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Web Strategies for the Curation and Discovery of Open Educational Resources

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Abstract

For those receiving funding from the UK HEFCE-funded Open Educational Resource Programme (2009–2012), the sustainability of project outputs was one of a number of essential goals. Our approach for the hosting and distribution of health and life science open educational resources (OER) was based on the utilisation of the WordPress.org blogging platform and search engine optimisation (SEO) techniques to curate content and widen discovery.

This paper outlines the approaches taken and tools used at the time, and reflects upon the effectiveness of web strategies several years post-funding. The paper concludes that using WordPress.org as a platform for sharing and curating OER, and the adoption of a pragmatic approach to SEO, offers cheap and simple ways for small-scale open education projects to be effective and sustainable.

Keywords: Open educational resources; OER curation; OER discovery; OER sustainability; Reuse; Search engine optimisation; SEO

Introduction

The HEFCE-funded Open Educational Resources (OER) Programme ran in the UK from 2009 to 2012 and was managed by Jisc and the Higher Education Academy (HEA), with around £12.5 million invested across three rounds of activity (Jisc, 2015a).

The HEA discipline subject centres led 25 projects, and 65 were managed by individuals and Higher Education institutions. In reality, the involvement across the further- and higher education sector was beyond that, with multiple institutions and groups participating in the subject centre activity and as project partners. The pilot phase focused on boosting OER creation skills and release, and the later phases aimed to further embed open practice in institutions. The UK OER programme (UKOER) was part of a global movement of investment in open education innovation provided by charitable foundations and governments, and a parallel tranche of activity has produced guidelines and policy to support OER development at local level (Stacey, 2013).

To date, there have been few examinations of the activity and impact of UKOER projects in the intervening years, and whether the diverse strategies for creating and sharing OER were effective? The adoption of sustainable approaches was an important part of the funding criteria, in order to "get the best value from the work that has been funded" and to provide longevity and "options for sustainability after funding ceases" (UKOER Phase 3 Call – Jisc, 2015b). The ambitions of the projects were varied in order to sustain their efforts, from changing institutional policy, establishing intellectual property guidelines and open licensing policy, involving students and other partners in co-creation, and/or integrating OER in curricula. One of the advantages of this programme was oversight of the technological standards by the Centre for Educational Technology and Interoperability Standards (CETIS). They encouraged an open approach to the use of technology that was very much driven by the OER community rather than imposed upon them (Thomas, Campbell, Barker

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& Hawksey, 2012). This encouraged innovation in open practice and technological approaches, and the project achievements were notable and detailed in the end of programme evaluation and synthesis report (McGill, Falconer, Dempster, Littlejohn & Beetham, 2013).

De Montfort University participated in all three phases of the UKOER Programme and adopted a philosophical stance quite different to other projects by partly moving away from the reliance on institutional repositories to curate and share resources. We explored a number of technological ideas for maximising the distribution of open content via the web, namely through hosting OER on the WordPress.org platform and adopting search engine optimisation (SEO) to enhance the discovery of resources. Making OER discoverable is an obvious but important barrier to overcome in order to drive sharing and adoption of materials (Yergler, 2010), and 'access' is the cornerstone to which the activities enabled by openness are defined—whether to retain and curate your own content, reuse, revise, remix and redistribute new versions on the web (Wiley, 2014). The use of SEO and reporting through Google Analytics services although the mainstay of Internet marketing has also been used for the promotion of other academic and professional services websites with success (Kent, Carr, Husted & Pop, 2011; Plaza, 2011). We considered some of these analytical measures not only in terms of website usability, but to understand facets of OER discovery and visitor interaction.

When considering how to promote access to OER, the role of search engines is not often discussed, yet they are a primary tool for discovering academic content and an important component for student information literacy development (Ladbrook & Probert, 2011). Google accounts for the majority of web search activity (NetMarketShare, 2016), and our projects adopted Internet marketing techniques to increase the search engine ranking of our projects and to drive visitors to our sites. The approaches were adapted from "The Challenge" which is an open digital marketing course that has run globally since 2008 (http://www.challenge.co). The four principle sources of traffic to a site include direct views where the visitor has knowledge of the URL, organic traffic from search engine retrieval, referrals where the URL has been placed as a 'back-link' in another location, and via social media. Typical SEO activity includes the researching of appropriate keywords that are then strategically placed 'on-site' within the written content, alongside 'off-site' marketing activity. As described previously, we established WordPress.org blogs as a hub for the curation and display of OER, and SEO techniques to distribute the content (Rolfe & Griffin, 2011a). It is important to review the performance of websites adopting SEO approaches regularly, and also to set targets and goals for intended visitor behaviour ((Waisberg & Kaushik, 2009). The performance of the sites were analysed regularly, and albeit not with goals of profitability in mind, targets were set for the ambitions of the OER sites to acquire global 'reach' with a degree of 'impact' or benefit to the end user (Rolfe, 2010). An additional digital marketing technique is the creation of content in multiple formats for easy dispersal across the web, and this was embedded within our projects and also served to promote interoperability and OER accessibility (Rolfe & Griffin, 2011a).

