress in order to promote search engine optimisation.

WordPress was also the focus for a group of developers at the CETIS/DevCSI OER Hackday⁸. Their work included:

- Creating a new platform independent and mobile-compatible OER bookmarker and bookmarklet plugin: "FavOERite".
- Reviewing how to populate WordPress with feeds from the University of Oxford's OpenSpires OER podcasts.
- Feeding WordPress using FeedWordPress and Custom Post Types, to be displayed using Featured Post type.
- Creating a plugin to search against Xpert, RSS and APIs.
- Reviewing plugins for OER Creative Commons work.

The group also discussed ways in which WordPress could potentially integrate with the Learning Registry, including pulling information in through RSS and using the Salmon Protocol⁸ to flow comments back to the source.

Virtual learning environments

There was relatively little use of VLEs / Learning Management Systems for releasing OERs. Moodle spaces can be easily "opened up" for public use and a previous JISC Rapid Innovation grant had funded MrCute¹⁰, repository functionality for Moodle. In October 2011, Blackboard announced support for OER¹¹ though it was too late for any projects to engage with this development. It is possible that changes to Blackboard might make it more attractive to use as an OER resource management platform.

Content management systems

Although several different content management systems were used, their use across the programmes was not widespread. However two OER Phase Two

Projects, ALTO and TIGER, added a CMS layer on top of a repository to improve the repository interface. There was no use of enterprise level solutions such as Sharepoint, which is rather surprising given the widespread use of such systems by educational institutions. Drupal was used only by projects based at Oxford. However the OERbit¹² platform at the University of Michigan is built on Drupal, and a developer participated in the CETIS / DevCSI OER Hack Day.

Repositories (including Jorum)

As described in the Introduction, the JISC funded Repository Programmes made significant progress in building institutional infrastructure and repository capacity between 2005 and 2009. A strand of start-up and enhancement projects (2007-2009)¹³ had developed repositories, some of which were built on by UK OER projects. In this area, Humbox¹⁴, LORO¹⁵ and edshare¹⁶ had branched off from the EPrints¹⁷ family to support learning materials. Many of these services had established user bases and made a natural fit with the UK OER Programme.

The UK OER Programmes cannot be described without reference to Jorum, the national repository funded by JISC from 2002 to support the sharing of learning and teaching materials among UK Further and Higher Education institutions. In Spring 2008 Jorum announced their intention to support the sharing of openly licensed resources¹⁸. This was referred to as JorumOpen as a way of distinguishing it from the more traditional closed sharing service it had previously provided. By spring 2009 the UK OER projects were under way and Jorum provided a holding bay for them to deposit their content, ready for the launch of Jorum's open sharing service. By requiring projects to deposit in Jorum, as well as another service, the Programme aimed to create an aggregation of project outputs.

The OER Data Analysis and Visualisation Project undertaken by Martin Hawksey visualised projects' deposits into JorumOpen during Phase One and Two, and provides a striking illustration of the nature of the aggregation¹⁹.

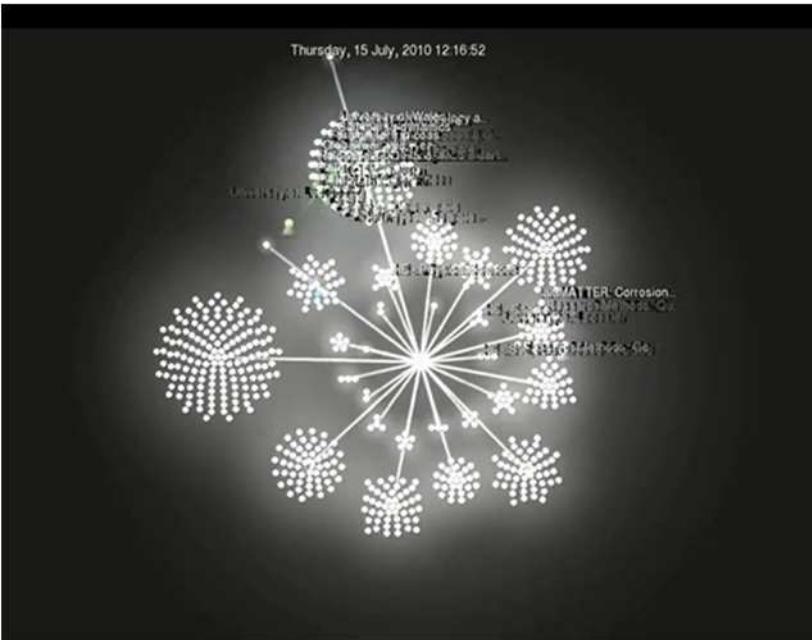


Figure 9 Snowflake visualisation of Jorum Deposits²⁰

Jorum learnt a lot from the Programme, sometimes the hard way. Being a service supporting an innovation programme was always going to be a challenge, in addition, during this period Jorum also migrated platforms from IntraLibrary to DSpace. The Jorum team had to adapt methods for bulk upload to support the projects and a fair number of methods were tried, some with less success than others. Many of the lessons learnt contributed to shaping Jorum's plan going forward. Over the decade, Jorum has responded to significant technical challenges, changed considerably and continues to develop.

Other repositories such as Merlot, Rice Connexions, OER Commons were not used by the projects, though there has been some technical dialogue with those developers.

It is fair to say that the anticipated progress expected by the JISC Repositories Programmes of a network of repositories for learning and teaching resources has not been realised. Repositories were one of many methods used for OER release by the UK OER projects but there was not a strong appetite to formalise the relationships between them.

Courseware platforms

Although the UK Open University provided access to LabSpace,²¹ which enables academics from other institutions to use the OpenLearn platform, no use was made of this platform by the UK OER projects.

RSS aggregators

Some projects made use of tool such as Netvibes, Pageflakes or Google Reader to aid their work and management, however none used these aggregation applications to release and disseminate their OERs.

Although creating new tools for content management and dissemination was generally considered to be out of scope for the UK OER Programmes some innovative tools for open education resources were developed in parallel with the Programme, including Xpert²² at the University of Nottingham, which was funded by a JISC Rapid Innovation grant. By ingesting OER RSS feeds Xpert has created a large scale aggregation of searchable metadata with links to hundreds of thousands of open educational resources. Xpert also incorporates a media search option that allows users to search for CC licensed image, sound or video resources. Users are able to submit their own RSS feeds to the aggregator, which currently contains metadata for almost 300,000 resources from 8000 providers.

Future directions

It was in the nature of the Programme that projects focussed on the act of releasing open educational resources. This was, of course, the necessary starting point, however just "getting the resources out there" does not represent a sufficiently broad resource management strategy to support a sustainable ecosystem that will fulfil many of the promises of OER. In order to do this, resource management strategies should be able to support, where appropriate, all stages of the resources' life cycle. There are various initiatives underway that show how this might happen in the future.

In essence there is nothing about an OER that requires a specific resource management approach to their creation, indeed it could be argued that one of the dimensions of openness is that resource creators should be free to use whatever tools are best suited to the type of resource that they wish to produce. Furthermore, the technology of resource management should not be a constraint on the pedagogy of the resources produced. Therefore it is unlikely that the

tightly integrated content editors and distribution platforms found in some content management systems will be suitable for OERs. It is also inappropriate for an OER to be so tightly bound into a CMS that it cannot be copied and run elsewhere. Even where such systems allow externally produced files to be distributed as "attachments" they often do not make good platforms for OERs as these attachments may not be handled well by the interface and do not benefit from the resource management capabilities of the platform. As an aside, it is worth noting that the versatility of HTML5 may ameliorate some of these constraints in the future.

While tight integration of resource authoring and management is not desirable for OERs, there are some OER management requirements that it would be useful for authoring tools to support. For example, as OERs will be released publicly, it would be helpful if the tools used to create them could be linked to the systems through which they will be released. One example of this in practice is the Xerte online toolkit which facilitates the creation and release of OERs through the Xpert repository via standard RSS feeds²³. Another approach is to integrate support for the Simple Web-service Offering Repository Deposit protocol (SWORD)²⁴ into authoring tools or resource creation platforms. SWORD is supported by many repository systems used for OER dissemination and has been implemented by Connexions²⁵ for their OER ecosystem, so providing authors with access to SWORD should allow them to deposit resources into dissemination platforms seamlessly.

One of the visions of what may be achieved through OERs is that the quality of resources may be improved through an open source model of shared contribution to their development. This may be more of an aspiration than an actual achievement in many cases, however it seems well accepted that the possibility that an education resource can be modified to fix perceived shortcomings or to match the needs of the user is helpful in promoting the reuse of resources. This is why the commonly used licences for OERs do not include the No Derivatives restriction. However many platforms used for managing OERs do not offer much by way of support for handling these derivatives or adaptations. One that does is HumBox which allows users to make copies of resources. The copies may then be edited, and HumBox maintains a record of the relationship between resources and their modified copies.

Some of the interventions mentioned in connection with supporting resource creation are also relevant to resource modification. The Xpert repository allows users of the Xerte toolkit access to the source code so that they can adapt the

Resource Management

resources they find. Connexions are actively developing an editor that integrates with their platform to allow users of the repository to modify resources that are hosted there.

The final aspect of resource management that is not well supported yet is the ability to create aggregations of OERs by bringing together resources from several dissemination platforms. Some tools do exist, for example the Xpert RSS aggregator²², OCWSearch²⁶, OCWC Course Search²⁷ and DiscoverEd²⁸. In addition one strand of Phase 2 of the UK OER Programme²⁹ concerned the automatic and manual creation of collections of OERs released elsewhere, and Jorum are experimenting with OAI-PMH harvesting. However despite these developments, it is still difficult to produce an attractive view, whether selective or comprehensive, of the resources released through the UK OER Programme.

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RESOURCE DESCRIPTION

Resource description may be explained as the way in which the characteristic properties of content items and the relationships between them and other resources and entities are described.

In discussing resource description it is useful to make a distinction between a human readable, textual description of a resource, which may be presented in a structured or semi-structured format, and metadata, the formal, standardised, machine readable representation of the characteristics of a resource. R. John Robertson in discussing resource description¹ suggested that it was "just good practice" that scholarly resources should include within the text information such as the title, a short description, enough information to identify the author and their affiliation, and the date. No one would talk to academics about this type of resource description and call it metadata.

Metadata is commonly defined etymologically as "data about data". A more formal definition is provided by NISO²:

"structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource."

While NISO explain that this can refer to information held in card catalogues etc, in modern usage the expectation is that this metadata will be machine processable, and in standard formats such as MARC, Dublin Core or IEEE LOM, which are frequently expressed in XML or RDF.

Some newer approaches, such as microformats, RDFa, and microdata, bridge the gap between human-oriented resource description and machine readable metadata in HTML pages by inserting machine readable tags into semi-structured descriptive text.

Why resource description is important

The NISO definition of metadata quoted above includes the common reasons for wanting to describe a resource, that is to assist in resource retrieval, use and management. However, use of the term "retrieval" hides what for many is metadata's single most important function: to facilitate resource discovery. In practical OER contexts, resource discovery means facilitating search on Google,

Resource Description

as discussed in the SEO and Discoverability chapter. Resource description may facilitate the use of OERs by providing the information necessary to select an appropriate resource. This may be information such as the suitability of the resource for the topic to be studied but may also include information about the timeliness of the resource, the technical format, and licence under which it may be used.

The role of metadata for resource management is more difficult to conceptualise, but includes the ability to repurpose and re-present collections of OERs. For example, by passing information about all or part of a collection held at an institution to a central service, it can be included in a national or subject-oriented collection. Resource management may also involve the analysis of activity and outcomes at a collection or programme level, such as the OER Data Analysis and Visualisation project³ undertaken by Martin Hawksey. Both these examples of resource management require a level of metadata standardisation and machine readability so that one computer system can understand the information provided by many others.

