COMPARATIVE ANALYSIS OF CURRENT METHODS IN SEARCHING OPEN EDUCATION CONTENT REPOSITORIES

Benneaser John
SVP, Engineering – AppNexus Inc., New York, USA
Research Scholar, Karunya University, Coimbatore, India
benneaser@gmail.com

V. Thavavel
College of Computer and Information Sciences, Prince Sultan University, Saudi Arabia
thavavelmurugesanv@gmail.com

Jayakumar Jayaraj
Department of Electrical and Electronics Karunya University, Coimbatore, India
jayakumar@karunya.edu

A. Muthukumar
Department of Computer Science & Engineering
PSG Institute of Technology and Applied Research Neelambur, Coimbatore, India
amk_in_2000@yahoo.com

Poornaselvan Kittu Jeevanandam
Program Manager, Tata Consultancy Services Edison, NJ, USA
poornakj@gmail.com

Abstract: The current generation of learners are living in a eConnected society where the technology and content are open. Open learning enables learners to be self-determined and interest-guided. To make online learning successful, it is critical that learners need effective ways of finding the appropriate learning resources. However, due to the generally unstructured nature and overwhelming quantity of learning content, effective learning remains challenging. This study compares different features offered by the Open learning content search platforms, and analyzes the past one-year website usage metrics data to gather insights about the usage. This paper also discusses the gaps in the current Open Content search dilemma and proposes potential solutions.

Keywords*:* Open Educational Resources(OER), Content search, Open Learning, Massive Open Online Courses(MOOC), Distance Education, Learner Centered Learning

Introduction

Computer-aided instruction (CAI) has evolved from its humble origins, to the level of Massive Open Online Course (MOOC), which was introduced in 2008 as open online courses aimed at unlimited participation. The Internet and the entire World Wide Web (WWW) constitute the largest and most comprehensive knowledge base in the history of the world. Learners are living through this information explosion (Chiou & Shih, 2015). Currently, e-learning is not simply providing the course materials, while the trend of Massive Open Online Courses (MOOCs) and the concept of flipped classrooms (Goodwin & Miller, 2013) is well applied everywhere. Rai & Chunrao (2015) states that "In recent years, Massive Open Online Courses (MOOCs) have attracted millions of learners around the world, through various MOOC providers, such as edX, Coursera, and Udacity. MOOCs allow millions of learners to enroll in courses form reputed universities such as Harvard University, Stanford University, Massachusetts Institute of Technology (MIT), and University of California at Berkeley (UCB). Outside of MOOCs, professors are creating and releasing their own content using tools such as Slideshare and YouTube. Every day, millions of learners make use of free, open online tools, and resources (MacDonald, 2015). Open content learning resources such as MIT's OpenCourseWare project (OCW), TED videos, Khan Academy, YouTube videos, and the MERLOT (Malloy & Hanley 2001; Hanley 2015) project are a few examples of systems through which millions of learners learn on the web every day.

Open learning enables learners to be self-determined and interest-guided. Stacey (2013) educators to "Go beyond open enrollments and use open pedagogies that leverage the entire web not just the specific content in the MOOC platform". Learners are often unable identify which material is needed, useful, and required at their level. Hence, open content learning design must assimilate the material from various sources and provide a new pedagogy that is appropriate to the needs of today's learners (Smyth, Bossu & Stagg, 2015). This paper explains the design for an Open Content Social Learning (OCSL) system that leverages Open Content to deliver an adaptive and personalized experience accounting for the pedagogical needs of the learners and similar learners

 Copyright © The Online Journal of Science and Technology

and the need to recommend learning activities in a pedagogically effective order.

A great majority of these Open Educational Resources (OER) initiatives are based on established web based technology platforms and have accumulated large volumes of quality resources which are shared openly. However, one limitation inhibiting the wider adoption of OER is the current inability to effectively search for academically useful OER from a diversity of sources (Yergler, 2010). While the open content grows in popularity, and the proliferation of repositories and portals for open content, it becomes more difficult for potential users to find the content they need (Dichev & Dicheva, 2012). Learners are often unable to identify which material is needed, useful, and required at their level. Hence, open content learning design must assimilate the material from various sources and provide a new pedagogy that is appropriate to the needs of today's learners (Smyth, Bossu & Stagg, 2015). In this paper, we present our analysis of the current Open learning content platforms. We reviewed the research papers relevant to OER search platforms, studied the survey results from learners and teachers, collected & analyzed the metrics from Alexa.com for the top eight OER search platforms, and then compared the features of the top eight OER search platforms. After the study and analysis, we proposed some potential solutions to overcome the OER adoption due to the massive and diversified volume of content by providing effective personalized search.