This paper captures the details of the De Montfort University open education projects that hosted OER on WordPress blogs, static websites and institutional repositories (2009–2012). It reflects upon the digital strategies adopted from the outset and the approaches used in the intervening years post-funding. It draws upon web analytical data and project evidence to examine the effectiveness of the approaches taken in terms of the 'reach' and 'impact' inferred by visitor metrics. It is important to acknowledge at the outset that in recent times, optimisation techniques have evolved for other popular social media channels such as YouTube, and there have been changes to Google ranking algorithms and the growth in paid-for search engine advertising. It is also recognised that larger-scale projects will employ more structured means using linked data to organise and facilitate the retrieval of knowledge on the web (Dietze, Sanchez-Alonso, Ebner, Qing Yu, Giordano, Marenzi, &

Pereira Nunes, 2013; Chicaiza, Piedra, Lopez-Vargas, & Tovar-Caro, 2014), although this was not the focus of the approach at De Montfort University.

Methodology

Project Details

In the first project phase of UKOER (2009), De Montfort University partnered with the Universities of Leicester and Northampton on "Transforming Inter-professional Groups through Educational Resources" (TIGER), and undertook work with the HEA Bioscience Centre to share laboratory skills OER in the "Virtual Analytical Laboratory" (VAL). In Phase 2 (2010) funding was awarded to the "Sickle Cell Open—Online Topics and Educational Resources" project (SCOOTER) that shared OER on the social and medical aspects of sickle cell disease (Rolfe, 2011). In Phase 3 (2011), the "Biology Courses" project shared a range of life science subjects from forensics to biomedical science, and incorporating the "Midwifery Open Resources for Education" project (MORE). Content was offered under a Creative Commons open license mainly using the CC BY-SA version. The projects were housed in the primary locations and distributed to other social media sites as indicated in Table 1.

Table 1: The primary location of projects on the web, and their distribution via social media sites

Project	Primary URL	YouTube/Flickr/Pinterest
2009–2014 VAL	hlsweb.dmu.ac.uk/ahs/elearning/	
2014 VAL	val.biologycourses.co.uk	
2009 TIGER	tiger.library.dmu.ac.uk	youtube.com/user/tigeroer
2010 SCOOTER	sicklecellanaemia.com	youtube.com/user/SCOOTERDMU flickr.com/photos/sicklecellanaemia
2011 MORE	more.library.dmu.ac.uk	youtube.com/user/moreoer
2011 BIOLOGY COURSES	biologycourses.co.uk	youtube.com/user/biologycourses flickr.com/photos/biologycourses/ pinterest.com/biologycourses/

Further technical details of projects are shown in Table 2, with projects located with external hosts or university servers. In 2009 VAL was a static HTML website launched onto a faculty server and subsequently was moved to an external host in 2014 after the server was closed. In 2010 and 2011, the SCOOTER and Biology Courses projects were hosted externally on WordPress.org blogs and employed SEO techniques. The 2009 TIGER project and the 2011 MORE project were hosted on institutional repositories managed by the university library.

Table 2: Dates of projects and technological approaches adopted, including the use of search engine optimisation (SEO) techniques

	Platform	Host	Date of Site Launch	SEO
2009–2014 VAL	HTML website	University server	Sep-08	
2014 VAL	HTML website	Reclaim Hosting	Sep-14	
2009 TIGER	DSpace 1.7.1	University server	Mar-10	
2010 SCOOTER	WordPress.org	Mint Host	Nov-10	Yes
2011 MORE	DSpace 1.7.1	University server	May-12	
2011 BIOLOGY COURSES	WordPress.org	Reclaim Hosting	Nov-11	Yes

OER Release and Granularity

For the projects using WordPress.org, OER were released on optimised blog posts, and also indexed via a separate HTML content page. In order to analyse OER use and discovery on the Internet, it is necessary to define granularity and the distinguishing characteristics of a top-level item. Keet proposes a taxonomic structure with the most basic characteristic at the top-level, and with descending hierarchies of content (Keet, 2010). Littlejohn suggests schema for learning objects where they are defined in educational terms (course, module unit), purpose terms (is it a learning object or an asset) or in terms of metrics (numbers of pages, time to complete) (Littlejohn, 2003). In the current study, the top-level is defined by the overarching educational topic that is then broken into a series of OER (video, narrated animations, photographs, text documents, audio files, documents). OER are accessed through web pages or blog posts containing further disaggregated content released in multiple file types. The multiple file types were also released to other web platforms, e.g. videos to YouTube, and photographs to Pinterest and Flickr. The lowest hierarchical levels are not recorded, as their fate would be impossible to track, for example separate graphics within animations.

SEO Techniques

A pragmatic approach was adopted to SEO to evolve a basic level of activity to ensure that projects ranked well in Google and were referred to from other locations (Rolfe & Griffin, 2011a). SEO techniques were based on those developed by The Challenge and used Market Samurai software (http://nobelsamurai.com) for keyword research, ultimately a trade off between word and phrases that were relatively unique and also popular with surfers. The blogs used additional SEO plug-ins, Technorati tags, RSS feeds and other features for encouraging engagement with, and distribution of articles. Chosen keywords were included in blog text and in page content, and other organisations and communities would be encouraged to place the URL on their website to obtain a 'back-link'. The goal of SEO is not just to rely on people knowing the URL but to drive discovery from other locations, such as another university or a social media channel. For SCOOTER and Biology Courses, these approaches were applied at the time of the project funding to establish the sites, and no further keyword analysis has been done in the intervening years.

Project URLs and representative OER were placed on Jorum.ac.uk, http://MERLOT.org and http://OERCommons.org. The objective of publishing OER in multiple file formats to maximise interoperability and accessibility also served to provide content to disperse through other social media channels. File formats included: photographs / images (JPEG, GIF, PNG), video (Mpeg-4,

ogg, WebM), animation (SWF), text-based documents (MS Office Doc, PDF, txt file), screen capture (SWF, Mpeg-4), audio (Mpeg-3, WAV). OER were therefore readily distributed to Facebook, Twitter, YouTube, Flicker and Picassa to name but a few areas, primarily through using the single click service http://Posterous.com which dispersed content to multiple sites and was disbanded in 2012.