Resource Description

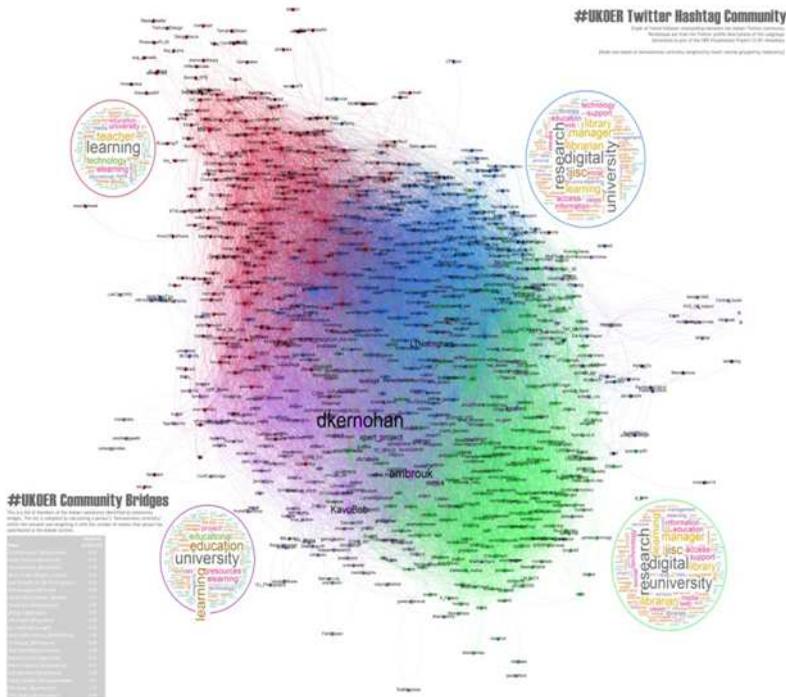


Figure 10 The Heart and Pulse of OER⁴

Programme approaches to resource description

At the outset of the first phase of the OER Programme, CETIS was asked to provide projects with guidance on resource description. As discussed earlier, for previous JISC programmes CETIS had provided projects with a strong steer on specific standards and application profiles to use in a number of technical domains including resource description. An important component of this work was an effort to produce an application profile of the IEEE LOM, the UK LOM Core⁵, tailored for use in UK Further and Higher Education. However, partly as a result of an increasing realisation that the UK LOM Core was not achieving the intended results, and partly in response to new approaches to resource description, such as folksonomies, informal tagging, and the use of platforms for resource sharing such as flickr, YouTube and SlideShare, which did not support formal metadata schema, the decision was taken not to mandate the use of formal metadata schema for the UK OER Programme.

Resource Description

Instead CETIS used the innovative pilot nature of the UK OER Programme as an opportunity to suggest that JISC explore a new approach to resource description⁶. Rather than mandating a formal application profile based on a single open standard, CETIS instead identified the type of information that projects were required to record for the resources they created, without mandating how this should be done. The hope was that this would give projects considerably greater flexibility as to how they described their resources and that this would ultimately result in richer descriptions of greater value to end users. The expectation was that projects would identify what they wanted to achieve and think through the resulting resource description issues that arose. It was hoped that by encouraging this methodology, collaborative approaches to interoperable resource description would be surfaced.

The metadata guidelines for phase one of the Programme mandated that the description of all resources should include information about the title of the resource; the author, owner or contributor; an indication of the date that the resource was created or published, whichever was significant; the URL at which the resource could be found; and technical information such as format, file size etc. There was also a mandatory programme tag, ukoer, which was to be used to identify resources produced through the programme. Other information such as a description, subject classification, keywords, tags, comments and the language of the resource were recommended as desirable but were not mandated. It was the intention that this minimal set of mandatory metadata would form the basis on which projects and related services could build resource descriptions that were adequate to meet the needs of their stakeholders. Some parts of the mandatory metadata set addressed programme-level requirements; for example, the ukoer tag was designed to facilitate the identification of all the resources produced by projects funded through the programme.

The Phase One guidelines were modified only slightly for subsequent phases of the Programme, the main variation being that licensing information was added to the mandatory metadata and technical information removed from the recommended list.

Issues

The programmes surfaced a number of issues relating to resource description.

What metadata is really required?

One of the factors in deciding not to mandate a specific metadata profile across the programme was an acknowledgement that it was necessary to rethink what metadata is *really* required for educational resource description.

It is not difficult to find recommendations for resource characteristics or relationships that it might be useful to record for certain, often speculative, use cases (see for example the Learning Materials Application Profile Scoping Study⁷), however it is less easy to find evidence about how often these use cases are actually important and whether the proposed metadata approaches actually work.

The hope that projects would invest time in analysing their resource description requirements was somewhat disappointed. The metadata requirements listed above, which were intended as a starting point, seemed to be interpreted by some projects as the final word on what was required. Some projects took what we had intended as the minimal base of metadata to the sum total of what was required. Indicative of this failure to provide a suitable level of resource description was that in the Phase One Pilot Programme it was frequently the case that information about the licence under which a resource was released was not provided. Jorum, the national JISC funded repository followed the CETIS lead in specifying a minimal metadata set (which included some additional information such as licence and subject classification not in the basic set), but the repository did not reveal any additional metadata provided by depositors through the interface. As a result, potentially useful information was not visible to users. In another case, metadata from an OER source contained a description that was only seven letters long. It is difficult to imagine for what purpose such a description could be adequate. The best that can be said about such approaches is that at least they did not result in anyone wasting time that could have been better spent on the release of OERs.

In order to stimulate discussion about what metadata was necessary, CETIS organised a meeting⁸ at which various approaches to gathering data that might inform an answer were discussed. Three approaches were identified as promising: questionnaires to ascertain from users what they were interested in and how they approached resource discovery; analysis of search logs to find what characteristics were being searched for; and semantic analysis of free-text descriptions to find out what was being described. Some preliminary results were reported at the meeting, however this remains an under-explored area.

UKOER

The use of the UKOER tag to identify OERs created through the funded programme did not work quite as anticipated as the tag proved to be very popular among projects and was widely used for tagging anything related to the programme, including tweets, discussions, blogposts, images, and other project outputs. As a result, a Google search for UKOER finds more information **about** the programme than resources created **by** the projects. It does, however, have some utility in identifying resources from the programme that were shared through social web sites such as YouTube, flickr and Slideshare. Several projects became aware of this issue and used a project-specific tag to identify their OERs. This also makes it possible to identify which resources came from which projects once they have been aggregated into larger collections.

Variation in vocabulary and classification

It was acknowledged from the outset that the freer approach to resource description was likely to have some impact on interoperability. One aspect of this was not mandating classification schemes or controlled vocabularies for the specific resource characteristics being described. Thus there was no single subject classification that was imposed centrally by the programme. This allowed individual projects to choose classification schemes that met their own needs. For example institutional projects could classify according to their departments or the programmes they delivered, subject-based projects could use a classification scheme that was specific to their discipline, and projects that disseminated through specific channels such as iTunesU or Jorum could use the classification scheme used by that platform. Jorum uses JACS⁹ to provide a top-level classification scheme that mirrors the subjects taught in UK Higher Education, a practice that was followed by many projects.

However some projects wanted a more restrictive approach. This may have been because they foresaw interoperability problems without mandated controlled vocabularies, in more than one case this opinion was expressed by a project team member from a library background. Alternatively it may have been that projects preferred to use recommended vocabularies rather than having to select classification schema themselves.

The thorny issues of educational metadata

One area where standardisation of approaches has proved to be particularly difficult is in describing the educationally significant properties of a resource. As noted in the Learning Material Application Profile Scoping Study¹⁰

"metadata for education was one of the domains where the issues were least well articulated and where solutions were least well developed."

In other words, while it is often stated that it would be useful to describe features such as the "educational level" or the "interactivity" of a resource, there remains a gap between this desire and defining exactly what is meant and how these characteristics should be described. If it is the case that these concepts are useful in assisting users in resource selection, but are too nebulous to be used by machines for filtering, then a realistic approach is to include them in the human readable resource description, without attempting to encode them as machine readable metadata. In other words, to include them in free text descriptions or free text keyword fields.

Metadata in the repository but not in the resource

One of the effects of the previous focus on formal metadata standards seems to be that resource description is seen as a technical issue to be dealt with by experts in information and interoperability standards, distinct from the resource creation process, and hidden away from those creating the resources. A recurring symptom of this was that resource descriptions tended to be created in the platform that was used to disseminate the resource, e.g. the repository, rather than being contained within the resource itself. The fact that programmes funded the release of existing material rather than the creation of new material may have accentuated this focus on dissemination systems, rather than on the resources themselves. The problem, of course, is that once the resource is downloaded by a user, or if the user is sent directly to the resource from an external link bypassing the description page, they will miss important information such as the licence and provenance of the resource. This issue is also explored in the Licensing and Attribution chapter, but in short, this is a recipe for creating orphan resources and uncertainty among users, that may inhibit the reuse of the resource. In addition, divorcing resources from their metadata, may deny the content creator

Resource Description

or publisher the potential reputational benefit arising from having their resource reused and their authorship acknowledged.

Sensible approaches to ensure that the description of the resource stays associated with the resource include creating a template of resource description elements as a header or footer running throughout the resource, cover pages providing a short summary of the resource, credits at the end of a resource such as an audio or video recording or the final slide in a stack. Images present a particular problem as they are typically non-textual and displayed as a single frame. One solution is to add the necessary information, in the form of text, as inconspicuously as possible at the edge of the image. A particularly interesting and useful application of this approach is the Xpert Media Search attribution tool¹¹ which will search flickr for Creative Commons licenced images and automatically create a copy of the image to which licence and attribution information has been added. This tool being developed further with funding from the JISC OER Rapid Innovation Programme.

Another approach is to embed machine readable metadata into the resource, for example as the properties of a Word or Powerpoint document, exif¹² metadata in images or id3¹³ tags in audio files. The extent to which this metadata is made visible to human users varies between applications, as does the reliability of the metadata found in the wild; arguably the two are correlated. At one end of the spectrum the metadata found in office documents, whether proprietary or open source, is rarely displayed when viewing the documents, and has been found to be unreliable. For example, the author of the template a document is based on often appears in the "document properties" as the author of the document, and is often left uncorrected. Some metadata in images and recordings which is created automatically (e.g. time and geolocation information from cameras) or imported from trusted sources (e.g. metadata in music recordings) is usefully displayed by systems that disseminate or display/play those resources.

There are limitations however, for example while some social media sites will import embedded metadata, such as geolocation tags, and display this information on the page along with the resource, frequently it is not possible to amend this embedded metadata. For example, a user may change the location of the image on the display page, but this will not change the geolocation information embedded in the image.

Future directions

Some future directions relevant to resource description have emerged from the UK OER Programmes that are worth highlighting.

Describing audio visual resources

The description of audio visual recordings at a highly granular level has always been problematic. "Shot lists", which provide a shot-by-shot description of the content of a recording and where it can be found, can be extremely useful but are very time consuming and expensive to produce. An interesting approach to providing this information is being explored by OER Rapid Innovation projects such as Spindle¹⁴, which aims to increase OER discoverability by improved keyword metadata via automatic speech to text transcription and Synote¹⁵ which supports the crowdsourcing of notes, bookmarks, tags, images and text captions that are synchronised with audio visual recordings. Synote also has the ability to publish linked data.

Schema.org

The use of microdata within HTML documents provides a means of combining human oriented resource description with machine readable metadata. Of particular significance is schema.org¹⁶, an initiative involving Google, Yahoo, Yandex and MS Bing that aims to

*"... improve the web by creating a structured data markup schema supported by major search engines. On-page markup helps search engines understand the information on web pages and provide richer search results."*¹⁷

There are two aspects to schema.org; a syntax for encoding the markup that is a subset of microdata or RDFa lite, and a shared ontology of item types and their properties. The Learning Resource Metadata Initiative is working to extend the schema ontology so that selected educationally significant characteristics may be marked up. These developments came late on in the Programme and are only at an early stage of implementation.

Paradata

It has long been acknowledged that publisher-created resource descriptions and formal metadata records are not the only useful sources of information about a resource. Often more useful, contextually sensitive and extensive information can be created by users, both incidentally as they use the resource, and through the conscious actions of reviewing, tagging, discussing and recommending resources. The new approaches to gathering and using this information encapsulated in the paradata¹⁸ approach may offer solutions to some of the more intractable issues around the description of the educational characteristics of a resource. For example rather than trying to identify the educational level of a resource, the paradata approach would be to record the courses a resource has been used in, so that it can be recommended to teachers and learners engaged with similar courses. This approach is discussed in more detail in the chapter on Paradata.