History of OER, OCW and MOOC

The term Learning Object, was first popularized by Wayne Hodgins in 1994 when he named the CedMA working group "Learning Architectures, APIs and Learning Objects", which has become the Holy Grail of content creation and aggregation in the computer-mediated learning field (Polsani, 2006). In 1998, David Wiley coined the term "open content", to which the principles of the open source free software can be applied to content. (Caswell, Henson, Jensen, & Wiley, 2008). This movement helped the creation of the first widely adopted open license for content called "Open Publication License" (Wiley & Gurrell, 2009). In 2001 Larry Lessig and others founded the Creative Commons (Commons, 2009) and released a flexible set of licenses which improved Open Publication License's confusing license option structure. One role of Creative Commons, in the history of OER, is to increase the credibility and confidence in their legally superior, much easier to use licenses brought to the open content community. Also in 2001, MIT announced its OpenCourseWare(OCW) initiative to publish nearly every university course for free public access for non-commercial use (West & Victor, 2011). MIT's OpenCourseWare played a critical role in the history of OER with its brand and commitment (Yuan, MacNeill & Kraan, 2008). Since first being coined by UNESCO in 2002, the term Open Educational Resources has evolved to meet the fast pace of the changing and diverse contexts in which it has now been used (Bossu, Bull, & Brown, 2012). Open Educational Resources (OERs) are teaching and learning materials that anyone can use and share freely, without charge. The worldwide OER movement is rooted in the idea of high quality education at no cost. The Cape Town Declaration (2007) states that "Educators worldwide are developing a vast pool of educational resources on the Internet, open and free for all to use. These educators are creating a world where each and every person on earth can access and contribute to the sum of all human knowledge. They are also planting the seeds of a new pedagogy where educators and learners create, shape and evolve knowledge together, deepening their skills and understanding as they go." The term MOOC was developed in 2008 by Dave Cormier and Bryan Alexander to describe a course experiment utilizing connectivism (Moe, 2015).

In summary, OER initiatives have resulted in the development of open content and open courses in higher education. OCW is a free and open digital publication of university-level educational materials. MOOCs are free online courses without formal entry requirement nor participation limit. OERs, OCW and MOOC are closely related to the Openness movement in education promoting the ideas of how people should produce, share, and build education.

Related Research

One of the challenges facing open learning is that while the open content grows in popularity and we witness the proliferation of repositories and portals for OER content, it becomes more difficult for potential users to find the content they need. The power in OER is not in their production; it is in their reuse by other educators and learners. If OER discovery is improved and simplified, many OER aspirations such as widespread remix, repurposing, and redistribution could become part of the educational practice (Dichev & Dicheva, 2012). The Paris OER Declaration (2012) states the need for more research in this area as "encourage the development of user-friendly tools to locate and retrieve OER that are specific and relevant to particular needs". Unwin (2005) argues that the problem with open content is not the lack of available resources on the Internet, but the inability to effectively locate suitable resources for academic use. Research shows (Mercer, Koenig, McGeachin & Tucker, 2011) that learners frequently arrive at open content items from outside search engines rather than by browsing through the repository's organizational structure. Jamali & Asadi (2010) state that scientists are

 Copyright © The Online Journal of Science and Technology

increasingly relying on Google to find scholarly literature and college students overwhelmingly use search engines as a starting point of their information searches.

Open content on the web can be found with some basic meta-data, such as the title, document type, and location, but additional metadata are required for the content to enable effective searching. Indexing, categorization and tagging methods are critical to search the content to offer a personalized learning experience (Barros, Costa, Magalhães,& Paiva, 2015). OER efforts led to a fragmented landscape of concurrent metadata schemas or interface mechanisms that were not designed to offer mechanisms to enable the exchange of resources between these repositories. Recent studies show that this scenario makes it harder to reuse the resources located in OER Repositories. The motivation to learn and engage with the e-Learning solution is key to its effectiveness, especially when the effectiveness is defined as the time spent on the learning platform instead of spending too much time finding for the right content.