Analysis of Internet Use

Google Analytics was used for insight into website visitors and behaviours. The Google Analytics service presents a number of different parameters and features for reporting (Google, 2016). In the 'Audience' data cluster, the following parameters are expressed, along with time on site, geographical information and device usage. Data from some of these analytics were interpreted to provide a view of the reach and impact of OER.

1) Sessions (formerly visits): the number of sessions interacting with website, APPs or social media platforms up to an end point which is either after 30 minutes of inactivity, at midnight or linked to a campaign change.
2) Users (formerly visitors): an estimation of unique visitors based on cookie trafficking.
3) % new sessions—how many sessions from people who visited the site for the first time.
4) Page views—number of pages viewed in all site sessions.
5) Pages per session—average page views in each session.
6) Bounce rate—the percentage of sessions that were a single page visit (the visitor explored the website no more).

A second cluster of useful analytics called 'Acquisition' alludes to the channels by which traffic reaches the website, and can provide interesting information regarding what other companies, organisations and outlets have placed your URL on their site—or 'back-linked' to it.

1) Referrals—a ranked list of other websites back-linking and therefore referring users on to your site.
2) Channels—comparison of the main access routes to your site, be it an organic Google search (user applies keywords for a search or via AdWords), direct (user has knowledge of your URL), referral (back-link) or social via social media outlets.

Data Capture and Analysis

The analytical data for the TIGER and MORE repositories was kindly provided by De Montfort University up to April 2015. The data was gathered using Google Analytics within the DSpace platform. For the static VAL website, both the early 2009 and later 2014 versions, an Analytics tracking code was generated and entered into the source code of each web page. For the WordPress blogs, data was collected via an Analytics plug-in. The use of Google Analytics allows for parity and comparisons across the different platforms. Data collected from other social media sites—predominately Flickr and YouTube, was drawn upon to provide a broader picture of activity; Flickr Stats provide an indication of total numbers of views per individual photograph, and YouTube Analytics indicates total views for each video. Jorum data is also calculated as total number of times a resource is viewed. For Flickr and YouTube, analytic data was compiled up to August 2015. The data was downloaded into an Excel spread sheet for analysis.

Results

Project Details

Projects (Table 3) comprised 424 web pages and blog posts covering 45 health and life science topics, and there were 271 'stand alone' OER in total. VAL comprises 11 lab skills topics, e.g. how to operate a microscope at the top-level, with OER shared in multiple file formats. Following the closure of the original VAL website, some revisions were made to the new version re-launched in 2014, with the removal of some HTML web pages and publishing of some of the OER in additional formats. TIGER and MORE collections are divided into a series of healthcare topics with resources also on YouTube. SCOOTER and Biology Courses shared OER as blog posts along with additional news articles to help the SEO strategy. SCOOTER comprises 9 academic disciplines with 110 OERs published in multiple formats. Biology Courses clustered into 10 biology topics using similar SEO approaches to SCOOTER.

Table 3: Details of numbers of topics and OER items released onto primary locations and social media sites

	Total no. pages and posts	No. Topics	No. OER	Multiple files	YouTube	Flickr
2009–2014 VAL	123 HTML pages	11	34	87		
2014 VAL	78 HTML pages	11	42	91		
2009 TIGER	15 HTML pages, + OER posts	8	27	403	30	
2010 SCOOTER	9 pages, 90 OER posts, + news blog posts	9	110	306	25	67
2011 MORE	15 HTML pages, 35 OER posts	7	35	103	72	
2011 BIOLOGY COURSES	6 pages, 53 OER posts, + news blog posts	10	57	144	53	150
TOTAL NO. ITEMS		45	271	1047	180	217

The total number of pages and posts = individual HTML web pages, WordPress pages, WordPress blog posts containing an OER or a WordPress 'news' post.

Audience Details

Based on analytic data from De Montfort University, Google Analytics and other social networking sites, the number of sessions and visits undertaken by global audiences up to the 2015 analysis point was around 1.26 million (Table 4). There is a distinction between those accessing materials via repositories and those using the WordPress.org blogs, with the latter being clearly more discoverable and receiving larger numbers of visitors. The vast majority of users accessing OER are retrieving video content via YouTube.

Table 4: Total number of sessions and visits to various primary locations and social media sites and the dates of analytical data retrieval

	Repository	Total no. Pages and Posts	YouTube	Jorum	Flickr
	Apr-15	**Aug-15**	**Aug-15**	**Aug-15**	**Aug-15**
2009–2014 VAL		73270		324	
2009 TIGER	2532		13236		
2010 SCOOTER		30040	362248	52	19009
2011 MORE	2054		317020		
2011 BIOLOGY COURSES		21504	356866		57000
2014 VAL		7818			
TOTAL	4586	132632	1049370	376	76009

Data presented as total number of sessions collected by Google Analytics for Repository, Blog and HTML pages; For YouTube, Flickr and Jorum, data represents total number of times a resource is viewed.

Geographical and Device Distribution

Data is unavailable for TIGER and MORE, but all other sites reach wide geographical distribution across all five continents (Table 5). Access favours English-speaking countries and includes Latin America, Asia and the Middle East. SCOOTER OER have been translated into sub-African and Brazilian languages to support the development of sickle cell learning materials in these locations.