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LICENSING AND ATTRIBUTION

Any original creative work automatically qualifies for copyright, allowing the owner to control various forms of use. Commonly, resources are published as being "© All rights reserved", however the owner may grant users permissions to reuse content through an explicit licence. Open licences are those that give the end user permission for significant levels of reuse, redistribution and modification with minimal restrictions. The most well-known type of open licences are those provided by Creative Commons¹. It is a common misunderstanding to think that someone chooses a Creative Commons licence "instead of" copyright, or that in using an open licence they are "giving away" the copyright. Licensing does not change the ownership. Licensing is about the owner granting permissions to other users.

Why licensing and attribution are important

Teachers have copied, modified and redistributed digital resources for as long as there have been digital resources. This was often without permission, but was low risk as the product was only shared with learners. With the growth of Virtual Learning Environments (VLEs) / Learning Management Systems (LMSs) in the early 2000s, and their use for distance and online learning outwith the institution, teachers' materials became more widely visible. This increased the risk associated with using copied material, and started to raise awareness of the copyright issues around reuse of digital content. The use of resources released under open licences legalises the teachers' natural practice of copying and adapting resources to meet their needs. Attribution to the owner of the resource is a requirement of all commonly used open licences, so technical approaches to managing attribution are important in facilitating the legal and ethical use of OERs.

Programme approaches to licensing and attribution

The approach the Programme took to licensing evolved as the Programme support teams learnt from the experience of the projects. In Phase One, the Programme allowed the use of any Creative Commons licence even though some projects would have preferred the Programme to mandate a particular licence. In

Licensing and Attribution

Phase Two, in response to the problems surfacing around restrictions on commercial use and having learned lessons from the Phase One, the Programme recommended that resources should be released under the most liberal licence that requires only attribution.

The Programme approach could be characterised as follows:

- Typically, the content user will want as many rights as possible to do what they want with the content. The Programme had a responsibility towards both resource users AND resource creators, so at times took a more cautious approach than some OER evangelists.
- Technology can provide many solutions for licensing. The programme took an interest in many of these solutions but always with a view to how scalable and sustainable they are.
- The Programme aimed to increase individual and institutional capacity to develop OER practices, so even where central support was provided, the responsibility for improving practice was not outsourced.

Issues

The lessons that have emerged from the Programme provide valuable insight into how awareness of licences and licensing practices can develop.

OER and Creative Commons

Creative Commons licences are not unique in facilitating the activities that teachers engage in when using and reusing resources, however they do have some benefits over alternatives. The single most persuasive benefit is that since their use in landmark initiatives such as the MIT OpenCourseWare² they have become a de facto global standard for open educational resources. The global use of a small set of licences brings the following advantages:

- Users only have to be aware of a small set of licences which are visually recognisable across a wide range of platforms.
- Systems such as resource management platforms can be developed to support only a limited number of licences.
- Difficulties that arise when trying to combine resources that are licensed under different terms and conditions are minimised as the number of conditions on reuse are reduced.

The widespread adoption of Creative Commons licences also provides assurance that they provide a sound legal and technical solution that can be easily implemented.

Other licences for OER

Although the steer from the UK OER Programme, both to projects and to Jorum, was to use Creative Commons, JISC remained very open to the emergence and adoption of new licences.

At the time the Programme started there was an additional licence available that had been developed by JISC Collections, JISC's national content negotiation body. It was designed as a bridging licence between publisher contracts and Creative Commons and was not actively promoted. Legally it was as sound and as liberal as Creative Commons, but it was not so widely known and recognised.

Towards the end of the programme, the Open Government Licence (OGL) gained currency with developers for data sharing, but this licence hasn't yet had a significant impact on the OER domain.

Software produced by projects was subject the JISC Software Outputs Policy³ which requires that it is released under an open source licence. These licences permit similar uses as Creative Commons licences but they also include provision for legal issues other than copyright that may be important for software reuse.

The OER IPR Team produced a useful briefing paper on different types of open licences.⁴

Reflections on Creative Commons clauses and how they support OER

The different Creative Commons licences combine restrictions on the use that can be made of a resource. In some quarters, these restrictions are considered problematic by those involved in promoting OERs. When referring to Creative Commons licences, each of these restrictions is commonly referred to by a two-letter acronym.



BY (Attribution): the user must attribute the work in the manner specified by the author or licensor (but not in any way that suggests that they endorse you or your use of the work). This is a requirement of nearly all the Creative Commons licences. This condition aligns well with academic practices regarding citation.

Licensing and Attribution



SA (Share Alike): if the user alters, transforms, or builds upon the work, they may distribute the resulting work only under the same or similar licence to the original. Given the ambiguities of the Share Alike clause, this licence can inhibit reuse and adaptation. CC SA licensed content can be difficult to adapt and re-use as effectively it can only be remixed with other content carrying the same licence. The OER IPR Team's Creative Commons Licence Compatibility Wizard⁵ provides guidance on different licence types.



NC (Noncommercial): the user may not use the work for commercial purposes. This is hugely problematic in the education domain due to different and changing perceptions of what may be regarded as commercial activity, whether it relates to the business model of the provider or the use of the content. Discussion of these issues can be endless and political, and no easy answers emerged during the three years of the Programme.



ND (No Derivative Works): the user may not alter, transform, or build upon the work. This restriction inhibits adaptation and therefore frequently regarded as unsuitable for OER, however some projects argued with just cause that allowing unchecked modification could be problematic, particularly where the resource dealt with medical or other potentially harmful issues.

Most Creative Commons licences are combinations of these four restrictions, for example CC:BY-SA represents a licence that requires derivative works to be attributed and shared under the same licence. The exception is CC Zero which waives all the author's rights, including attribution. This option is increasingly popular for data and for the free culture movement. There is also a Creative Commons Public Domain mark by which resource publishers can express that the content is not copyright. This is not a licence as such, but an expression of the IPR status of the work that negates the need for a licence. Over the course of the programme the Creative Commons Public Domain mark was not used by any of the UK OER projects.

Authorship, ownership and identity

It was well known before the Programme began that the ownership and copyright of content produced by academics was at best unclear and and at worst misunderstood. Different institutional cultures take different approaches to intellectual property rights, particularly in relation to teaching and learning resources. For a definitive answer to who owns educational content in any specific institution, it is necessary to refer to institutional policies and guidelines, terms and conditions of staff contracts, handbooks and codes of practice. It is to be hoped that institutional IPR clauses will become articulated more clearly, driven in part by increasing awareness of the open access and open educational resource movements. In the meantime however, the situation is complex.

The advice given by the UK OER Programme, stressed that projects should address how authors, owners and contributors were attributed, both as part of the production process and at the point of release. Attribution is a non trivial problem as the author (the person or persons who creates the work), the owner (sometimes the employer of the author), and the contributor (sometimes the person who deposits the content to a repository) are usually distinct separate entities. Allocating unique identifiers to people and institutions is one obvious solution to aiding attribution and citation, but the governance of such a service is complex.

Attribution

Attribution is important to both the contributors and users of OER for a variety of reasons, including:

- Personal reward resulting from people recognising one's work.
- Increasing institutional reputation and brand recognition.
- Facilitates accurate citation.
- Enables users to contact authors and contributors.

Importance of attribution for OER users

- Establishing provenance
- Finding more resources by the same author or contributor
- Providing accurate citation as part of academic work
- Seeking further permissions

Licensing and Attribution

Provenance and citation are important aspects of all academic and scholarly practices; the ability of Creative Commons licences to support these practices is of particular importance to OER developers and users.

An interesting parallel can be drawn with the importance of attribution to photographers; indeed photographers have helped drive this debate with the Creative Commons community. This was nicely illustrated by the contribution of the Phonar⁶ project at Coventry University.

By contrast, the critical problem facing the domain of open data, is not how to manage attribution, but how to deal with attribution stacking. This is when the sheer volume of aggregated content makes effective attribution unfeasible. As a result, open data advocates are inclined to argue loudly against the BY clause in Creative Commons licences and in favour of CC0, however in the OER domain the drivers are stronger to maintain attribution.

Even though most Creative Commons licences include the "BY" clause¹⁷ many resources that use these licences are still not attributed effectively. There is a lack of comprehensive data on the ways in which licences are applied, however anecdotal evidence suggests that although it is very common to find a logo that includes information about the owner of a resource, and it is much rarer to find a logo accompanied by a name and an identifier.

Consider the combinations in figure 11

Licensing and Attribution

		Licence	Author	Owner	Facilitates Attribution	Citable	Owner is Traceable
A	Licence without author / owner	CC BY					
B	Logo without author / owner						
C	Author / owner without licence		Amber Thomas				
D	Full ownership, no licence		Amber Thomas	JISC			
E	Licence with author	CC BY	Amber Thomas		Yes		
F	Full ownership with licence	CC BY	Amber Thomas	JISC	Yes		
G	Logo with author		Amber Thomas		Yes		
H	Logo with author and owner		Amber Thomas	JISC	Yes	Yes	?
I	Linked logo, with author and owner		Amber Thomas	JISC	Yes	Yes	?
J	Logo with linked author and owner		Amber Thomas	JISC	Yes	Yes	Yes
K	Linked logo, author and owner		Amber Thomas	JISC	Yes	Yes	Yes

Figure 11 Thomas, A., (2012), *Human Readable and Clickable Licences*

Although there is widespread recognition of the importance of open licences for open educational resources, there is little appetite for strict enforcement of licences and considerable resistance to digital rights management (DRM). However it is not just the protection of copyright and intellectual property rights that is undermined by lack of effective attribution, the reuse of content also suffers, and the crucial link back to the author, from which other benefits can arise, is broken. Putting DRM to one side, and focussing instead on enabling a healthy ecosystem of use and re-use is the way forward for licensing of open educational resources, but there is still considerable room for improvement.

Embedded and machine readable licences are in their infancy

As described in the chapter on Resource Description, once an OER is released into the wild, it is best if it carries some of its metadata with it. This is critical for licensing information and metadata because, without the attribution information, the licensing and attribution conditions cannot be complied with.

Embedded Licences are licences that are part of the resource itself and that travel with the resource. Portability is important as, due to the nature of the web, copyright owners cannot assume that the user will view the resource in the same place or context that it was published.

Machine readable Licences are licences that can be read automatically by machines. The diverse range of formats used for OERs, as well as the range of capabilities of authoring, dissemination and view/play platforms, results in a plethora of technical combinations that need to be considered when implementing machine readable licences. The potential for better technical solutions is clear, and JISC has tried to nurture new solutions. See the Future directions section, below, for details of the Creative Commons Licence chooser, which is a good step in this direction.

Xpert Media Attribution⁷ at the University of Nottingham was funded by JISC prior to the UK OER Programme. This is a hosted web service that provides image, audio and video search via the flickr and Jorum APIs, and uses the rights metadata to stamp the copyright information onto the bottom of the image. With OER Rapid Innovation funding, the service is now developing a stand-alone image attribution stamper⁸.



Figure 12 Image with licence and attribution added by Xpert

In parallel with the UK OER Programme, UK developer Pat Lockley, also contributed to the OpenAttribute project⁹. One aspect of this project is the development of browser plug-ins to display the information from RDF embedded licences in the browser. This is a good solution for html resources, but relies on the user having installed the plug-in for their browser.

With a small JISC CETIS OER Mini Project grant, a team at MIT developed CaPRéT Copy and Paste Attribution¹⁰ which builds on OpenAttribute to provide attribution and tracking functionality for content that is copied and pasted online resources.

For example anyone who gets hold of a copy of the resource would want see that it is an OER, so it seems obvious that the Creative Commons licence should be clearly displayed on the resource; they would also want to see something about who created, owned or published the resource, partly to comply with the attribution condition of Creative Commons licences but also to conform with good academic and information literacy practice around provenance and citation.

Phil's JISC CETIS blog |

Source: <http://blogs.cetis.ac.uk/philb/>

License: <http://creativecommons.org/licenses/by/3.0/>

Author: Phil Barker, JISC CETIS

Figure 13 Text copied from CaPRéT enabled blog. It should be noted that the text appended to that which was copied is not always welcome.

Attitudes to risk

In the early phases of the Programme, projects focused on raising awareness of the importance of licensing, supported by materials from the OER IPR Support Project including a risk management calculator¹¹

It is still the case that institutional library staff, those traditionally tasked with the stewardship of IP, are likely to be the most risk-averse. IP and enterprise offices tend to be more concerned with protecting IP in patents rather than exploiting IP through open content approaches. However institutional libraries and professional library staff have started to engage much more with open licences in recent years and are now have the potential to play an important role in making open educational resources more credible.

