Quality Evaluation of Open Educational Resources based on Academic and Technical Aspects: State of the Art Review

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Abstract Opening up education and facilitating learning are among the open education movement. Open Educational Practices (OEP) witness several efforts to evaluate quality of Open Educational Resources (OER) considering contents and their platforms, i.e. digital repositories. Information and Communication Technologies, such as software engineering and knowledge based technologies (e.g. metadata, testing and information sharing) assist to apply OEP practices and to adopt frameworks to achieve the aim of OER quality criteria. Quality assurance for the emerging learning and teaching enabled by ICT is a crucial issue that should be tackled to further develop the OER for learning and teaching. Identifying quality criteria with academic point of view will further promote the development and use of OER in higher education. This paper presents a literature review about OER and their repositories (ROER) by focusing on quality assurance. The main aim is to highlight quality concepts and approaches related to ROER. The paper also provides an overview of definitions of quality for OER and gives examples of relevant existing practices and initiatives to illustrate the quality concepts and their mapping to academic practices. Finally, it provides recommendations on ROER quality assurance support the further development, use and reuse of OER in higher education.

Keywords: Open Educational Resources, Repositories, ROER quality, Open Courseware on Computing and Telecom.

تقييم جودة المصادر التعليمية المفتوحة على أساس الجوانب الأكاديمية والتقنية: مراجعة حديثة

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الملخص إن عملية فتح المصادر والموارد التعليمية وتسهيل التعلم من بين حركة التعليم المفتوح. إنطلاقاً من هذه الحركة تشهد الممارسات التعليمية المفتوحة (OEP) العديد من الجهود لتقييم جودة الموارد التعليمية المفتوحة (OER) بالنظر إلى المحتويات المنهجية ومنصات التعليم الإلكترونية، أي المستودعات الرقمية. وقد تساعد تقنيات المعلومات والاتصالات، مثل هندسة البرمجيات والتقنيات القائمة على المعرفة (مثل البيانات الوصفية والإختبار ومشاركة المعلومات) في تطبيق ممارسات التعليم المفتوح واعتماد أطر لتحقيق هدف وجود معايير جودة الموارد التعليمية المفتوحة. من هنا يُعد موضوع ضمان جودة التعلم والتدريس الناشئين اللذين تم تمكينهما بواسطة تكنولوجيا المعلومات والاتصالات مسألة حاسمة يجب معالجتها لزيادة تطوير الموارد التعليمية المفتوحة للتعلم والتدريس. سيؤدي تحديد معايير الجودة من وجهة نظر أكاديمية إلى زيادة تعزيز تطوير واستخدام الموارد التعليمية المفتوحة في التعليم العالي. تقدم هذه الورقة مراجعة الأدبيات حول الموارد التعليمية المفتوحة ومستودعاتها (ROER) من خلال التركيز على ضمان الجودة. الهدف الرئيسي هو إبراز مفاهيم الجودة والأساليب المتعلقة بــ ROER. تقدم الورقة أيضاً نظرة عامة على تعريفات الجودة في الموارد التعليمية المفتوحة وتعطي أمثلة على الممارسات والمبادرات الحالية ذات الصلة لتوضيح مفاهيم الجودة وتخطيطها للممارسات الأكاديمية. وأخيراً، فإنه يقدم توصيات بشأن ضمان جودة ROER الذي يدعم التطوير الإضافي واستخدام وإعادة استخدام الموارد التعليمية المفتوحة في التعليم العالي.

الكلمات المفتاحية: الموارد التعليمية المفتوحة، المستودعات، جودة مستودعات الموارد التعليمية المفتوحة، الدروس المفتوحة في مجال الحوسبة والاتصالات.

Introduction

Since 18 years, the open education practices (UNESCO 2002) empowers the use of open educational resources (OER), which enable open and electronic education and learning through the World Wide Web. This new movement needs further evaluation in several aspects. Therefore, OER adoption shall motivate access to higher education in terms of its face-to-face, distance

education and online learning where OER can be considered as an efficient way to promote continuous learning and lifelong education [1]. According to the William and Flora Hewlett Foundation vision [2], remixing and revising OER needs to be embedded in teaching and learning practices to contribute to increase learning efficiency and to improve the quality of education by using OER. Hence, Improvement of OER materials and enhancement of its quality over time are critical issues in OER adoption that can be sustained through considering best design practices during early faces of development of repositories of OER (ROER). OER with good quality can enlarge informal education through independent learning and can enlarge formal access through free access to learning materials. Then good quality OER can enhance formal education by offering study resources to prevent dropout. Learners and institutions can benefit from cost decreasing, and therefore benefits can be indirectly affordable for community and governments. Additionally, OER will motivate teachers to become authors, and raise their self-esteem and social status, and help raise the profile of the institutions [3]. This article reviews works from 2010 to early 2019, in which articles that do not examine the quality of OER and ROER are excluded, while the rest of articles are profoundly studied.