Table 5: The distribution of visitors from different global locations visiting project sites, with the top five for each listed (and % of top visits)

2009–2014 VAL 152 countries	**2014 VAL 98 countries**	**SCOOTER 149 countries**	**BIOLOGY COURSES 150 countries**
United Kingdom (56.33%)	United Kingdom (27.96%)	United Kingdom (33.61%)	United Kingdom (46.11%)
United States	United States	United States	United States
Australia	China	India	India
India	Russia	Canada	Brazil
Malaysia	Japan	Brazil	Philippines

The distribution of sessions by type of device used to access the OER represents desktop as the dominant means of using the materials, although for Biology Courses, the use of mobile and tablet devices is more prevalent (Figure 1). This may reflect the geographical or demographic preference and device culture, or the file type of OER predominating? In terms of browser, Internet Explorer, Chrome, Firefox and Safari were in the top four most used operating systems for all sites.

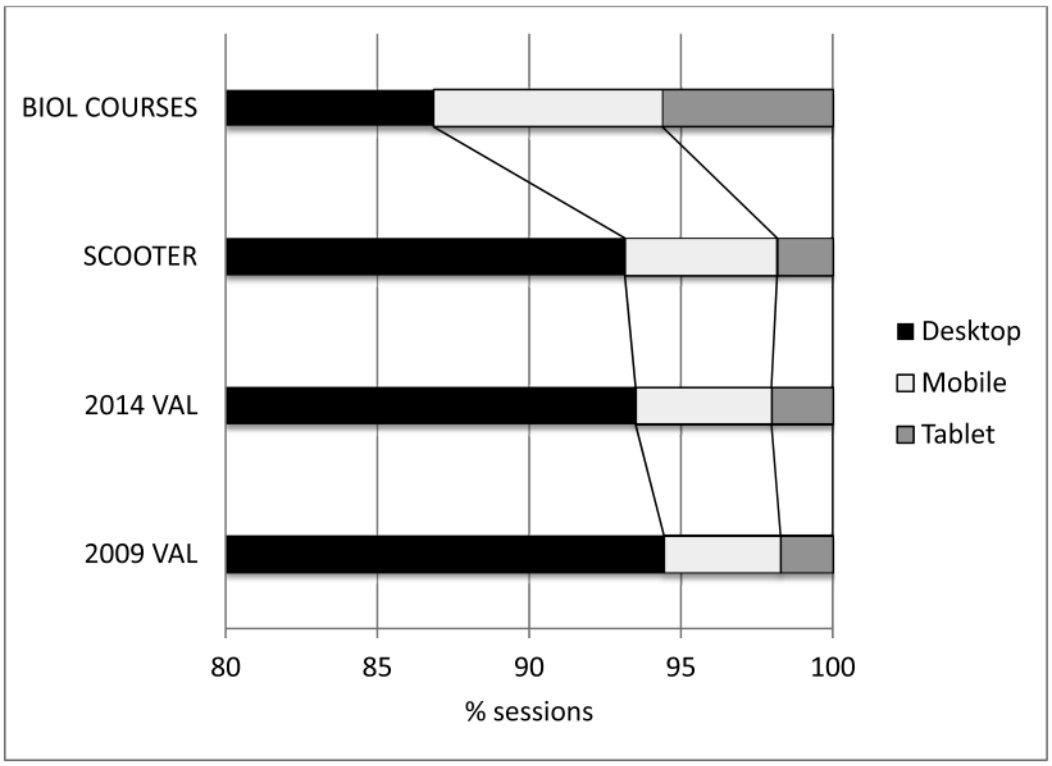

Figure 1: The device preferences for viewing projects (as a % of all sessions)

Acquisition Channels and Referrers

Users were able to access the OER through direct searching (having the URL), organic searching via browsers, by referral and accessing the URL 'back-linked' on another site, or by social media (Figure 2). The SEO strategies of Biology Courses and SCOOTER are apparent with less of a reliance on direct traffic, and having numbers of visits boosted by organic searches and referrals compared to the static and un-optimised HTML sites (VAL) and repositories (MORE and TIGER).