OER has partial roots in hacker culture, where there is a higher tolerance of risk than in many institutional settings. Within the context of the Programme it would have been acceptable for individuals to waive their rights entirely, but perhaps unsurprisingly, none of the projects took this approach.

No easy technical solutions to permission seeking

Early on there were high expectations of how technology could facilitate the clearance of rights, with some project staff even suggesting that JISC could provide a central clearing house for "orphan works" (works within copyright but where the ownership is unknown). Most commonly though, the focus was on seeking rights from known owners to reuse content under CC licences. This might be content currently held in authenticated environments like VLEs, or content available on the web with all rights reserved, or content provided by negotiated publisher deals.

In Phase Three, the PublishOER¹² team built on their previous OER projects to tackle the question of rights seeking head on. It is notable that this is one of the most experienced teams in the programme and one of the few to explore different approaches and technologies for embedding of third party rights in a systematic way.

The need to decouple licence assignment from repository deposit

Probably the most commonly-held misunderstanding regarding licensing is that the licence must be assigned by or to the repository. This is not the case with Creative Commons licences however the perception persists largely because repositories frequently act as the point of distribution, and the notion of deposit is tightly coupled with the notion of licensing. However, it is unhelpful to envisage licensing in this way because once content has been created it is the rights associated with the content that determine the licence, rather than the rights associated with the repository.

Questioning the need for open licences

To take a step back, there is a fundamental question of how far open licences are essential for facilitating the creation and use of OER. As Amber Thomas explored in "Rethinking the O in OER"¹³ and "The OER Turn"¹⁴, there are questions to unpick: if content is simply read, played, watched or linked to, does it require the contributor to have made it available under an open licence?

"I find myself asking what the "Open" in Open Content means. Well, it definitely means free (not paid). And it means easily linkable, which means not authenticated (not closed). However what about

near-ubiquitous controlled access through gmail or facebook? Sometimes the format matters, sometimes the licensing matters. Maybe this matters a lot for content to cross language boundaries, maybe it matters a lot for accessibility. In which case do we need to articulate the costs and benefits of open content for those use cases? We don't want to kill open practice dead by focusing too strictly on definitions of openness any more than we want to kill open content by diluting the promise to users seeking editable re-licensable content. What questions should be asking about open content?"¹⁴

Regardless of degrees of openness or the type of open licence used, if open educational resources are to be used more widely in education they need to be citeable. Consequently, the importance of provenance means that attribution is a key aspect of any educational resource use.

Future directions

Smarter machine readable licences

The CC Licence Chooser¹⁵ released in summer 2012 has improved users ability to select appropriate licences and generate snippets of HTML referring to the licence deed and including all the information required for attribution encoded as RDFa.

The image shows two panels from the Creative Commons Licence Chooser. The left panel, titled 'Help others attribute you!', contains a form with the following fields: 'Title of work' (Example Deed), 'Attribute work to name' (Amber Thomas), 'Attribute work to URL' (http://www.jisc.ac.uk/oonta), 'Source work URL', 'More permissions URL' (a.thomas@jisc.ac.uk), 'Format of work' (Other / Multiple forms), and 'License mark' (HTML+RDFa). The right panel, titled 'Have a web page?', displays a Creative Commons Attribution 3.0 license icon, a text snippet: 'Example Deed by Amber Thomas is licensed under a Creative Commons Attribution 3.0 Unported License. Permissions beyond the scope of this license may be available at a.thomas@jisc.ac.uk.', and a code block for HTML+RDFa:

```
<a rel="license" href="http://creativecommons.org/licenses/by/3.0/deed_en_US"><a><br /><span xmlns:dot="http://purl.org/dc/terms" content="dot">Example Deed</span>
```

 Below the code block are two radio buttons: 'Normal Icon' (selected) and 'Compact Icon'.

Figure 14 Creative Commons Licence Chooser

New open licences

It is also likely that that new open licences will emerge. Creative Commons 4 is under development at the time of writing but it is not clear whether that will simplify or extend the licences currently available.

Remixing platforms and applications

The potential for dedicated remixing applications and platforms to make legal remixing of content easier is a real technical opportunity, and one being explored by SupOERGlue¹⁶. However, due to the sheer volume of content available and the diversity of contributors and users, it is not enough for a platform to simply exist; it needs to have traction, to be used, and for other actors in the ecosystem to provide content and licensing data in machine and human readable formats.

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SEO AND DISCOVERABILITY

Search Engine Optimisation (SEO) is the process of improving the visibility of resources in search engine results. Discoverability is related to search engine optimisation as those resources that are most visible in search engine result pages are more easily discovered. Discoverability also relates to the ability to find resources in appropriate places, for example, in curated collections, institutional repositories and through web services.

Why SEO and discoverability are important

In common with other types of web resources, most people will use a search engine to find open educational resources, therefore it is important to ensure that OERs feature prominently in search engine results. In addition to ensuring that resources can be found by general search engines, it is also important that OERs are easily discoverable in content or type specific sites such as iTunes, YouTube, Flickr, etc.

Although search engine optimisation can be complex, particularly given that search engines may change their algorithms with little or no prior warning or documentation, there is growing awareness that if institutions, projects or individuals wish to have a visible web presence and to disseminate their resources efficiently and effectively search engine optimisation and ranking can not be ignored¹.

The statistics are compelling:

- Over 80% of web searches are performed using Google².
- Traffic from Google searches varies from repository to repository but ranges of between 50-80% are not uncommon³.
- As an indication, 83% of college students begin their information search in a search engine⁴.

Given the current dominance of Google as the preferred search engine, it is important to understand how to optimise open educational resources to be discovered via Google Search. However SEO techniques are not specific to Google and can be used to optimise resource discovery by other search engines.

Programme approaches to SEO and discoverability

In a summary of search and discovery conducted by OLnet⁵, an international research hub for open educational resources, the following observations were made:

1. *Google and Wikipedia are the two most used search sites for learning resources;*
2. *Most users prefer a simple search strategy (i.e. entering one or two keywords), they don't care about using metadata until they can't find what they are searching for;*
3. *Good search tools allow users to continue solving their problem, providing them with some useful content / links that will further their search.*

Projects were specifically asked to explore SEO and discoverability during Phase 2 of the UK OER Programme, and as part of the Phase 3 Rapid Innovation (OER RI) Call. Phase 2 included a dedicated strand for "The Discovery of OER"⁵, which funded six projects to create thematic collections with the aim of investigating how discipline and subject area collections of open educational resources could increase their discoverability for those working in subject domains.

The Phase 3 OER RI Call highlighted two previous projects worthy of further investigation; the Phase 1 Multimedia Training Videos Project, which explored SEO by purchasing Google AdWords⁴ and the Phase 2 Sickle Cell Open Online Topics and Educational Resources (SCOOTER)⁶, which examined SEO guidance for open educational resources.

The creation of thematic collections is good practice on a number of levels. Collections generally create internal or backlinks to the resources within the collection, these links are then used as a positive indicator for search engine ranking algorithms. Actions to improve SEO and discovery of collections and individual resources can be seen as taking place at two levels: at the level of the individual resource or collection, and at the repository or resource management system level.

SEO at the individual resource level

For content creators who wish to make individual resources more discoverable, Peter Robinson of the University of Oxford provides the following advice on the OpenSpires blog⁷:

- 1. Reflect on what people would actually type into Google to find your material – make sure these search terms are on the page that delivers your material and ideally in the title of the web page.*
- 2. Get your delivery web pages to use human readable URLs – Google still values search terms in web page titles. [See the title of Peter's WordPress page to see how clever this system is at generating human readable web page titles.]*
- 3. Use Web 2 social networks to generate a buzz – Create a conversation around your content on Twitter, Facebook and other social networks.*
- 4. Promote your material in a blog, perhaps relating it to what's happening in the news – timely material will be spotted by Google Instant⁸.*
- 5. Join the wider Open Learning landscape by adding your content to OER directories such as Jorum, Xpert and the global US OER directories.*

The SCOOTER project also produced a "Guide to Search Engine Optimisation"⁶, the first steps of which focus on keyword generation by brainstorming, analysing the effectiveness of the keywords and including them in a resource description¹¹. However it is important to note that changes to search algorithms now mean that keywords included in the head of webpage are ignored by Google and may be misinterpreted by Bing as an indication of spam content and removed from search listings⁹.

SEO at resource management level

In addition to including suitable descriptive information embedded within resources, it is also important to ensure that resources can be indexed by search engines. In order to do this two files should be maintained on a webserver, one

identifying what parts of the site should be indexed (the robots.txt file), and another listing the resources on the site, formatted as an xml sitemap.

System level optimisation of this kind is already integrated into various resource management platforms. As part of the UKOER Phase 3 Triton project, the blogging platform WordPress was used to host resource collections. The project final report highlighted the following benefits of using this platform¹⁰:

1. *URL structure – WordPress supports multiple URL formats. By default, each link is based on the ID of the post so the URL (canonically) would appear as `http://wordpress_site/?p=1` – where 1 would be the post ID on the database. This offers next to no information to the search engine on the page content. However using a different WordPress URL structure, we can change the URL to `http://wordpress_site/a_blog_on_politics/` and so offer extra information to anyone indexing the site.*
2. *Sitemaps – Google, Bing and Yahoo can have their indexing system guided by providing a sitemap. A sitemap is a block of XML which demonstrates the structure of the site to the indexer. WordPress has many plugins supporting sitemaps.*
3. *Simplified tagging and categories – Contributors are not SEO experts, but WordPress makes adding categories and tags to content simple. It also creates pages for these tags and categories increasing the likelihood of content being found.*
4. *Associated Google tools – Using Google analytics, and Google +1 increases the knowledge Google can hold about your site, and so increases the likelihood of site content being found.*

Metadata and microdata

A more detailed discussion of metadata and microdata is included in the Resource Description chapter. However, in terms of search engine optimisation, when creating metadata, it is important to consider how information will be read and processed by search engines, as metadata included in the head of a resource webpage may be ignored or, as previously mentioned, interpreted as spam and negatively impact search ranking.

Issues

The UK OER Phase 3 Rapid Innovation Call explicitly encouraged project to explore SEO for open educational resources¹¹, however no proposals were received covering this topic. Furthermore, most of projects funded made little attempt to directly address SEO and resource discoverability.

Search engine optimisation can seem like something of a black art, particularly given that search engines can and do change their algorithms with little or no prior warning or documentation. However there is growing awareness that search engine optimisation cannot be ignored if institutions, projects or individuals wish to have a visible web presence and to disseminate their resources efficiently and effectively. SEO needs to be an iterative process; search engine referrals must be monitored in order to identify and deal with any new and unforeseen issues. In 2011, following a change to Google's search ranking algorithm, Julie Walling provided useful guidance on "Troubleshooting a Drop in Search Engine Rankings"¹², which included:

- Structure sites so they are as content rich as possible.

- Pick one keyword per page and stick to it.

- Include your keyword in the anchor text of internal links.

- Attract high value external links.

Recommendation and discoverability

The use of recommendation systems is commonplace in a number of web services such as YouTube and slideshare. When users view content on these sites, they are given recommendations of other similar resources that might be of interest based on their viewing history. Recommendation systems of this kind are still uncommon within institutional repositories, though plugins such as CORE¹³ provide a framework for integrating "similar documents" to search results. Within the education sector the growing use of non-traditional repository systems such as WordPress, which allow the use of existing "similar document" plugins, may lead to more widespread integration of recommendation systems in the future. Initiatives such as the Learning Registry, which is explored in the Paradata chapter, also have the potential to make a significant contribution to search engine optimisation and discoverability of open educational resources.

Future directions

Interest in SEO and discoverability of open educational resources seems to be growing and questions are increasingly being asked about how repositories can better surface content on the web. More significantly for OER, the development of services that mesh together social web functions with discoverability will impact on the way that content is shared and found: for example, Google+ and other emergent models use a sort of paradata to weight the presentation of results. The challenge for service managers is to keep abreast of developments in search services so that they can continue to optimise their content and open educational resources for discoverability.