1. How do the learners' find OER content online?
2. Is there a significant difference in the time spent on the site based on the traffic from direct visits to search engine driven traffic?
3. Is the learner engagement with the OER platform varies based on the features offered by the platform?

Comparison of Current OER Search Platforms

Most of the search platforms currently use standard search techniques by combining conventional information retrieval techniques that are based on page content, such as word vector space (Salton, & McGill, 1983), with link analysis techniques based on the hypertext structure of the Web, such as PageRank (Brin & Page, 1998) and HITS (Devi, Gupta, & Dixit, 2014).

Web search engines built on standard search techniques, parse text into tokens to be indexed into an inverted index for any relevant information about documents (such as categories, subject or other attributes). The results are then ranked to obtain an ordered list of results. The PageRank (Page, Brin, Motwani & Winograd, 1999) value for page u is dependent on the PageRank values for each page v that is contained in the set Bu (the set that contains all of the pages that link to page u), divided by the number L(v) of links from page v. The PageRank value for any page u can be expressed as

$$PR(u) = \sum_{v \epsilon B_u} \frac{PR(u)}{L(u)},$$

The PageRank algorithm (Brin & Page, 1998) attempts to provide an objective estimate of the Web page's importance. However, the importance of the Web page is subjective for different users. Learners loose confidence in open content if their search results produce random irrelevant content. The true relevancy of a page depends on the interests, goals and existing knowledge of the individual users; a global ranking of a web page might not necessarily capture the importance of a page for a given individual user.

Data Collection and Analysis

The purpose of this study was to examine learners' OER interaction patterns, effectiveness of OER content search and features offered in the OER platforms for effective learning. Currently, there are no research reports with the detailed metrics of the OER resources used, usage patterns of the OER repository and how satisfied the users are. Survey based results may not be able to provide the overall effectiveness because of the volume and diversified nature of the open content and users. Jansen & Molina states (2006) that the Alexa.com ranking is an indicator of the popularity of an engine. In this study, we use Alexa.com (Xun, 2015) to examine the performance of the most commonly used eight OER search platforms. We selected curriki.org, oeconsortium.org, oercommons.org, mooc-list.org, merlot.org, class-central.org, cnx.org and coursetalk.org for further analysis. Alexa.com's bounce rating (Arslan & Seker, 2014) is an indicator of the number of bounces, which means that the users just visit a single page and then leaves the web site. The higher bounce rates the lower the web reputation index, while the lower values indicate a higher reputation value. Lower percentage generally indicates that the user spends more time on the web site. Page Views per User (Chu, Chen, Jia, Pouwelse, & Epema 2014) is another indicator to calculate the number of pages visited by a single user. The higher number means that the user is spending more time to visit more pages and we consider these views as an indicator to a more attractive web site.

The following table produces the result of the top 8 OER search platforms and the performance metrics (average page views per user, bounce rate and time spent on site) of global internet users who visited the site over the past 1 year.

 Copyright © The Online Journal of Science and Technology

Table 1: Top eight OER search platforms and performance metrics over the past 1 year

Site	Number of page views/user	Bounce Rate	Time on site (minutes)
curriki.org	4.4	38.40%	8:35
oeconsortium.org	3.1	38.90%	2:16
oercommons.org	3.3	44.70%	3:05
mooc-list.com	2.19	50.99%	2:19
merlot.org	2.3	51.90%	3:15
class-central.com	2.6	53.70%	2:35
cnx.org	2.11	63.00%	2:29
coursetalk.com	1.79	73.40%	1:21

The following diagram explains the percentage of traffic for the top 8 OER search platforms from various sources (search, social, links and direct visit).