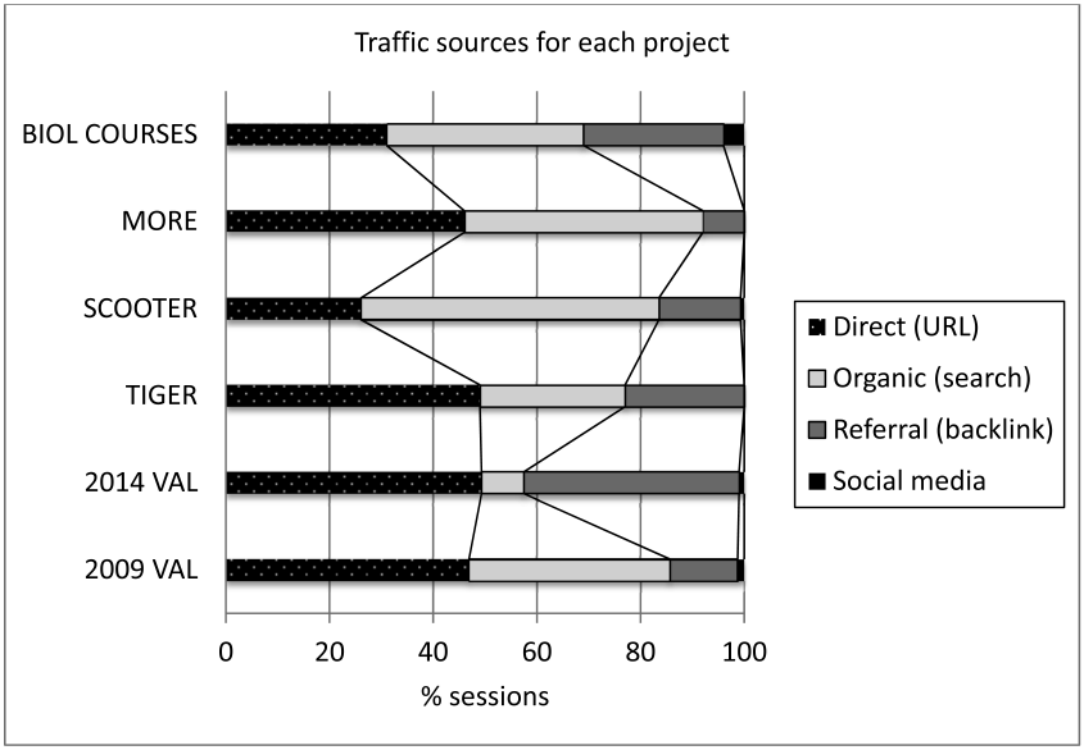

Figure 2: Traffic sources of OER projects (as a % of all sessions)

Despite not continuing to review the keywords as part of the SEO activity in recent years, SCOOTER and Biology Courses continue to attract visitors through web searches and referrals, and this is partly through serendipitous back-linking (Table 6). The URL of the projects are picked up by other universities and organisations and included on their websites, and this directs traffic back to the blogs.

Table 6: Details of the top ten referring organisation websites (with % of traffic to site). Strategically acquired links = un-highlighted; serendipitous links = bold

	2009–2014 VAL	SCOOTER	BIOLOGY COURSES
1	oup.com (14.87%)	google.com (15.56%)	youtube.com (10.44%)
2	blackboard.gcal.ac.uk (13.28%)	en.wikipedia.org (10.73%)	facebook.com (8.23%)
3	global.oup.com (10.02%)	cdc.gov (5.27%)	vivrolfe.com (7.81%)
4	moodle.coventry.ac.uk (5.37%)	google.co.uk (<5%)	medev.ac.uk (6.36%)
5	ibls.moodle.gla.ac.uk (<5%)	globalsicklecelldisease.org	dmuviv10041904.wikispaces.com (<5%)
6	abpischools.org.uk	sicklecellanaemia.posterous.com	global.oup.com
7	moodle.uws.ac.uk	hlsweb.dmu.ac.uk	oercommons.org
8	elearningrepository.nhs.uk	onlinebooks.library.upenn.edu	stumbleupon.com
9	dmu.ac.uk	google.co.in	methodsnorthwest.ac.uk
10	open.jorum.ac.uk	methodsnorthwest.ac.uk	pinterest.com

At the time of these projects, back-linking campaigns used by businesses would invest in positioning the URL on as many other sites as possible, from authoritative organisations and social media 'profiles' pages, to blogs and forums. The profile of referring sites (Table 6) shows partners that were specifically targeted and connections that happen serendipitously. VAL was initially picked up by other universities, Oxford University Press (OUP) to support a bioscience textbook series and the Association of British Pharmaceutical Industry (ABPI). SCOOTER and Biology Courses equally have been discovered by new organisations, and evidence of the use of social media to distribute OER via the web can be seen with the use of YouTube, Facebook, Wikispaces and Pinterest, that were set up at the outset of these projects.

Discussion

Between 2009 and 2012, De Montfort University participated in the UKOER programme and shared a body of health and life science OER with academic communities around the globe. The projects adopted a range of technological approaches with OER collections released onto university servers and that hosted externally. Projects shared OER across five health and science thematic areas, and the academic teams and students involved gained digital skills to create resources that were openly licensed using Creative Commons, and that were shared in a variety of file formats. These projects have reached a global audiences and resources have been viewed in excess of 1 million times. The projects have provided free access to OER with no enrolment or payment restriction, achieving aspirations set out early on for technological openness (Downes, 2006).

The intention of these projects was to provide simple means for academic teams to share OER where there might not be the technological infrastructure or support for the use of other established approaches of discovering and reusing OER. Larger-scale projects that have the relevant technical and IT expertise have looked at the use of Linked Data to evolve common vocabularies and approaches to facilitate the organisation and retrieval of knowledge. The goal is to unify what has become a fragmented landscape for OER and other learning materials on the web (Dietze et al., 2013; Chicaiza et al., 2014). Whilst this paper acknowledges these as important approaches for the sustainability of open education that will be discussed later, it was our intention to explore the effectiveness of a simple practitioner-based approach in this instance.

Reflections on SEO approaches and OER discovery

Wiley (2014) describes access as the definitive step in achieving openness in education, and a healthy life-cycle for OER and learning resources requires them to be discovered, improved and reused (Yergler, 2010). For two projects, we used WordPress blogs and adapted Internet marketing techniques to facilitate the curation of OER, and to promote discovery through organic web searches, referrals from other websites, direct traffic through knowledge of the URL and via social media. Details of the SEO approaches were previously reported although these techniques have altered with time due to algorithm changes that dictated how websites are ranked on search engines (Rolfe & Griffin, 2011a). We evolved a pragmatic approach that would be a achievable by one individual and a time investment of a few hours per week. SEO involves initial work to identify pertinent keywords, and these are set up as categories on the WordPress blogs, and used as keywords within blog articles. The SEO approaches included the use of one of the keywords as the website URL—hence the use of "sicklecellanaemia.org" rather than the SCOOTER acronym, and "biologycourses.com" rather the project name. The use of website optimisation to achieve business targets is time and money intensive, and we did not have the capacity for a large-scale campaign for example placing back-links (URLs) in multiple locations. We achieved this via a light-touch

through publishing OER in multiple formats that could then be uploaded to social platforms such as YouTube and Flickr. By including the project URL where possible when setting up new profile pages, and in the basic video or photo information, this created a 'long tailed' back-link that are still providing visitors to this day. The primary WordPress.org hub contained all the project details, copyright and open license terms and conditions.