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TRACKING OERS

Tracking here refers to techniques to ascertain what use and reuse has been made of open educational resources by people after they have been released. The emphasis is on tracking what has happened to a resource: how many times it has been viewed or downloaded, whether it has been copied to another server, whether derivatives have been made. User activity tracking is not in scope here, other than to the extent that it can be assumed that a user will be doing the downloading, copying and remixing (this is touched upon in the chapter on Paradata).

Why tracking is important

There are several reasons for wanting to track resources, depending on the stakeholder in question.

- Funders (including institutions funding internal OER initiatives) need evidence to show that their money has been spent on resources that are useful and meet a demonstrable need; creators and publishers of OERs who have an interest in continued funding should be ready to respond to this requirement.
- For those with policy and operational remits, tracking can be useful to help assess the potential value of time consuming activities, for example ascertaining whether the time and expense involved in clearing rights to allow reuse and remixing of content is justified.
- Authors are likely to have an interest in tracking as it can show where and how often their resources are reused. This not only provides evidence of the value of the resources that they create, but also provides pointers as to how content may be expanded or revised.

Of course the assumption behind such reasoning is that resource tracking will actually be able to show evidence of use. However tracking can be something of a double-edged sword, as it may equally show that resources are not being used and that the time and effort spent clearing rights so that they could be edited freely was of little value. It is also clear that tracking should be subordinate to the release of resources, that is, it is necessary to first solve the problems inherent in releasing resources before they can be tracked. In addition, tracking techniques should not limit the ability of users to access and reuse open resources, nor

should it interfere with the benefits that resource publishers may wish to achieve by releasing content as open educational resources.

Programme approaches to tracking

The initial call for Phase One of the UK OER Programme included the following recommendation¹:

"As far as is possible projects will need to track the volume and use of the resources they make available, because: JISC aims to track the outputs of this programme, contributors benefit from access to usage information, and monitoring usage improves resources and services. Projects should put their own tracking and reporting in place, and be prepared to work with JISC to develop these approaches. To support institutions in this, a range of potential measures of success for OER repositories will be published by JISC early in 2009. This data will be essential in determining whether a longer term programme would be useful."

To incentivise the collection of usage data, the Programme offered small grants to projects to measure and report on the use of their content. Few projects tackled tracking in any depth, the one or two notable exceptions were the more mature OER projects based at the University of Oxford, University of Nottingham and the Open University. The reasons for this apparent lack of interest in tracking, and in some cases active resistance, are explored later in this chapter.

Techniques for resource tracking

Questionnaires and user feedback

Before considering technical approaches to tracking use and reuse it is worth remembering that there are many approaches to tracking that involve little use of technology, for example, asking users to fill in feedback forms, gathering feedback through informal communication and formal interviews. Clearly there are problems associated with these approaches; the effort required may not be justified by the number of responses received, or the sample may be biased by "friends and colleagues" and other eager users who are more likely to respond

than more casual users. However, these techniques do make up for what they lack in coverage by increased depth in the data that can be gathered.

Use tracking through web statistics

If one has access to the log files kept by the web server hosting the OERs then monitoring how often those resources are downloaded from that server is routine since analysis packages have long existed for such tasks on any website.

This information may also be available from hosts such as Flickr, YouTube, SlideShare and other web sites for sharing resources, displayed as a count of the number of times a resource has been viewed on that site, downloaded, or embedded into third-party sites. This information is often also available through the host's API to facilitate automatic monitoring.

Information from the logs includes data about the user's internet domain, client software and the platform being used to access resources. This may be useful if the number of visitors from a specific user group which can be associated with a domain is of interest, for example if the target audience is not in the UK.

The referrer logs also provide information about the link which sent the user to the OERs being downloaded, which is useful in providing information on who is linking to the resources, and on the keyword terms being used to find the resources in search engines.

However the extensive use of caches, web crawling robots (e.g. used by search engines) and the general impossibility of knowing whether a downloaded file was actually viewed, render the results suspect for any use other than qualitative comparison between resources from servers where the logging and analysis routines are known to be similar.

Web search

The idea behind using web search as a tracking mechanism is that it is possible to discover where on the open web a resource is available by putting a unique phrase, tag or identifier into the text of the resource and then searching Google or other index for that phrase. The key phrase used should be unique to the resource, project or programme depending on the level of aggregation required for the tracking. The Engineering OER pilot project² proposed a "date-of-birth" code³ for this use made up of three parts: three-letters to identify the project or institution, the date of assignment of the code in format ddmmyy, a

unique 5 character string to disambiguate resources assigned codes on the same day. The recommendation was that this should be included in the copyright and licence notice as this text is least likely to be altered. As an alternative to the date of birth code as text, one could use an http URI as an identifier with the advantage that it could act as a link back to the original resource or other useful information, and that people following that link would generate useful tracking information (see reback tracking).

Reback tracking

Reback has been suggested by Creative Commons as a means of reuse tracking⁴. It involves putting a link in the resource being tracked to the site doing the tracking (the two variants are that this may be either the publisher or Creative Commons, i.e. independent and distributed or hosted and centralised). If a curious user follows that link (and the assumption is that occasionally someone will) the tracking site will log the request for the page to which the link goes, included in the log information is the “referrer” i.e. the URL of the page on which the user clicked the link. An application on the tracking site will work through this referrer log and fetch the pages for any URL it does not recognise to ascertain whether they are copies of a resource that it is tracking. It's worth noting that links clicked in on a secure website (https) do not include referrer information if the destination is not also a secure https destination⁵. To allow tracking of resources located in secure environments the solution is to also make sure the destination is on https.

Google Analytics and other online analytics

Google analytics (GA) is the most well known and widely used member of a class of online software services that use a number of approaches to provide an analysis of the usage of web-based resources; a well known open alternative is Piwik⁶. Most of these services, GA included, use a combination of JavaScript code and cookies to log information such as how often a resource is used, some of the characteristics of the user's web client, and the link the user followed to arrive at that resource, the last of which can also give information about keywords used to find the resource on a search engine. Technically this involves the insertion of some JavaScript tracking code into the pages being tracked, this tracking code includes an identifier for a report that aggregates the statistics from individual

Tracking OERs

resources: these reports can be shared over sites and statistics for an individual resource can be aggregated into multiple reports.

The tracking code only works for HTML documents that the person doing the tracking can edit. Non-HTML resources, those hosted on web content management systems that limit what JavaScript can be embedded into resources, and resources that are hosted on a third-party web2.0 sites cannot be tracked in this way. There are also legal and ethical implications involved, see below.

URL redirects

The idea of using URL redirection⁷ for tracking is that instead of providing a link that goes directly to a web resource, one provides a link to a service which first logs data for tracking purposes and then redirects the browser to the required resource. Such an approach is common in catalogues and search engines, Google for example uses this technique to track which links from search engine results pages are followed. With the recent rise in popularity of URL shortening services (e.g bit.ly or the twitter t.co shortener), which are in essence just URL redirection services, and growing competition between these services, some have begun to provide tracking functionality which allows their users to monitor the traffic being routed through the shortened URL.

This approach may be applied to OER tracking in two distinct ways: links to the OER may be redirected or links from the OER may be redirected.

It is possible to gather information about how often a resource is accessed by providing a redirected URL as a link to the resource and examining the data gathered through it. This is useful for tracking the use of the resource as a result of specific dissemination or advertising activities (e.g. a listing in some directory or an email announcing the resource). It is less useful for providing general information about how often a resource is accessed, as the direct URL for accessing the resource will soon become known to people who will then be more likely use the direct rather than the indirect URL.

Information about who is using a resource may be gathered by using indirect links in the resource so that anyone following a link from the resource leaves some tracking information. If a suitable link is chosen this can be a reasonable indicator that the resource is actually being used (as opposed to those methods which only show that the resource has been downloaded). The information recorded may include the web location of the OER, which can be valuable if one

wants information on whether OERs are being copied and used from sites other than the original host.

Web bugs and beacons

A web bug, or beacon, is an invisible object that is embedded in content and used to record that a user has viewed the resource. Commonly these objects are invisible images (e.g. a single pixel transparent gif), images that act as a badge, or JavaScript code, which are hosted on the server doing the tracking and which are downloaded when the file is opened. The address for the object is given using an absolute URL so that even when the web page is copied from one server to another the web bug object will be obtained from the original server specified. Thus the web bug object is accessed every time the page in which it is embedded is opened. Tracking methods such as web usage stats and online analytics, including information gathered by JavaScript and stored in cookies, applied to the web bug provide tracking information for the original page even if it has been copied to a server which the person doing the tracking has access to. The precise URL used to call the web bug may be varied (while still linking to the same object), by use of fragment identifiers of the form #resourceID, so that resource-level tracking may be achieved with a single object. Web bugs can be embedded into resources that can make HTTP requests, typically (but not only) web pages. It doesn't matter if the resource is viewable on the open web or not, so long as the software used to view it can access the web.

Tracking by web bugs is generally considered to be controversial, partly because it involves silently passing data to a third party (i.e. the person doing the tracking is not the end user or necessarily connected to the site where the resource is hosted), and partly because some high profile uses of web bugs are connected to activities such as checking the validity of email addresses in lists used by spammers (see the section on legal and ethical issues below). There are many uses of web bugs which seem to be widely accepted, for example: the use of JavaScript by Google Analytics amounts to a web bug; the smiley ☺ visible somewhere on many wordpress.com blog pages is used for tracking; and, many 'badge' or 'button' images advertising the use of or support for a service, campaign or software (e.g. Creative Commons) which are inserted by copying and pasting a link to an image that resides on another website, could be used as web bugs for tracking.

A side benefit of this approach is that having a link in the resource to an object on a server under the control of the OER provider may be useful for conveying information after the resource is released. For example, a single pixel transparent gif could be changed to a large red warning indicating that information contained in the resource is no longer valid.

Issues

Appetite for tracking

During the course of Phase One of the UK OER Programme it became clear that tracking was not a priority for many of the projects. Even the offer of additional funding for reports on tracking, during Phase Two of the Programme, elicited few examples that went beyond simple reporting of access statistics such as the number of views and downloads from the hosting web server. Of the two meta studies commissioned by the Programme, the Value of Reuse Study⁸ or the study on Learners Use of Learning Resources⁹, neither identified significant quantitative data from the projects, though qualitative data was more easily found.

The reason for this may be partially due to a clash in priorities. While funders and other observers had the space to look ahead at how to gather evidence that would be desirable in securing future funding for the sustainable release of OERs, project staff had more immediate concerns. Project teams already had to address many complex issues, e.g. relating to licensing and partnership agreements, before they could start releasing their open educational resources and, clearly, tracking can only take place if content is released in the first place. Also, in the absence of sustained current practice with different approaches to tracking OERs, the long term costs and benefits are unknown. It is arguable that recognition of the importance of tracking is an indicator of mature OER initiatives, that appreciate of the type of evidence that needs to be gathered in order to make a case for sustainable input and investment.

Technical challenges

Most of the approaches outlined above involve an additional level of technical complexity which could, in certain circumstances, inhibit both the release and use of OERs. For example, third-party redirection services may fail within the lifetime of the resource, thus breaking the link to the content. Unless one has

confidence in the longevity of such services, third-party redirection services should only be used for short-term tracking, e.g. tracking the effectiveness of a time limited dissemination campaign. However the redirect need not be handled by a third party; it could be the resolution service hosted by the OER provider for HTTP-URI identifiers for the resource, that are independent of where the resource itself is hosted. There may also be degradation in the time taken to load the resource in the case of web bugs, as loading them involves an HTTP request and response, which will take time even if the image being used is minimally small, this may be an issue if the server on which they reside is slow to respond.

One of main limitations on how well several of these tracking methods work is the assumption that the resource being tracked will be a web resource: written in HTML, hosted on a web server, viewed and used through a web browser or other internet-connected application. In reality many OERs released through the UK OER Programme were either "old fashioned" formats such as Powerpoint and Word documents, or were multimedia content such as audio or video recordings. While such resources are frequently hosted and disseminated from web sites they themselves are not "web native" and their use is more difficult to track.

Legal and ethical issues

There are ethical and legal implications involved with several of the tracking approaches outlined above. While the emphasis here is on tracking the use of resources, this necessarily involves tracking the action of individual users, which has privacy implications. The EU e-Privacy Directive¹⁰ ("cookie law") may apply to some of the methods discussed in this chapter. Some users may take steps to avoid being tracked, which will render some efforts at resource tracking ineffective, for example URL redirection is sometimes used for nefarious activities and may be flagged as malware by some applications. Perhaps the biggest cause for concern is that tracking methods, that are used for reasons that some users find objectionable, will lead to reputation loss by association. The distinction between tracking the use of a resource and tracking the users of a resource may not be seen as clear cut by everyone involved.