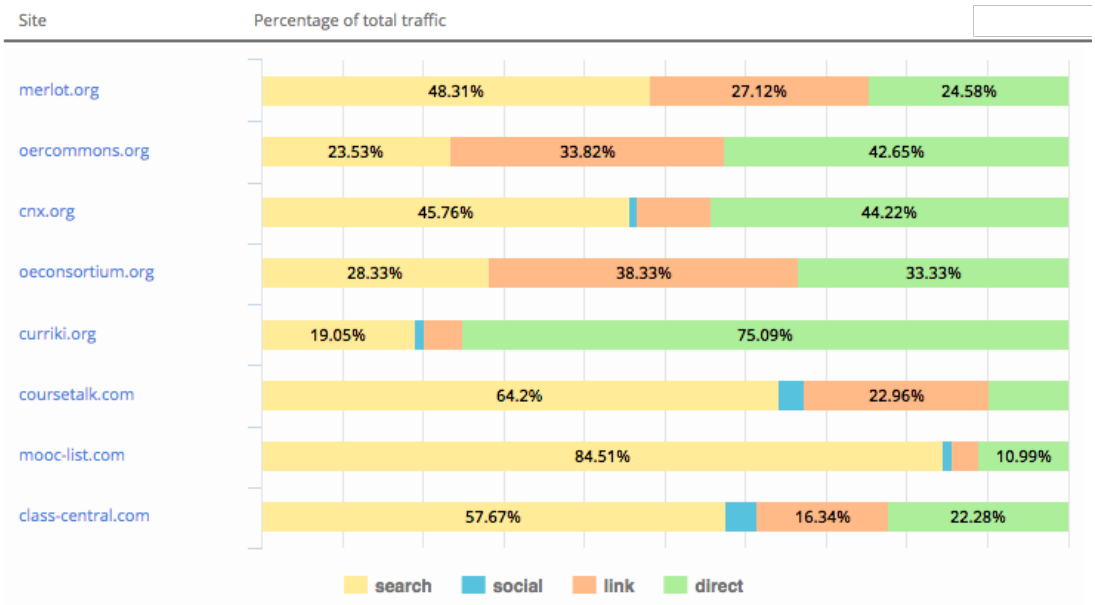

Figure 1: Traffic for the OER search platforms from various sources over the past 1 year

Our hypothesis is: There will be a significant difference in the time spent on the site based on the traffic from direct visits relative to the search engine driven traffic. curriki.org is getting 75.09% of its traffic from direct visits, the highest by 30.87 percentage points. Average user spends approximately 8 minutes on the curriki.org web site compared to 1 minute on the classcentral.com platform.

 Copyright © The Online Journal of Science and Technology

Analysis of OER Search Platform Features

During this study, we analyzed some of the critical features that require for effective learning in an open learning environment on the most popular OER search platforms.

Table 2: Comparison of features offered by the most commonly used OER search platforms

Feature	OER search platform	Result
Feature: Advance Search functionality to filter and refine the content based on their content choices like type of content, date modified, keywords, author etc. This feature helps the learners to retrieve OER that are specific and relevant to their learning. The Paris OER Declaration (2012) states the importance of this feature as "user-friendly tools to locate and retrieve OER that are specific and relevant to particular needs".	merlot.org	Yes
	oercommons.org	Yes
	cnx.org	No
	oeconsortium.org	No
	curriki.org	Yes
	coursetalk.com	Yes
	mooc-list.com	Yes
	class-central.com	Yes
Feature: Supports peer review and ratings to understand the quality of the content. This feature helps the learners to know the quality of the content peer reviewed by other learners. As research suggested by (Gehringer, Ma & Duong, 2016) online review sites often let readers see helpfulness ratings or other information on reviewers as well as permit users to flag reviews they consider inappropriate or inaccurate.	merlot.org	Yes
	oercommons.org	Yes
	cnx.org	No
	oeconsortium.org	No
	curriki.org	Yes
	coursetalk.com	No
	mooc-list.com	No
	class-central.com	No
Feature: Login functionality, dashboard view and personalized portal to organize/save learning collections, learning plan which offers richer learning experience and enables engagement. Brusilovsky, Kobas & Nejdi (2007) suggest that students would be less likely to suffer from information overload if they were presented with personalized activities.	merlot.org	Yes
	oercommons.org	Partial
	cnx.org	No
	oeconsortium.org	No
	curriki.org	Yes
	coursetalk.com	No
	mooc-list.com	No
	class-central.com	No
Feature: Total number of searchable learning content available	merlot.org	63,000
	oercommons.org	70,000