Our analytic data shows how effective the use of WordPress blogs are for promoting OER discovery are compared to placing materials in a repository where traffic is minimal without knowledge of the URL. The SEO techniques worked well for SCOOTER and Biology Courses, with them gaining high-ranking positions on page one of Google for their main keywords early on (Rolfe & Griffin, 2011b). In 2012, SEO fell victim to changes to the Google Algorithm, and the rankings of websites decreased if it had the keyword as the URL (Wikipedia, 2015); this rule had a big impact on the ranking position of SCOOTER and Biology Courses. However, as they became more established, the reliance on SEO to gain ranking diminished, as the URLs were adopted by other organisations, and visitors discovered content through social media platforms. Therefore, it was not our intention to change these URLs just for the purpose of SEO. For business, there might be a different approach, with high-ranking on Google still imperative, as sites ranking in page positions 1, 2 or 3 will gain the majority of the traffic (Brooks, 2004), and an estimated 62% of users only ever clicking on links from the first page of the search results (Malaga, 2008). Today, the lack of regular fresh content on the sites would also affect their ranking, but the use of YouTube and Flickr mitigates this in terms of traffic, and all projects are achieving a level of sustainability and discoverability with little effort.

In considering the effectiveness of the projects using WordPress and SEO techniques there are many advantages compared to those hosting their content on university repositories. Firstly, the blogs are easier to discover, and content is also visible on YouTube and Flickr that drives visitors back to the sites. These techniques were simple enough for academic colleagues to carry out without the need for specialist technology support. The sites that are hosted externally are not subject to changes in infrastructure or personnel within universities, as seen with the original VAL project where the server was closed. With cost effective hosting services for education such as ReclaimHosting.com, it becomes viable to host OER in multiple web locations, and at least two locations are recommended to add resilience to change if other services and infrastructure comes and goes.

Reflections on WordPress for OER curation

The benefit of a blog for curating digital content is that resources can be added in perpetuity through the publishing of a new post. For SCOOTER and Biology Courses, all OER was published as blog posts, and additional 'news' blogs relating to the projects further integrated the chosen keywords to boost the discovery of the projects. In order to apply a model for the curation of digital materials, each asset is allocated an intrinsic value regarding their actual use or potential for use (Grindley, 2015). From the traffic data we assume all these projects are still valued today, with regular users and reusers of the sites visible on a monthly basis. Although the temporal distribution of data is not shown, this would be an appropriate area for future study to more fully understand which OER are more popular than others, and where possible, which granularities of materials are most likely to be used and reused by returning visitors.

Other OER projects have adopted similar approaches to curate and promote OER discovery. In the Phonar Open Photography Class funded in UKOER Phase 3 (https://phonar.org), a WordPress blog was used as a central project location that could be web searched, and was shown to receive high volumes of traffic. This became an approach that other departments were encouraged to adopt

at the host university (McGill & Gray, 2015). The Triton project (http://openspires.oucs.ox.ac.uk/triton/) was another example of using WordPress to host an OER collection. One of the benefits reported was the use of setting up categories of content and using the tags feature to make retrieving content simple. In our projects, the SEO keyword research was used to determine the blog categories which are part of the WordPress search feature. Searchability on the sites themselves were further enhanced by the use of tagging, and also by including a static HTML index page. The problem is with this approach, the selection of keywords based on web discovery will possibly conflict the use of common vocabularies as part of Linked Data approaches (Zerr, d'Aquin, Marenzi, Taibi, Adamou & Dietze, 2014). The picture is even more complex with the advent of strategies for optimising discoverability within YouTube and other social media platforms; therefore future evaluations need to look at a holistic approach.

Interoperability with wider open educational systems

The application of common schemas and vocabularies is an important goal for web developers to enhance discovery and interoperability of content, (Zerr et al., 2014), but the uptake of these shared approaches is challenging. As the web has fragmented into a multitude of platforms, and people increasingly view on a diverse range of devices, a number of competing metadata schemas are being exploited by repositories and technologists to address these issues (Dietze et al., 2013). Dietze describes four challenges to interoperability—how to integrate data from heterogenous educational repositories; how to deal with constant change; how to structure texts and evolve taxonomies, and how to compile metadata to facilitate web discovery at scale (Dietze et al., 2013). At the time of the UKOER programme (2009–2012) a wide range of activities and platforms were adopted, from university repositories, WordPress blogs, SlideShare, YouTube and wikis, and many projects adopted Dublin Core elements into HTML metadata (Robertson, 2011). This was the approach taken with our static HTML websites (the Virtual Analytical Project), and common templates for the sharing of OER on blog articles were developed to include details of author, resource title, level of study, date of publication and other items. An added approach to tackling interoperability was to release OER in multiple file formats, again which served to facilitate web discovery. For example, Adobe Flash animations published as .swf files were also released as .MP4 video for YouTube. Most of these steps were not time intensive, with the exception of providing animation and video audio transcripts. Here the approach for each resource was to write a storyboard and script first to form the basis for a narration. For other videos, the transcripts were produced from the recordings afterward. Multiple content versions allowed for distribution via different platforms and could be responsive to change when services disappeared; multiple files provided users with choice over format to reuse, and facilitated interoperability across platforms and devices. We were also endeavouring to meet appropriate standards of accessibility to produce resources that would suit diverse learner needs. As stated by McAndrew,

> "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". (McAndrew, in Thomas et al., 2012).