This article presents the methods of OER quality indicators and frameworks. The findings from previous literature show that adoption of OER in education is still needs more efforts and the use of OER among higher institutions and academics in early stages.

OER movement

The OER movement started with the emergence of MIT Open Courseware (OCW) announced in the New York Times just after the start of the millennium [4]. The term OER was coined in a meeting at UNESCO in 2002, and since that many OER projects and initiatives have emerged across the globe [5]. Some of OER projects used in higher education since its emergence are the UK Open University (UKOU) and Athabasca University (AU). AU is considered as the 'First OER University' in 2006 [1]. In 2009 open data witnessed mainstream visibility, when various governments (such as the USA, UK, Canada and New Zealand) declared initiatives towards opening up their public information. Open data help to address the greatest challenges of time and generate value for everyone [6].

In 2012, UNESCO and Commonwealth of learning foundation (COL), with the assistance from the William and Flora Hewlett Foundation, organized the World OER Congress at Paris, resulted in the Paris OER Declaration [7]. Then, huge efforts were made to deploy OER resources online.

A list of more than 450 OER initiatives and about 600 institutional repositories are existed [8], and known as Global List of OER Initiatives (http://www.wsiscommunity.org/pg/directory/view/672996), while ROER (repositories) can be found at the Directory of Open Access Repositories (http://www.opendoar.org/) [8].

OER and ROER preliminaries

The benefits of OEP movement include launching of OER, which is free (i.e. gratis without restrictions) and their platforms ROER that can be accesses in any time. The academia use OER despite many challenges among them that OER are not yet adopted widely and they are known by all teachers and learners. Furthermore, lack of technical assets, limited hardware, and technology rapid evolution. Other challenges that can face higher education institutions can take forms of bureaucratic barriers. Therefore, adoption and use of OER repositories are limited for well-established higher education institutes that exist in developed countries. Since that, well known scholars and organizations have defined OER and ROER as following:

1. ROER

McGreal's defines ROER as digital databases that house learning content, applications and tools such as texts, papers, videos, audio recordings, multimedia applications and social networking tools. Through these repositories, OER are rendered accessible to learners and instructors on the World Wide Web [9]. Repositories of OER (ROER) are platforms that host and facilitate access to the OER resources [10]. ROER enables stakeholders to interact, collaborate, create and use materials and processes [10], [11]. Researchers argue that the culture underlying OER and therefore the creation of ROER can be distinguished by four key characteristics that refer to as Search, Share, Reuse, and Collaborate [12].

From the above definitions, one can consider as ROER as online digital platforms that use web 2.0 technologies such as social collaboration and recommendation mechanisms.

2. OER definitions

Many definitions are well established since 2002. UNESCO defines OER as "the open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non- commercial purposes" [13]. Further, the OECD defines OER as "digitized materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research" [14].

More recently, UNESCO (2011) refers to OER as "learning resources that include curricula, teaching materials, interactive, digital books, videos, multimedia, podcasts and other materials designed for educational purposes and that can be shared on a network, which is available to teachers, academics and students, and can be accessed without having to pay for subscriptions or licenses" [15].

From these definitions, it is remarkable that OER should be open, sharable and editable without restrictions. However, proprietary resources cannot be classified into OER resources due to authorship license that restrict any modification or sharing without prior agreement. In this manner, the most famous license that can offer free and libre access (gratis) is the Creative Commons (CC), but among their own six open

licenses, there are two CC licenses, BY-ND and BY-NC-ND, that do not apply to OER since they don't allow derivatives, i.e. do not allow any future adaptation. CC BY-SA license is mostly suitable for OER sharing and reuse [5].

OER and ROER quality

Higher education teachers and learners normally require finding high quality data and information to satisfy their knowledge requirements. Since OER resources are developed by learners, researcher and teachers as users of ROER then the need for assessment of these resources is essential step to guarantee their quality. The quality can be achieved in this circumstance through evaluating the OER and developing ROER that assure high quality resources.

General definition of quality for OER materials can be defined as "appropriately meeting the stakeholders' objectives and needs which is the result of a transparent, participatory negotiation process within an organization" [16]. In this manner, quality is not an objective that can be measure directly, but a tool to enhance learning objectives and outcomes. The issue stills that the quality of OER resources is usually determined through developing ROER platforms with following attributes: accurate content, authorship/institution excellence, technical tools adoption, integrity of revisions, and fitness for purpose, pedagogic design and users interaction [10][17].