 Copyright © The Online Journal of Science and Technology

	cnx.org	20,000
	oeconsortium.org	50,000
	curriki.org	58,000
	coursetalk.com	44,000
	mooc-list.com	12,000
	class-central.com	3,000
Feature: Supports collaboration with fellow learners to enable peer learning & review. Lane, McAndrew & Santos (2009) reviewed the experiences with the OpenLearn site from the UK Open University and identified that the learning outcomes are positive when individual learners and institutions communicating and collaborating online and considers the influences of offline networks.	merlot.org	No
	oercommons.org	No
	cnx.org	No
	oeconsortium.org	No
	curriki.org	Yes
	coursetalk.com	No
	mooc-list.com	No
	class-central.com	No
Feature: Content recommendation based on learner's activity and goals. Paireekreng & Wong (2010) observe that prior knowledge of each learner's activity and an effective user profile is required for personalization.	merlot.org	No
	oercommons.org	No
	cnx.org	No
	oeconsortium.org	No
	curriki.org	No
	coursetalk.com	No
	mooc-list.com	No
	class-central.com	No
Feature: Content recommendation based on similar learners and peer grouping. Cuéllar, Delgado, & Pegalajar (2011) proposed the learning management platform as a social network and do social network analysis (SNA) over teachers, learners, learning resources and their interactions.	merlot.org	No
	oercommons.org	No
	cnx.org	No
	oeconsortium.org	No
	curriki.org	No
	coursetalk.com	No
	mooc-list.com	No
	class-central.com	No

 Copyright © The Online Journal of Science and Technology

Gap Analysis

It is highly unlikely that the millions of users who have access to the Internet are so similar in their interests that one approach to browsing or searching, respectively, fits all needs (Gauch, Chaffee, & Pretschner, 2003). A solution is needed that will personalize the information selection and presentation for each user (Brusilovsky, Kobas & Nejdi, 2007). Information overload is a concern due to the easy access to an abundance of online information sources (O'Donnell, Lawless, Sharp & Wade, 2015). Another aspect of effective search and personalized results is consideration of the learner's profile. All learners are unique; no two will achieve the same learning outcomes across a range of subject areas. Clear guidance can be provided on the diverse learning needs of each student by collecting and continuously updating metadata that is stored for learners in user profiles. Chan (2000) describes that implicit profile creation based on observations of user's actions has been used in more recent projects and describes the types of information that is available. This model considers the frequency of visits to a page, the amount of time spent on each page, how recently a page was visited, and whether the page was bookmarked. The user's learning behavior is used to create user profiles in several systems. Paireekreng & Wong (2010) observe that prior knowledge of each learner's activity and an effective user profile is required for personalization. Kurshan (2008) states that "drawing on the social network model, Curriki is advancing a collaborative culture of learning, creating and sharing that is paramount to a networked learning environment". Alexa.com performance metrics proved curriki is attracting more learners to its platform and make them engaged in the learning. Research shows that effective learning requires the following:

1. Learner centric adaptive learning by personalizing with relevant content based on the learner's goals, style, habits and prior knowledge.
2. Learner centric social learning based on the goals, learning style and behavioral patterns of similar learners.

Most of the current systems OER Commons (Yoav Yair 2014, D'Antoni, S 2009), iseek.org (Bansal 2013), Project MERLOT (Malloy & Hanley 2001; Hanley 2015), OCW (Vahdati 2015) and mooc-list (Holotescu, Grosseck, Cretu & Naaji, 2014) are not personalized with recommended content and search results. They do not offer personalized content based on a learner's goals and prior knowledge. To overcome these limitations, further research is required to develop an Open Content Repository by consuming the OER content and personalizing the learning experience based on the learner's goals and activities and similar learners' learning activities.

Conclusion and Further Research

We began with a review of the existing OER search engines and examine some of the research studies that pertain to the effectiveness of Open content searches. We found that most of the existing research is based on surveys and real-time user metrics was not considered. We thus designed a study to test and evaluate the OER platforms based on Alexa.com ranking results. We also compared the features across the top 8 OER search platforms and documented the results.