An area of future work would be to track the fate of resources within education systems to see which of these strategies were most effective in encouraging use and reuse.

What was the lasting impact of the OER?

What of the impact of these projects? According to the OER Research Hub eleven impact hypotheses, our OER are readily discoverable beyond the host institution, arguing a case for having met enabled different usage patterns to take place other than materials hosted within the university setting (OER Research Hub, 2014, Hypothesis 2). All projects are globally distributed, with access favouring English-speaking countries. Interestingly, Brazil is a top visitor to the SCOOTER project, and several of the OER (to our knowledge) have been translated into Brazilian languages, and also African dialects, supporting the development of sickle cell learning materials in these locations. We therefore can argue for equality of access and the serving of a broader base of learners than traditional education (OER Research Hub, 2014, Hypothesis 3)?

Another indicator of reuse is through the back-links from other websites. There are three approaches to this—1) you may approach a collaborator directly e.g. Oxford University Press, to discuss an informal partnership around projects, or to place a back-link on their site; 2) a collaborator may be interested in your site and approach you as in ABPI; 3) or people use your URL without discussion therefore growing back-links serendipitously. Again, a former SEO strategy, acquiring back-links was outsourced work to achieve high volumes of traffic. A number of authoritative organisations link to our OER projects including commercial and charitable bodies, thus clearly achieving a level of 'redistribution', (Wiley, 2014, one of the 5R's), and this could possibly be added as a new area of impact in the OER Research Hub's hypothesis framework.

Limitations to approaches used

In analysing Google and repository analytic data, several assumptions are made. Firstly any interpretation is limited since there is no linked demographic data to determine who is using the materials. Google Analytics has recently introduced demographic data that can be interpreted from Cookies (Google, 2016), but this says little about the open learner or educator. The analytic data is vulnerable to spamming, and variability is introduced through visitors altering browser sessions and removing Cookies. Data is best interpreted in a semi-quantitative manner providing an indication of trends and movement in the data, rather than undertaking a statistical analysis. The analytical evaluation was confined to Google searches only, although Google is known to dominate the majority of Internet searching (Burns, 2008), but there is no insight into browsing strategies on other systems reported in this publication.

The approach presented is a pragmatic and simple solution for OER curation and discovery for academic teams where technologist-support and infrastructure is not available. A limitation is the lack of application of linked data and semantic web technologies, and also the maintenance of standards within these projects without a level of technical expertise.

Conclusions

The exploration of digital marketing approaches adapted from the business world has identified a series of technological steps that can benefit small-scale OER projects. The utilisation of the WordPress.org blogging platform is a simple means of curating and sharing OER. Using SEO techniques and social media channels, OER can quickly become widely dispersed and discoverable on the Internet, as shown with activity sustained several years-post funding with little regular maintenance. We would propose hosting OER in at least two locations to overcome the vulnerability of university-based or web services. Thomas et al. (2012) recognised the challenge for technologists and service managers to keep abreast of developments to sustain content and OER activity, and

it is a recommendation that the different groups within the OER community need to work together —academics, curators, technologists—to draw together ideas to ensure that OER is discoverable and forms a sustainable viable option for education and society.

The question of impact becomes more speculative based upon analytics alone, but the health and life science materials shared are clearly serving communities beyond the host institution, and recent interview data alludes to the on-going benefits to students and teachers within the host institution (Rolfe, 2015).

This paper provides insight into how OER can be distributed on the web in a simple and sustainable manner. The question remains, how will the OER fare with time as it becomes remixed and republished? We will need to consider whether we wish to continue tracking the fate of our content, or whether those involved in global open education will have to accept that OER will fledge and leave their project nests as part of the natural cycle of events.

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References

Brooks, N. (2004). *The Atlas rank report: How search engine rank impacts traffic*. Insights, Atlas Institute Digital Marketing. Retrieved from http://www.inesting.org/ad2006/adminsc1/app/marketingtecnologico/uploads/Estudos/atlas onepoint - how search engine rank impacts traffic.pdf

Burns, E. (2008). *U.S. core search rankings* (February). Retrieved from http://searchenginewatch.com/showPage.html?page=3628837

Downes, S. (2006). *Models for Sustainable Open Educational Resources*. National Research Council Canada. Retrieved from http://www.oecd.org/edu/ceri/36781698.pdf

Dietze, S., Sanchez-Alonso, S., Ebner, H., Qing Yu, H., Giordano, D., Marenzi, I. & Pereira Nunes, B. (2013). Interlinking educational resources and the web of data: A survey of challenges and approaches. *Program, 47*(1), 60–91. http://dx.doi.org/10.1108/00330331211296312

Chicaiza, J., Piedra, N., Lopez-Vargas, J., & Tovar-Caro, E. (2014). Domain categorization of open educational resources based on linked data. *Knowledge Engineering and the Semantic Web*. 5th International Conference, KESW 2014, Kazan, Russia, September 29–October 1, 2014. Proceedings (pp. 15–28). Springer International Publishing.