As Helen Beetham has said "openness is the enemy of knowability"¹¹. Tracking would be much easier in the context of a closed centralised system, that requires users to register before accessing content that can not be re-used or copied. However open educational resources stand little chance of thriving in such an environment

Future directions

The overwhelming findings of the Programme were that appetite for tracking was low and that approaches to resource tracking in the OER domain were immature. However it is encouraging that the more experienced and mature UK OER projects did appear to appreciate the benefits of tracking their content. The Open University's TrackOER project¹², for example, is seeking solutions to support its service development and has made rapid progress in investigating web bugs.

The mechanisms for tracking are developing as a component of the digital business models of the big web players, within constraints set by regulatory frameworks such as Data Protection¹³, the EU cookie directive¹⁴ and other privacy laws. It is likely that the accuracy of resource tracking on the web will improve as companies such as Google, Facebook, etc, invest resources in this area, in order to support their business models.

In parallel, it is possible that increased sharing of open usage statistics will encourage people to be less fearful of such data within the context of an open content. More confidence in capturing and interpreting data may also increase the appetite for tracking. Jorum's beta dashboard¹⁵, developed in parallel with Phase Three of the UK OER Programme, provides a useful example of open usage statistics, and hopefully reflects the beginnings of a shift in the perceived value of such data.

Related to this final point are emerging developments in aggregating and sharing usage data. At the very basic level this may involve repository managers sharing data information and files, however there are emerging opportunity for recording and sharing paradata.

It is perhaps understandable that projects that are not committed to tracking, are inclined to suggest that it cannot be done effectively. While it is true that no single approach will capture all use and reuse of a resource, and that some use will be hidden from all reasonable attempts at tracking, there is still more to be lost than to be gained from making no attempts to track the use and reuse of open educational resources.

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PARADATA - ACTIVITY DATA FOR LEARNING RESOURCES

Paradata is a means of recording and openly exchanging data about how, and in what context, learning resources are used.

Why paradata is important

Over the last decade the volume of open educational resources on the web has grown exponentially, boosted by the proliferation of OER initiatives, including the UK OER Programme. While search engines such as Google have made it easier to discover all kinds of content, it has remained difficult to identify the context of educational resources. Whether for teachers, learners or content providers, when it comes to discovering and using educational resources, context is key. Search engines may allow users to discover educational resources but they will say little about how those resources have been used, by whom, in what context and with which outcome.

Formal educational metadata standards have gone some way to addressing this problem, but it has proved to be extremely difficult to capture the educational characteristics of resources and the nuances of educational context within the constraints of a formal metadata standard. Despite the not inconsiderable effort that has gone into the development of formal metadata standards, data models, bindings, application profiles and crosswalks, the ability to quickly and easily find educational resources that match a specific educational context, competency level or pedagogic style has remained elusive.

A new approach to learning resource discovery was developed in 2010 by two US initiatives, the US National Science Digital Library (NSDL)¹ and the Learning Registry² which in addition to recording first party metadata also focused on sharing second-party usage data referred to as paradata. The term paradata was first used by the NSDL in early 2010 to describe data about user interactions with learning resources within the NSDL's STEM Exchange³. Later that year the paradata approach was adopted by the Learning Registry, an initiative funded by the U.S. Department of Education and the U.S. Department of Defense. The Learning Registry is an open source decentralized content-distribution network of peer-to-peer nodes that can store and forward information about learning

Paradata - activity data for learning resources

resources. The primary purpose of the Learning Registry is to share descriptive metadata and social usage paradata across diverse educational systems.

Paradata is essentially a stream of activity data about a learning resource that effectively provides a dynamic timeline of how and in what context that resource has been used. Paradata is generated as learning resources are used, reused, adapted, contextualized, favoured, tweeted, retweeted, shared. Some of this data is deliberately created by users e.g. likes, comments tags; while some is generated incidentally as a result of the resources' use, e.g. hits, download statistics, links to other resources. As more usage data is collaboratively gathered and published the paradata timeline grows and evolves, amplifying the available knowledge about what educational resources are effective in which learning contexts. Paradata complements existing metadata by providing an additional layer of contextual information. By capturing the user activity related to the resource, paradata can help to elucidate its potential educational utility. The Learning Registry team refer to this approach as “social networking for metadata”¹.

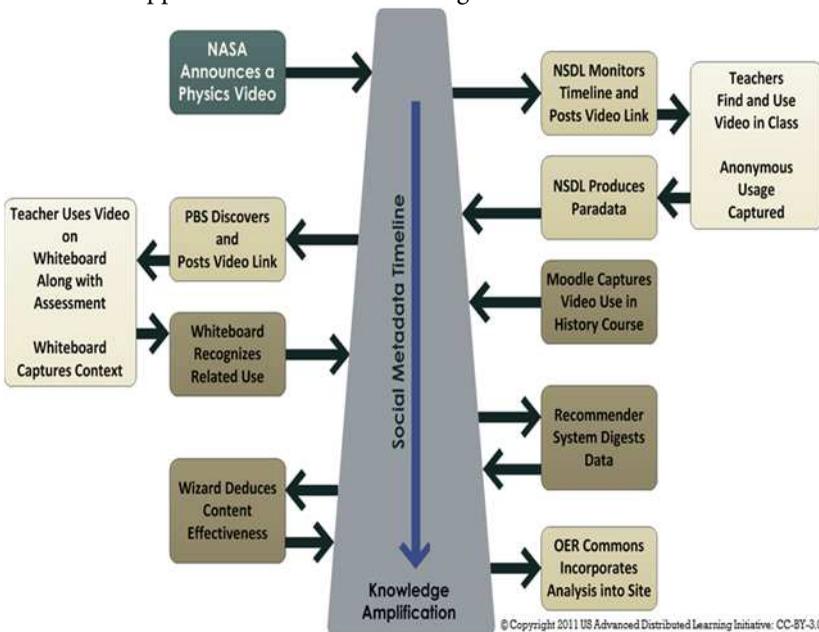


Figure 15 Paradata about a learning resource visualised as a stream of data about the activities in which the resource has been used, similar to the timeline feature in social networking sites such as facebook

Paradata - activity data for learning resources

On the simplest level paradata can be used to record how users interact with a resource by viewing, downloading, sharing, liking, commenting, tagging, etc. Paradata can include information about users of a resource; e.g. age, educational level, geographical location, etc. It can also record contextual information by linking resources with educational standards and curricula, pedagogic approaches and methodologies. In addition paradata has the ability to record complex aggregations of activities, e.g. "between January 2011 and January 2012 lecturers in Engineering, Physics and Maths, used this resource, 6 times for undergraduate teaching activities".

The Learning Registry infrastructure is built on Apache CouchDB⁵, a noSQL style document oriented database providing a RESTful JSON API. The initial Learning Registry development implementation, or node, is available as an Amazon Machine Instance. This enables anyone to set up their own node on the Amazon cloud quickly and easily. However as CouchDb is a cross-platform application, nodes can be run on most systems (e.g. Windows, Mac, Linux). In addition a key feature of the Learning Registry is that it is metadata agnostic; in addition to diverse paradata, it will accept legacy metadata in any format and will not attempt to harmonise the metadata it consumes. These approaches represent a potentially interesting solution of the "messy" problem of aggregating usage data from the tens of thousands of open educational resources produced by the UK OER Programmes. In this context a "mess" implies a complex issue that is not well formulated or defined while a "problem" is a well formulated/ defined issue but with no single solution⁶.

Programme approaches to paradata

Since its inception, the Learning Registry development has been of considerable interest to JISC due to the innovative technical approach it adopted to facilitating resource discovery.

JISC initially commissioned CETIS to undertake a watching brief on the Learning Registry as the project was being scoped and specifications developed. Experiences from the JISC content creation programmes and the technical approaches adopted by the OER Pilot Programme were fed into the scoping phase. The Learning Registry team also engaged closely with the JISC, CETIS and the UK technical development community by participating in hackdays, contributing to several CETIS events, and attending a number of JISC strategic planning meetings. This ongoing communication fostered an appetite among the

UK OER community for engaging with emerging innovative approaches and several of the more mature technically oriented OER projects took an interest.

JLeRN

In 2011 around the same time that JISC launched the OER Rapid Innovation programme, technical intervention funding was allocated to a small team at Mimas⁷ to develop an experimental Learning Registry test node, the first to be developed outwith the US, this became known as the JLeRN Experiment⁸.

The JLeRN Experiment⁸ was a proof of concept project run by Mimas with support from JISC CETIS to explore the practicalities of configuring and running a Learning Registry node and to explore the practicalities of getting data in and out of the network. The project also brought together UK technical developers who were interested in working with the Learning Registry and the JLeRN test node.

A number of projects funded by a range of JISC programmes have engaged with JLeRN. developements on various levels.

ENGrich

ENGrich⁹ at the University of Liverpool is leveraging the Learning Registry to design and develop a customized search engine for visual media relevant to engineering education. Using Google Custom Search¹⁰ (with applied filters such as tags, file types and sites/domains) as a primary search engine for images, videos, presentations and Flash movies, the project will pull and push corresponding metadata and paradata to and from the Learning Registry. A user interface is also being developed to enable end users (students and academics) to contribute further data relating to particular resources and their usage. This information is also published to the Learning Registry. The Learning Registry data is then used to help order any subsequent search. Thus, the Learning Registry plays a central role in "enriching" the visual engineering content beyond the basic results provided by Google search.¹¹

Jorum Paradata Enhancement Project

Jorum¹² is a national JISC funded DSpace repository for sharing open learning resources and is described more fully in the Resource Management chapter. Jorum is run by Mimas and the Paradata Enhancement Project is being

undertaken by Cottage Labs. The aim of the project is to enhance the exposure of usage statistics from the Jorum Dashboard¹³, a PHP application which provides a view on the current status of the paradata for the Jorum OER repository, giving users, developers and managers access to this information in new and useful ways.

Sharing Paradata Across Widget Stores

SPAWS¹⁴ is a collaborative OER Rapid Innovation project involving the University of Bolton, the Open University, KU Leuven, and IMC, which aims to share usage data, such as reviews, ratings, and download statistics, between educational widget stores. SPAWS is building on the Learning Registry and Activity Streams¹⁵ to connect together several app stores that share web widgets and gadgets for educators. Each time a user visits a store and reviews, rates or embeds a particular widget or gadget, that information will be syndicated to other stores in the network.¹¹ The project's lessons learnt post comments that the technology works for this use case and that there is an appetite for developing this approach.

Rapid Innovation Dynamic Learning Maps-Learning Registry (RIDLR)

RIDLR¹⁶ is another OER Rapid innovation Project based at the University of Newcastle that builds on two previous OER projects, Dynamic Learning Maps¹⁷, and FavOERites¹⁸ social bookmarking project, to develop open APIs to harvest and release paradata on OERs from end users, including bookmarks, tags, comments, ratings and reviews etc., from the Learning Registry and other sources, for specific topics within the context of curriculum and personal learning maps.¹¹

Issues

In articulating the lessons learnt about paradata it is useful to distinguish the issues relating to the Learning Registry architecture from those relating to paradata itself.

Emerging architectures

Regardless of whether or not a network of Learning Registry nodes proliferates across the UK Higher and Further Education sectors, it seems likely that the approach taken to their technical architecture (using noSQL document oriented databases, cloud hosting, and RESTful JSON APIs) is indicative of innovative technical developments in the area of large scale data management. For example, the University of Lincoln recently demonstrated the use of another massively scaleable no SQL database, MongoDB¹⁹, for handling large volumes of research data. The early barrier to overcome is the need for skills, particularly in noSQL databases, to be able to handle the messy data inherent to the architecture.