The issue of quality in development of OER-based material relates to two aspects-content and pedagogy. Subject experts normally can evaluate the content, but quality of ROER platforms mainly lies in the hands of OER developers. Hence, during planning stage developers should collaborate with pedagogic designer to properly build main teaching and learning underlines such as matching course objectives, checking learning outcomes and designing evaluation assessment. In this stage, academics and teachers shall search and reuse affordable OER content through platforms, e.g. MERLOT II and OepnStax, and may mix content from different ROER before creating new content. The idea here is to use, share and reuse available OER resources to achieve OEP practices. Finally, after checking licenses and verifying that OER content is fully open and free, i.e. CC Licenses, and contain high quality information, i.e. peer reviewed, then developers design and present their content online. Additionally, feedback and evaluation of OER users shall be useful to motivate developers and teachers to update course contents. This final step is very essential for sustainability of ROER platforms.

The next section provides detailed analysis of related studies that propose quality indicators and frameworks.

Literature review

A framework proposed by [18], which is a theory approach that is distributed among four levels: Teaching aspects, Information content aspects, Presentation aspects, and System technical aspects that give the acronym TIPS - for a highly validated framework as guidelines for determining and improving OER quality. The author has undergone several rounds of international workshops, questionnaires, surveys and referrals; these have been examined by more than 200 OER experts and teachers around the world to produce a practical framework consisting of 38 key criteria [18].

The TIPS framework, alongside JRC recommendation and Achieve OER evaluation tool are used by [19] as a basis for a specific set of criteria to evaluate OER quality. The authors had developed OER to teach modeling and simulation topics in higher education [19].

Software engineering testing is used by [20] to evaluate OER quality indicators. Authors used software engineering enabled testing to evaluate OER and Learning Objects. They proposed a framework to map software testing to OER. Technically, they proposed an equation to determine reliability or what called trust index [20].

An agile based method is proposed by [21] for the development of OERs (AM-OER), where authors aim to improve quality and facilitate reuse and adaptation of OERs. The results of their work showed preliminary evidences on the applicability, effectiveness and efficiency of the method in the development of OERs [21]. In fact, this method combines learning and software engineering to develop reliable content from learning and pedagogy viewpoints. It allows designing and creating pedagogically effective OERs.

Work of [22] suggested machine learning algorithms enriched with quality verticals to analysis and test OER content automatically after development. - Outcomes of this work can be used in evaluating one aspect of quality of educational resources, namely, engagement quality. Outcomes of this work shall mark a significant step towards Automatic, Scalable Quality Assurance in Open Education [22]. The authors proposed 5 main quality verticals that seem to emerge consistently across multiple research domains. These quality verticals are understandability, topic coverage, freshness of information, presentation, and authority [22].

A review study provides insights on the role of different actors and institutions involved in quality and OER. Furthermore, it gives a detailed overview of quality assurance models for OER and the study identified recommendations for policymakers on quality assurance to support the further development and use of OER in Europe [23].

From another viewpoint, [24] Present a rating system for open data as OER is proposed. The system presents a framework to search, download and re-use digital resources by teachers and students.   In this work, an evaluation framework for open datasets is outlined, under the categories of readiness, implementation and use. Hence, the authors built a system from the ground upwards on Open data principles and Semantic Web technologies. The authors said that "By following open data best practices and Linked Data principles, open data initiative ensures that

data hosted can be fully connected into a Web of Linked Data." [24].

Conclusion

This paper presents a literature review focusing on quality of OER and ROER. Main findings that OER resources must satisfy open educational practice to be considered as open education materials. To ensure quality, open resources such as OER must satisfy this practice and respect other quality indicators. The OEP practice insists on specific requirements that include: 1) openness, 2) online access, 3) free as gratis, 4) explicit open license for use/reuse, 5) the license allows sharing and collaboration, 6) known authorship. In addition to that, quality can be assured by adding more features such as: 1) peer-review, 2) search tools, 3) meta-data, 4) rating, 5) recommendation, 6) interoperable files and applications, 7) free source code and original files. Designing ROER with these features motivates adopting OER resources and sustained success of their contents. The development of OER and their ROER must allow collaboration among stakeholders in order to achieve open education goals which in the most prepare for equal access for knowledge and learning. In the future, we will use a questionnaire to survey teachers and learners' opinion about OER and its quality in order to propose technical quality features and metrics.

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