Google, (2016). *Google Analytics help Centre*. Retrieved from https://support.google.com/analytics

Grindley, N. (2015). *The digital curation sustainability model*. Retrieved from http://www.4cproject.eu/dcsm

Jisc (2015a). *Open education project archive*. Retrieved from https://www.jisc.ac.uk/rd/projects/open-education

Jisc (2015b). *Academy/JISC Open Educational Resources Programme Phase 3*. Retrieved from http://webarchive.nationalarchives.gov.uk/20140702233839/http://www.jisc.ac.uk/whatwedo/programmes/ukoer3.aspx

Keet, C. M. (2010). A top-level categorization of types of granularity. *Novel Developments in Granular Computing: Applications for Advanced Human Reasoning and Soft Computation, IGI Global*, pp. 92–130. Retrieved from http://www.meteck.org/files/CMKDevGrG08chCRC.pdf

Kent, M.L., Carr, B.J., Husted, R.A. & Pop, R.A. (2011). Learning web analytics: A tool for strategic communication. *Public Relations Review*, *37*(5), 536–543. http://dx.doi.org/10.1016/j.pubrev.2011.09.011

Ladbrook, J. & Probert, E. (2011). Information skills and critical literacy: Where are our digikids at with online searching and are their teachers helping. *Australasian Journal of Educational Technology*, *27*(1), 105–121. http://dx.doi.org/10.14742/ajet.986

Littlejohn, A. (2003). *Reusing online resources: a sustainable approach to e-learning*. Psychology Press.

Malaga, R. A. (2008). Worst practices in search engine optimization. *Communication of the ACM*, *51*(12), 147–150. http://dx.doi.org/10.1145/1409360.1409388

McGill, L., Falconer, I., Dempster, J.A., Littlejohn, A. & Beetham, H. (2013). *Journeys to Open Educational Practice: UKOER/SCORE Review Final Report*. JISC, 2013. Retrieved from https://oersynth.pbworks.com/w/page/60338879/HEFCE-OER-Review-Final-Report

McGill, L. & Gray, T. (2015). *Open media classes at Coventry University. Jisc Final Evaluation Report 2015*. Retrieved from http://repository.jisc.ac.uk/6069/1/JR0041_OPEN_EDUCATION_REPORT_V3.pdf

NetMarketShare (2016). *Search engine market share*. Retrieved from https://www.netmarketshare.com/search-engine-market-share.aspx?qprid=4&qpcustomd=0

OER Research Hub (2014). *Impact hypotheses*. Retrieved from http://oerresearchhub.org/collaborative-research/hypotheses

Plaza, B. (2011). Google Analytics for measuring website performance. *Tourism Management*, *32*(3), 477–481. http://dx.doi.org/10.1016/j.tourman.2010.03.015

Robertson J (2011). *UKOER 2: Content management platforms*. Available http://wiki.cetis.ac.uk/OER_SEO

Rolfe, V. (2010). How to monitor the use and reuse of open educational resources using Google Analytics. *EDULEARN 2010 Conference, Barcelona Spain 2010.* Retrieved from http://www.iated.org/concrete2/view_abstract.php?paper_id=11681

Rolfe, V. (2011). SCOOTER Final Project Report. Retrieved from http://www.webarchive.org.uk/wayback/archive/20140701134511/http://www.heacademy.ac.uk/projects/detail/oer/OER_REL_DeMontfort

Rolfe, V. (2015). Open education: sustainability versus vulnerability. *The Open Education Conference (#opened15), Vancouver 18–20 November 2015.* Retrieved from http://sched.co/49NV

Rolfe, V. & Griffin, S. J. (2011a). *A guide to search engine optimisation*. Retrieved from http://www.sicklecellanaemia.org/open-educational-resources/training/search-engine-optimisation-guide

Rolfe, V. & Griffin, S. J. (2011b). Building online communities. *OER11 Conference. Manchester 2011*. Retrieved from http://www.ucel.ac.uk/oer11/abstracts/1119.html

Stacey, P. (2013). Government support for open educational resources: Policy, funding, and strategies. *The International Review of Research in Open and Distributed Learning*, *14*(2), 67–80. http://dx.doi.org/10.19173/irrodl.v14i2.1537

Thomas, A., Campbell, L. M., Barker, P., & Hawksey, M. (2012). *Into the wild: Technology for open educational resources.* University of Bolton. Retrieved from http://publications.cetis.ac.uk/2012/601

Waisberg, D., & Kaushik, A. (2009). Web Analytics 2.0: empowering customer centricity. *The Original Search Engine Marketing Journal*, *2*(1), 5–11.

Wikipedia (2015). *Google Penguin*. Retrieved from https://en.wikipedia.org/wiki/Google_Penguin

Wiley, D. (2014, March 15). Clarifying the 5th R. *Iterating toward openness*. Retrieved from http://www.opencontent.org/blog/archives/3251

Yergler, N. R. (2010). Search and Discovery: OER's Open Loop. *In Open Ed 2010 Proceedings.* Barcelona: UOC, OU, BYU. Retrieved from http://hdl.handle.net/10609/4852

Zerr, S., d'Aquin, M., Marenzi, I., Taibi, D., Adamou, A. & Dietze, S. (2014). Towards analytics and collaborative exploration of social and linked media for technology-enhanced learning scenarios. *PROFILES 2014 Proceedings of the 1st International Workshop on Dataset PROFIling and fEderated Search for Linked Data, CEUR Workshop Proceedings*, CEUR-WS.org.