The value of paradata

Although both paradata, and the technical approaches for sharing paradata developed by the Learning Registry, have aroused considerable interest in the UK F/HE community, these are still relatively experimental and immature technologies and it is debatable how much impact they will have in the immediate future. While many systems used for managing and sharing OER generate large volumes of paradata in the form of usage statistics, little of this data is currently being surfaced in such a way that it can be analysed. In addition, work undertaken by the OER Data Analysis and Visualisation Project on Jorum resource records revealed only minimal social interactions, in the form of sharing, liking retweeting, etc, around individual resources²⁰. That said, there is growing anecdotal evidence to suggest that more social sharing occurs around curated collections of resources. For example a single mention on Stumbleupon of a set of resources released by the University of Oxford on the topic of stress and depression resulted in 20,000 hits on one video in a seven day period²¹. This activity was only revealed by a spike in the project's Google Analytics. In another instance a single page of curated Film Studies resources developed as a personal project by a lecturer at the University of Sussex generated almost 50 Facebook reactions, over 80 tweets²². Further work is required to understand more about how, why and under what circumstances social activity occurs around different types and aggregations of learning resources.

A stable curriculum enables stronger patterns to form out of the data, so it lends itself to a more structured educational content space. It is notable that the Learning Registry developed in parallel with a focus on the K12 curriculum in

the US. Though there has been significant interest in the development of the Learning Registry through JISC, it remains to be seen whether an initiative which is primarily focused on surfacing resources for the US schools sector will have a significant impact on UK Higher and Further education.

Future directions

Taking a network level approach to reuniting content with its context is a new solution to the problem of "educational metadata" as described in the chapter on Resource Description. It does not seem too far fetched to say that the Learning Registry's technical strategy and their approach to attempting to solve the messy problem of aggregating and surfacing distributed heterogenous metadata and paradata is highly likely to influence future technical directions and innovations in resource management and discovery.

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ACCESSIBILITY

This chapter has been contributed by Terry McAndrew of JISC TechDis¹.

Accessibility is about the provision of content and services in a manner most suitable to the user, no matter what disability they may have, in order for them to fully participate with it. By sensible design, based on awareness of user needs (and provider responsibilities) the delivery of materials should not present any significant barriers to the user.

Why accessibility is important

Accessibility is absolutely vital for a project to produce truly "open" educational resources. The ethos of "open" is to be accessible – consider "open" in the widest social sense, not (as often illustrated) geographically. If the outputs are not meeting appropriate accessibility requirements then they have failed to be 'open' before they have even left the building, and a sustainability decline has already commenced.

A principal philosophy behind open educational resources is to maximise opportunity for others to be able to engage, not only as recipients but also as potential contributors. For a resource to be adopted (i.e. used "as is") or adapted (i.e. enhanced, disaggregated or integrated into other resources) in another institution it must be attractive in terms of its content and the standards it follows. But accessibility does not have to be onerous or restrictive; a lowest common denominator. It merely needs to be carefully considered to avoid creating accidental barriers and provide alternative routes or enhancements. For a simple example, it may be just provision of an image - perhaps something difficult for another individual to obtain themselves e.g. an electron micrograph captured during a research investigation which would have value for other communities, if it was made readily available to them. Its potential issues have to be considered as soon as possible: its description needs to be concise and accurate (not only to use it but also to discover it) with some authentic provenance; its licence may need to be suitable not only for re-use, but also for editing or annotation for a wider audience including those with disabilities, not as a possibility but as a certainty because it is, by philosophy, open to all. Therefore, some thought needs to be given to its other potential uses before it is

exposed to a wider audience: this is necessary for OER projects, it's not "showing off". The resource description therefore can be made to a standard suitable for a radio listener or podcast thereby automatically meeting the needs of visually impaired students. If a quality description is a core element of the resource's metadata then the resource is far more likely to be discovered and reach a wider audience, perhaps drawing more to the project it is embedded within. Another simple example is the use of video transcripts; far easier to translate into other languages and search, and if pre-scripted (thereby providing the accessibility option by default) the narrative is often far more focussed on the topic, a higher quality of output is generated for all.

Programme approaches to accessibility

For a project to meet its accessibility requirements it needs to consider users with disabilities as equal stakeholders to the generic "students" that were probably quoted in the project specification: a project may have assumed that identifying "students" alone was sufficient, using this broad descriptor in its inclusive sense. By recognising "students with disabilities" as separate stakeholders their needs can be addressed with some equivalence, i.e. not as a small fraction of the wider population and therefore an equivalent small fraction of the effort available, a 'bolt-on' solution. The irony is that to solve the requirements for this stakeholder group alone all other non-disabled students are catered for: two tasks collapse into one.

For many projects it has often been thought efficient to create the resources first, then tackle the additional requirements for a series of appropriate "special needs", be it a visual or hearing impairment, or a learning disability like dyslexia. Planning for this retro-fitting is easier, there is no plan! However, it is expensive in terms of time and effort; and difficult to complete in a compressed time-scale towards the end of the project, when the funding is becoming exhausted, as well as the staff. Accessibility is not a process of fine tuning, it's a design principle; there is no reason why this content should not be understood for what it is by anyone who meets it. It is a far easier solution to direct a little effort during the design stage and realise that many other barriers and issues will be removed in this way before they can grow to become difficult hurdles towards the end.

There are many sources of information for solving most digital delivery problems already available in the JISC network, including those from JISC TechDis, where a pedagogical approach to the application of inclusive

technologies helps explain the issues they address. Note that experiences in one education sector can lend themselves to OER in others. If a resource is to have an impact then it must not hold any unnecessary limitations. The structures and hierarchies of Higher Education will inevitably be challenged by a population circumventing the barriers of its "walled garden".

Reporting requirements for projects need to highlight the value of accessibility for the wider usability and sustainability of the project or initiative. An "Accessibility Challenges, Issues and Benefits" tactic is therefore recommended:

- Challenges: What would challenge those with visual or hearing impairments, motor difficulties or print impairment? How might alternatives be provided?
- Issues: How were disabled people included in user testing? What were the situations that arose that required consideration and the decisions made to ensure the resources remained accessible? Did user-testing give valuable feedback?
- Benefits: How did accessibility improve during the project? What wider benefits might this bring (e.g. accessing on a mobile device, or benefits to ESOL (English for Speakers of Other Languages) students, or enhanced usability)?

The term "disabled student" can be misleading as it can subconsciously imply the disability affects the "studentness" of the individual, whereas thinking of a "student with disabilities" can isolate this issue. The facility to gather, evaluate and synthesise knowledge is rarely affected if suitable (often inexpensive and ubiquitous) technologies are utilised. With appropriate support, disabled students can excel just like any other learner.

Many software solutions to accessibility are available as FOSS - Free and Open Source Software, freely available to download and use at no cost, often without needing a costly technical install if used from a pen-drive or memory-stick. Without adequate environmental provision (including managed software permissions) we are disabling students themselves. OER projects that link to recommended support FOSS support tools would often assist both internal and external users. There are many resources available through JISC TechDis resources to assist with improving accessibility; FOSS resources, techniques and technologies, to tools to help validate the outputs; Sim-dis² enables authors to visualise how content may appear to users with disabilities, and the Accessibility Passport³ helps producers check they have considered other needs.

Issues

During the preliminary Phase One of the UK OER Programme many projects sought to make their outputs accessible but it was often difficult to highlight the advantages of the approach as these were often "taken for granted" and not emphasised. This was highlighted by a survey by Anna Gruszczynska⁴ which sought to discover how embedded accessibility as a design process was within UK OER. Gruszczynska notes that although accessibility was a consideration by most respondents, this was less apparent in the outputs, "rarely mentioned or incorporated in the project workflow". For the issue to be addressed it needs to be explicitly reported and disseminated for the benefit of these stakeholders.

Future directions

In the future, the information about the accessibility of a resource may be an expected part of its accompanying metadata; perhaps as part of the Dublin-Core initiatives⁵ or community developments in other countries e.g. Merlot.org⁶, to raise the profile of this more professional approach. Publishers are also working with JISC TechDis to create a framework for accessibility as part of EDItEUR⁷. If better metadata becomes coupled with community generated paradata (usage data about learning resources including pedagogic context, inferred through the actions of educators and learners) then more novel uses of resources may be better realised, practice shared, and benefits maximised. Access for all is attainable and sustainable if we know what we want and we can agree how to get it.

Accessibility is a design component best tackled early. Explicit inclusion of accessibility in testing and reporting will considerably improve the usability of the output and links to appropriate FOSS support tools may also help. Finally, consider accessibility as a component of resource metadata to explain to potential users how best to utilise the OER.

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CONCLUSIONS

Open content ecosystems

The Technical Directions chapters presented in this book explore a wide range of technical issues relating to the release of open educational resources into the wild. Within this context, the authors have identified not only future technical directions but also the implications of current real world practice. Underpinning many of these technical issues and directions is the concept of an open content ecosystem. By adopting the principles and ethos of openness and exploiting existing open technical approaches and applications, the global OER community has the potential to develop a rich ecosystem of services. Many of these services and applications may not be designed specifically for OER, but can be regarded as "OER-friendly". Given the fuzzy boundaries between open education, open source, open access, open educational resources, open content and free online content, this pluralistic approach to infrastructure may be more sustainable than centralised approaches. The key characteristics of this OER-friendly ecosystem are: prominence given to licensing, integrated tools and APIs, aggregation and remix solutions, educational authoring platforms, and rich release and export functionality. This approach consists of small parts loosely joined. Within this ecosystem there is potential to drive demand for mainstream content services to adopt more OER-friendly functionality, primarily through rich APIs and licensing-aware resource handling. It is neither feasible nor desirable for the OER community to develop a separate infrastructure, but rather to enrich existing tools, services and applications to support OER, and to support the signposting of OER-friendly services.

Key considerations in developing OER-friendly digital infrastructure include:

- The format of OERs varies greatly, making it difficult for developers to anticipate the presentation and editing technologies required within platforms, (see Resource management).
- Content packaging approaches commonly used by learning management systems do not fit well with the web-based model of presenting OER, (see Resource management).
- Many OERs are composed of audio visual materials. Enriched licensing expression, annotation, transcription and metadata for discovery are a priority for many users and producers of audio visual OERs. Openly

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licensed content makes the development of these approaches easier and their take-up is likely to extend well beyond the OER domain. This has positive implications for the sustainability of technical solutions, (see Resource description).

- There is always a delicate balance to be struck by content services regarding requirements placed on contributors to provide descriptive metadata, (see Resource description).
- Deriving metadata from authoring environments and from secondary usage may reduce the requirement on contributors to produce rich resource descriptions. These approaches are worthy of further investigation, (see Paradata - activity data about learning resources, Resource management and Resource description).
- Completing the loop from creation to description to end use is an ecosystem-level challenge. Resource descriptions that feed the major search engines may increase the drivers for contributors and system developers to create or generate richer metadata. This should be a major priority for OER platform providers, (see Paradata - activity data about learning resources and SEO and discoverability).
- Interest in usage data and social sharing is likely to continue to grow, from both content provider and content user perspectives. Services should explore approaches to surface and share this data, (see Paradata - activity data about learning resources and SEO and discoverability).
- OER-friendly platforms should enable metadata about the content to be syndicated via RSS, and also imported and exported via emerging SWORD-type technologies, (see Resource management).
- Whilst open educational resources are not a distinct resource type in any technical sense, there may be benefits to developing OERs within education-specific authoring tools. These OER-friendly authoring tools could be designed to produce content in both LMS and web friendly formats, (see Resource management).
- Platforms that enable editing of resources at source level hold great promise, both for collaborative authoring and for reuse and repurposing. However the complexity of such systems is greater than standard content repositories, particularly if they are to handle the multiple formats required. One of the key challenges will be to provide user interfaces that provided access to rich functionality in a user friendly way, (see Resource management).

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- Creative Commons licences are a key aspect of OER, though other open licences may emerge. Consequently a priority for the OER ecosystem is the creation of interoperable systems that can support the selection, presentation and use of open licences, (see Licensing and attribution).

Future technical directions

The funded phase of UKOER ended in October 2012 and it is too early to predict the longer-term impact of the programmes on the embedding of OER and the continued development of digital infrastructure to support open educational resources and practices in the UK. The programmes have been viewed positively by those involved, though some have questioned whether they could have had a greater impact on the wider UK HE community:

"Now the funding has come to an end what's going to be the long term legacy, what are the sustainability issues and what do we do to try and raise the profile of OERs? Has UKOER met the needs of academics at the digital chalk face, i.e. resources that can be reused in multiple different contexts? Is there lots of high quality content that academics want to use and assimilate into their teaching?"¹

While these are valid questions, it is clear that an identifiable community has grown up around UKOER and that many of the most active and engaged members of that community are those who have contributed to innovative technical developments. A recent discussion on the oer-discuss mailing list around continued use of the ukoer tag for classifying resources, and whether the tag now represented a community, rather than simply resources produced during the funded phases of the programmes, generated an overwhelming response and it appears that this debate is likely to continue.²

Within the wider context, "openness" continues to gather momentum through initiatives such as Open Access and Open Government. These policies have the effect of changing expectations regarding access as well as raising awareness of open licensing approaches such as Creative Commons.