The proposed further research is to focus on Learner Attribute-based Matching (LAM) to enhance the conventional search experience by building a user profile to provide more personalized search results based on learning style, type of content, recent activity, content categories, or other interests of the users. The art of keeping learners engaged and motivated is a critical component of any learning platform design. This approach shifts the paradigm because it requires software systems to be sufficiently intelligent to recommend information to users. As an enhancement, we can implicitly and explicitly collect information from learners about their learning behaviors, learning goals, and other criteria. While a conventional search engine builds a sparse matrix of terms that are mapped to documents in the content index, the recommendation is to design to map the user's behavior to those documents.

References

Arslan, M. L., & Seker, S. E. (2014). Web based reputation index of Turkish universities. arXiv preprint arXiv:1401.7547.

Bansal, T., Chabra, S., & Joshi, D. (2013). Current Initiatives and Challenges to OERs in Indian Higher Education.

Barros, H., Costa, E., Magalhães, J., & Paiva, R. (2015, April). Integrating Educational Repositories to improve the reuse of Learning Objects. In Proceedings of the 30th Annual ACM Symposium on Applied Computing (pp. 270-272). ACM.

Bossu, C., Brown, M., & Bull, D. (2012). Do Open Educational Resources represent additional challenges or advantages to the current climate of change in the Australian higher education sector?. In Proceedings of the 29th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE 2012).

Brusilovsky, P., Kobsa, A., & Nejdl, W. (2007). The adaptive web: methods and strategies of web

personalization (Vol. 4321). Springer Science & Business Media.
Caswell, T., Henson, S., Jensen, M., & Wiley, D. (2008). Open content and open educational resources: Enabling universal education. The International Review of Research in Open and Distributed Learning, 9(1).
Chan, P. K. (2000). Constructing web user profiles: a non-invasive learning approach. In Web usage analysis and user profiling (pp. 39-55). Springer Berlin Heidelberg.
Chu, X., Chen, X., Jia, A. L., Pouwelse, J. A., & Epema, D. H. (2014). Dissecting Darknets: Measurement and performance analysis. ACM Transactions on Internet Technology (TOIT), 13(3), 7.
Chiou, Y., & Shih, T. K. (2015). Auto Grouping and Peer Grading System in Massive Open Online Course (MOOC). International Journal of Distance Education Technologies (IJDET), 13(3), 25-43. doi:10.4018/IJDET.2015070102
Commons, C. (2009). About the licenses. Creative Commons.
Devi, P., Gupta, A., & Dixit, A. (2014). Comparative Study of HITS and PageRank Link based Ranking Algorithms. International Journal of Advanced Research in Computer and Communication Engineering, 3(2).
Dichev C., Dicheva D. Open Educational Resources in Computer Science Teaching, In Proc. SIGCSE'12, Raleigh, NC, 2012.
Dicheva D., Dichev, Ch. A Framework for Concept-Based Digital Course Libraries. Journal of Interactive Learning Research (JILR), 15(4), 347-364, 2004
Gauch, S., Chaffee, J., & Pretschner, A. (2003). Ontology-based personalized search and browsing. Web Intelligence and Agent Systems, 1(3-4), 219-234.
Gehringer, E. F., Ma, K., & Duong, V. T. (2016). What Peer-Review Systems Can Learn from Online Rating Sites. In State-of-the-Art and Future Directions of Smart Learning (pp. 341-350). Springer Singapore.
Goodwin, B., & Miller, K. (2013). Evidence on flipped classrooms is still coming in. Educational Leadership, 70(6), 78-80.
Jamali, H. R., & Asadi, S. (2010). Google and the scholar: the role of Google in scientists' information-seeking behaviour. Online information review, 34(2), 282-294.
Jansen, B. J., & Molina, P. R. (2006). The effectiveness of Web search engines for retrieving relevant ecommerce links. Information Processing & Management, 42(4), 1075-1098.
Klašnja-Milićević, A., Vesin, B., Ivanović, M., & Budimac, Z. (2011). E-Learning personalization based on hybrid recommendation strategy and learning style identification. Computers & Education, 56(3), 885-899.
Hanley, G. L. (2015). MOOCs, MERLOT, AND OPEN EDUCATIONAL SERVICES. MOOCs and Open Education Around the World, 33.
Holotescu, C., Grosseck, G., Cretu, V., & Naaji, A. (2014, October). Integrating MOOCs in Blended Courses. In The International Scientific Conference eLearning and Software for Education (Vol. 4, p. 243). " Carol I" National Defence University.
Kurshan, B. B. (2008). OER Models that Build a Culture of Collaboration: A Case Exemplified by Curriki. eLearning Papers, (10), 3.
MacDonald, M. (2015). The Battle for Open by Martin Weller. Journal Of Perspectives In Applied Academic Practice, 3(1). doi:10.14297/jpaap.v3i1.139
Malloy, T. E., & Hanley, G. L. (2001). MERLOT: A faculty-focused Web site of educational resources. Behavior Research Methods, Instruments, & Computers, 33(2), 274-276.
Mercer H., Koenig J., McGeachin R., Tucker S. Structure, Features, and Faculty Content in ARL Member Repositories. Journal of Academic Librarianship 37:4, 333-342, 2011.
Mercer, H., Koenig, J., McGeachin, R. B., & Tucker, S. L. (2011). Structure, features, and faculty content in ARL member repositories. The Journal of Academic Librarianship, 37(4), 333-342.
Mitchell, S. M. and Lutters, W. G. Assessing the Value of Computer Science Course Material Repositories. In Proc. of CSEETW'06, IEEE Computer Society, 2006.
Moe, R. (2015). The brief & expansive history (and future) of the MOOC: Why two divergent models share the same name. Current Issues in Emerging eLearning, 2(1), 2.
O'Donnell, E., Lawless, S., Sharp, M., & Wade, V. P. (2015). A Review of Personalised E-Learning: Towards Supporting Learner Diversity. International Journal of Distance Education Technologies (IJDET), 13(1), 22-47. doi:10.4018/ijdet.2015010102
Page, L., Brin, S., Motwani, R., & Winograd, T. (1999). The PageRank citation ranking: bringing order to the Web.
Paireekreng, W., & Wong, K. W. (2010, January). Mobile content personalisation using intelligent user profile approach. In Knowledge Discovery and Data Mining, 2010. WKDD'10. Third International Conference on (pp. 241-244). IEEE.
Paris, O. E. R. (2012). Declaration at http://www. unesco.