In terms of future technical direction, there are a number of international initiatives and developments that have the potential to have an impact on OER digital infrastructure developments going forward.

Learning Registry

While there has been some interest in the Learning Registry from technical developers within the UK, and the JLeRN Experiment met with considerable success, the impact on the UK F/HE sector has been negligible at this point in time. However it is still possible that the technical approaches developed by the Learning Registry will have considerable impact on solutions for dealing with the messy problem of learning resource description and management. It may also be significant that Cisco, Dell and Amazon have all recently expressed some interest in running Learning Registry production nodes.³

LRMI

Like the Learning Registry, the Learning Resource Metadata Initiative has not been developed specifically for open educational resources, however it does have the potential to have considerable impact on our ability to describe and find OERs. Although the specification has only recently been released, it has already been adopted by MIT OpenCourseWare. MIT OCW launched a new site in late November 2012 which allows users to browse all 2,150 courses “by topic, course number or by department, and filter results according to the content type they are seeking, such as video or interactive simulations”.⁴ As part of this redesign MIT OCW have implemented some elements of LRMI on a large scale. No doubt the community will watch the relaunch of MIT OWC with interest and it will be intriguing to see whether the adoption and implementation of LRMI has a significant impact on the ability of users to easily find resources that meet their requirements.

Pearson Blue Sky

Two developments related to the publishing domain may also have an impact on OER technical infrastructure developments. In early November 2012 Pearson announced a new OER search engine, Project Blue Sky⁵, which will launch as a beta in early 2013. The search engine, which is powered by Gooru Learning’s “search engine for learning materials”, includes content from a range of sources including MIT OCW, Connexions and OER Commons. According to the project’s press release, Blue Sky will:

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“leverage Gooru’s powerful search capabilities to build applications that seamlessly integrate high-quality learning resources on the web, including OER, with instructor-created and Pearson content.”⁶

No information was available at the time of writing about what licences Blue Sky resources would be released under. Large commercial publishers have been slow to engage with open educational resource initiatives, and there is arguably some scepticism as to their commitment to open education practices and business models, so it will be interesting to see whether Pearson’s initiative will gain traction in this space. In this context it is also relevant to note the involvement of Elsevier in the UKOER Phase 3 PublishOER project, which explored the partialities of blending copyrighted publisher resources with OERs.

CEN ISSS WS-LT eTernity

A new project involving textbook publishers has also been launched by the European CEN-ISSS Workshop on Learning Technologies. The aim of the eTernity initiative is to:

“develop common vision, frameworks and specifications for e-textbooks for educational purposes. The idea is to fulfil educational requirements for e-textbooks as a channel for creating interactive, adaptable, personlizable resources to improve learning, education and training.”⁷

Although eTernity appears to be focused primarily on etextbooks, the project website acknowledges that:

“OER is changing the publishing model of educational resources, making the learners themselves and their teachers a more prominent actor in content development, and promoting a redefinition of the content creation and use life cycle.”⁸

It is not clear at this early stage how the CEN WS-LT project will engage with OER developers and users, or how the technical direction of this initiative will develop, however it is significant that publishers, both in Europe and the US are increasingly realising the need to engage with the OER community.

EU "Opening up Education"

The European Union's Directorate General for Education and Culture recently conducted a consultation on "Opening up Education – a proposal for a European Initiative to enhance education and skills development through new technologies".⁹ The objective of the consultation was to explore the perceived need for EU action to promote the use of Open Educational Resources (OER) and of ICT in education. The consultation is ambitious in that it covers both open educational resources and the use of ICT in education more general and it is unfortunate that the two have become conflated in some places in the consultation document, as this could lead to unrealistic expectations of what OER developments alone can achieve.

The consultation document identifies four priority areas:

- Access inclusion and equity
- Quality efficiency and internationalisation
- Teaching educational practices and assessment
- Policy development

While it is encouraging that the EU recognises the importance of OER at European policy level, the benefits of some of the possible actions proposed are debatable, e.g. establishing a single "EU-wide platform facilitating access to all OER portals". There is also a questionable focus on European quality standards for open educational resources.

The findings of the EU consultation are due to be published in late 2012 in a communication on "Rethinking Skills aiming to increase the quantity, quality and relevance of skills supply for higher economic and social outcomes." This Communication will announce a new EU Initiative on "Opening up Education": a proposal to exploit the potential contribution of ICTs and Open Educational Resources (OER) to education and skills development, with a further communication on "Opening up Education" planned for mid 2013.

UNESCO OER mapping

UNESCO are still an active and influential participant in global OER developments and have recently put forward a proposal to create a world map of OER projects and developments¹⁰. Discussions around this topic have attracted participants from around the globe and it is interesting to note some of the technical issues and assumptions that have surfaced. There have been some calls

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for centralisation (e.g. a single global OER repository) and standardisation (e.g. of packaging formats, metadata, controlled vocabularies and even international curricula mappings) that seem unrealistic if not misguided. However at the same time it is encouraging that many participants, particularly those outwith Europe and the US, have voiced a strong preference for using open source solutions in preference to proprietary applications wherever they are available, e.g. adopting Open Street map, rather than Google maps. The scope of the project is still under discussion but it seems fair to say that there is considerable enthusiasm for the initiative worldwide.

Conclusion

Over the three years of the UK OER Programmes, from 2009 to 2012, there has been a huge growth in open content and open educational resources. Whilst mainstream awareness of the OER concept within education may be low, the practices of many web users suggest an appetite for sharing and reusing digital resources.

The UK's contribution to the global commons is significant, in terms of the rich educational content released into the wild, and the knowledge and expertise generated by these projects and initiatives. The OER community now needs to utilise both political will and international funding where it is available to embed the principles of OER into accessible applications and services that the majority of educators and learners can use. It may be that the term "OER" is transitional, but even if that is so, its legacy could be a richer digital infrastructure for all.

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CONTRIBUTED COMMENTS AND FEEDBACK

This chapter is a compilation of comments received from the global OER community. We invited views on individual chapters or the whole book, asking: what rings true? what doesn't? what do you think the technical directions are for OER? We particularly welcomed comments that were grounded in experience of designing and running OER services.

The comments that we received were a mixture of specific suggestions for alterations to the text, which were considered and lead to many corrections and improvements of what we had written, the remainder were more general reflections or sharing of experience, a selection of which are given below.

Nick Sheppard, Leeds Metropolitan University

Reading through the draft of "Into the wild", this sentence (from #ukoer Phase 1) resonates... there has been growing awareness of...the web itself as a technical architecture as opposed to a simple interface or delivery platform ... #intothewild. Also reminding me that very little of our #ukoer content from Unicycle¹ has embedded.

Obviously I've tried to keep abreast of developments throughout the UK OER programme but as one whose first exposure to the concept of OER was through our Phase 1 project Unicycle in 2009, the historical overview in particular provided an essential context; though aware of the broad picture, the chronology and evolution of the OER space is now much clearer!

I do also still think there are untapped synergies between the two and now the "Open" domain is arguably more homogeneous (or is it?!) than at the beginning of the Programme, particularly I would argue due to the proliferation and mainstream institutional uptake of web 2.0 style technologies, though partly also due to the influence of the programme itself.

Two of the key points that resonated for me reading the book are the somewhat contradictory facts in that while there undoubtedly has been a recognition that Open Education is "a natural fit to what the web is really

all about" and that the web itself is a technical architecture, at the same time the commercial and proprietary components of the web have become ever more significant, both generally and specifically in the context of "Open" education (I'm thinking of Apple in particular of course with its iPad, ebooks, apps, iTunes and the rest) which potentially makes the discussions around open licensing all the more significant, to say nothing of JISC and HEFCE funded technologies like Jorum and Xpert, particularly as the lines of commercialisation are now so blurred within HE as the result of government policy, whether tuition fees or the Finch report.

I have also recently been struck by the impact that new institutional software can still have on Open; we have a new streaming server, for example, that in theory I should be able to link (unauthenticated) to video but have found various authentication settings mean that only certain browsers and settings work, with many still asking for an institutional login. I've mitigated this to some extent by embedding video directly in the repository record page but the link (from RSS, OAI) still points to the link that may or may not require authentication.

I also relate very much to the need to decouple licence assignment from repository deposit and this was (and is) a major problem for us with virtually all of the Unicycle material (being pre-existing resources) merely being assigned CC at the metadata level. The crucial factors, of course, are educational and cultural and we simply didn't have either at the time (and only pockets even now) such that CC is probably still an afterthought for any newly created resources.

Tracking resources is one rabbit hole I never really ventured down, at least not far, and have software issues even getting basic usage data – in this regard I think IRUS-UK² has huge potential for COUNTER³ compliant usage data, ostensibly for OA research repositories but also for OER (IRUS-UK is based at Mimas and there is a plug-in for DSpace...not sure how far they have liaised with Jorum?)...then there is the whole Learning Reg / paradata thing which I can see would be hugely beneficial and with a little help from Nick Syrotiuk of JLeRN⁴ I'm currently having a go at pushing our OAI-PMH to the test node though in the context of paradata my Google Analytics data is of limited use.

I confess that, even now, and though I have found your various posts published recently to be very useful, I still find the Learning Registry conceptually somewhat abstract; I am getting an inkling of the potential of

the technology, not least as harvesting Jorum into intraLibrary⁵ has emphasised the issues around repository interop/metadata idiosyncrasies...but I probably need to see more examples of services built on the architecture to really get it.

I also wonder what potential there might be for research material pushed into the Learning Registry by OAI-PMH as the killer-app for aggregated research repositories still hasn't materialised...

David Kernohan, JISC

The link between "whole institution" OER approaches and tracking is not simply a maturity one. I'd argue it is a mistake to see whole institution approaches as more mature than the approaches of interest groups.

Sheila MacNeill, CETIS

I appreciate that this is focused squarely on the technical developments, it is worth making an acknowledgement that this work is informing wider open practice issues too, the technical work is not done in isolation. Also the approaches from the programmes are filtering into other work where projects have chosen to create open content though OER has not been mandated - JISC programmes and beyond e.g. Curriculum Design and Delivery⁶, Developing Digital Literacies⁷.

Dan Rehak, Isal.org

Overall this is great! It's a really nice concise summary of tons of key issues, and it puts the entire OER programme into context - even helped me understand how some of the pieces fit together.

The biggest omission I see, which I think is intentional, is something more forward looking as conclusions. The "futures" in the chapters are good, but they seem to be very tactical and not synthesized into a whole. I'm not sure "what's next" or what's key to continue, but in some form, or some forum, some big picture synthesis and gazing into the crystal ball would be nice - even if it turns out to be wrong.

[The Conclusions chapter was added in response to Dan's comments.]

Peter Robinson, University of Oxford

A key thing historically for me is that the question of what licence (obscure one-off licences) and what conditions (silly geo conditions) has now ended ... Creative Commons has won as we knew it would.

For me the failure of UKOER is still marketing - to get a really well known directory of UKOER (ignoring Jorum for now) is a regret. HumBox⁸ seemed to be a really good community repository.

The end of the Higher Education Academy Subject Centres⁹ seems to be a big gap in getting things out to the community - for the Great Writers Inspire¹⁰ project we had to do a lot.

There is still an easy quick win in UKOER with an aggregator of video - we had a demonstrator alive, Steeple¹¹, in 2009/2010 but there was little vision nationally to push it into a service.

There have been developments in third-party services better supporting CC licences, e.g. Apple iTunesU now supports a licence field that I can fill with our Oxford CC licence.

Evaluation of usage over the longer term is sorely missing. I know my stuff benefits from a massive long tail effect... This is an area that needs more work, more understanding of logging and tracking feedback mechanisms, better understanding of how to take advantage of Google Analytics and URL builders, etc., etc. I'm trying to do a lot in this area at Oxford but tool development and analysis of feedback etc. takes up a lot of time.

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