org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/pdf/Events. Paris% 20OER% 20Declaration_01. pdf.
Polsani, P. R. (2006). Use and abuse of reusable learning objects. Journal of Digital information, 3(4).
Rai, L., & Chunrao, D. (2016). Influencing Factors of Success and Failure in MOOC and General Analysis of Learner Behavior. International Journal of Information and Education Technology, 6(4), 262.
Smyth, R., Bossu, C., & Stagg, A. (2015). Toward an Open Empowered Learning Model of pedagogy in higher education. Open learning and formal credentialing in higher education: Curriculum models and institutional policies. Hershey: IGI Global.
Vahdati, S., Lange, C., & Auer, S. (2015, March). OpenCourseWare observatory: does the quality of OpenCourseWare live up to its promise?. In Proceedings of the Fifth International Conference on Learning Analytics And Knowledge (pp. 73-82). ACM.
West, P. G., & Victor, L. (2011). Background and action paper on OER. Report for The William and Flora Hewlett Foundation. Menlo Park, CA: The William and Flora Hewlett Foundation.
Wiley, D., & Gurrell, S. (2009). A decade of development…. Open Learning, 24(1), 11-21.
Yergler, N. R. (2010). Search and discovery: OER's open loop. 2010 Proceedings. Barcelona: UOC, OU, BYU.[Accessed: 10/10/15].< http://hdl. handle. net/10609/4852.
Yair, Y. (2014). Open educational resources: reasons to be cheerful?. ACM Inroads, 5(4), 37-38. http://doi.acm.org/10.1145/2684721.2684729
Yuan, L., MacNeill, S., & Kraan, W. G. (2008). Open Educational Resources-opportunities and challenges for higher education.
Xun, J. (2015). Return on web site visit duration: Applying web analytics data. Journal of Direct, Data and Digital Marketing Practice, 17(1), 54-70.