Overcoming Barriers for OER Adoption in Higher Education Application to Computer Science Curricula

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Abstract: The use of Open Educational Resources (OER) in all contexts of education is increasingly promising. Nevertheless, some barriers are discouraging or delaying the adoption of OER in Higher Education (HE). In this work, we propose a strategy to overcome obstacles that hinder the adoption of OER as teaching materials in Computer Science Curricula. This strategy is based on the collaborative work of professors and students within a Community of Practice (CoP) backed up by MERLOT, a renowned repository of OER. To validate the proposed strategy, we applied it in some courses of the Computer Science Engineering Curricula from a Latin American university by two consecutive academic terms. The evaluation obtained from professors and students who participated in this teaching-learning experience was encouraging for the use of OER. It also enabled us to settle issues concerning the discoverability and quality of OER. Furthermore, the results of this proof fostered the institutional willingness to sponsor and spread the OER adoption initiative.

1 INTRODUCTION

Open Educational Resources (OER) are freely accessible digital materials that are intended to use in education. A conjunction of factors is driving OER as a strategy to increase access to educational opportunities globally. As evidence of that, the UNESCO Recommendation on OER, adopted in November 2019, proclaims the use of OER as a change agent to ensure inclusive and equitable quality education for all (UNESCO, 2019).

Currently, higher education (HE) takes advantage of technology-based resources, such as OER, to low costs and broaden their capacity to serve the growing demand (Atherton, et al., 2016).

The advantages of using OER in HE have been documented in some works. For example, the use of open textbooks is exposed in (Jhangiani, et al., 2016; Ruth & Boyd, 2016; Ozdemir & Hendricks, 2017), the use of OER in undergraduate courses is addressed in (Bradshaw , et al., 2013; Klein, 2015). Nevertheless, in spite of the increasing mainstreaming of OER in HE, the obstacles for their formal adoption are still unsolved (Wong & Li, 2019). In this work, we propose a strategy that aims to overcome some barriers to OER adoption in HE curricula. This strategy is based on the shared knowledge in communities of practice (CoP) integrated by educators and students.

To validate this strategy, we applied it in some courses of Computer Science Engineering from a public university in a Latin American country. We aim to test the feasibility of OER-based teaching in formal education when the content of knowledge discipline is aligned with the ACM/IEEE Computer Science Curricula (2013).

The results of this proof have shown that both professors and students achieved a fulfilling experience of teaching-learning. Professors highlighted the quality and diversity of resources, as well as the interrelations that arise from their participation within a CoP, which provide them for new academic horizons. The students found that they are capable of learning from courses prepared by academics from leading universities of developed countries.

The rest of this paper is structured as follows: Section 2 covers the background concepts, Section 3 depicts the strategy for the adoption of OER, Section 4 describes the results of the application of the proposed strategy, and Section 5 presents the conclusions and future work.

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2 BACKGROUND

2.1 Open Educational Resources

The latest definition of OER states: "OER are teaching, learning and research materials that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions" (UNESCO, 2019). OER range from full courses including syllabi to textbooks, lecture notes, video lectures, software simulations, and more (Atkins, et al., 2007).

OER are mostly released with a Creative Commons (CC) license. For the fully comply of the concept of "openness", resources should enable the 5R activities (Retain, Reuse, Revise, Remix, Redistribute (Wiley & Hilton, 2018).

Many of the largest OER websites are supported by prestige Universities or academic coalitions, such as OER Commons by ISKME (Institute for the Study of Knowledge Management in Education), MERLOT by the California State University Center for Distributed Learning, and the OpenLearn project at the Open University of the United Kingdom, OpenStax College.

2.2 Community of Practice

The term Community of Practice (CoP) refers to a group of people who agree to participate in collaborations that take place in relation to a domain of knowledge, developing shared practices to build a common store of knowledge and accumulate expertise in the area (Wenger & Snyder, 2000).

To differentiate from any community, a CoP must have three characteristics (Wenger, 2011).

a. The domain. Members are connected by a learning purpose they share. Therefore, membership implies to hold a competence over the domain and an interest in deepening knowledge on it.
b. The community. Members are engaged in joint activities, help each other, and share knowledge and information. In pursuing their interest in their domain, they build collaborative relationships.
c. The practice. Members develop a shared set of practices, resources, tools, and documented experiences to address problems in the domain.

Currently, CoPs are emerging as a strategy in the educational field to promote knowledge sharing. Members develop their willingness to share useful resources and support other members to increase their domain of knowledge (Tseng & Kuo, 2014).

3 ADOPTION OF OER IN HE

3.1 Barriers for Adoption

The obstacles to the adoption of OER into HE have been documented in the literature. A survey applied to 2,144 higher education professors in the U.S. (Allen & Seaman, 2014), revealed that the time and effort required to find, retrieve, evaluate and adapt OER was the most significant barrier for OER adoption. In a follow-up survey (Seaman & Seaman, 2017), applied to 2,700 professors, the main obstacle continued to be this same, the effort needed to find and evaluate suitable resources. Also, in a complementary qualitative study conducted with 218 professors, the lack of time for resources evaluation became the barrier for OER adoption (Belikov & Bodily, 2016).

Another study (Kortemeyer, 2013) exposed that OER adoption major hurdles were discoverability (searching and retrieve suitable resources) and quality control. Moreover, the Commonwealth of Learning (COL) and UNESCO conducted six regional consultations, where the main barrier to mainstreaming OER was described as the lack of users' capacity to access, reuse and share OER (COL, 2017).

On the other hand, the adoption of OER in Latin American HE introduces the obstacle of the language of the resources, because the predominant language for OER is English.

The quality of OER has widely covered in literature as a primary requisite to encourage their use in HE. For Camilleri, et al. (2014), the quality assurance of OER relies on peer work, from the perspective of its fitness for the required purpose, the ability for reuse (editing), and the kind of learning experience that can provide.

Another alternative is the application of rubrics to evaluate the quality of OER. Although rubrics aim to measure OER quality, each one emphasizes different aspects. For instance, the rubric used by OER Commons includes the degree of alignment to standards, quality of explanation of the subject matter, the assurance of accessibility, and some other aspects depending on the type of resource (Achieve, 2011). Some other rubrics relies on the content quality as a major dimension for evaluating OER quality, considering indicators such as completeness, clarity, and accuracy (Jonsson & Svingby., 2007).

In this work, we assumed as a starting point that professors already have awareness about the nature and purpose of OER. We have focused our strategy on those barriers that are possible to overcome with actions conducted by professors themselves. For this reason, the institutional policy for supporting OER adoption is out of the scope of the proposed strategy. The barriers we address are those considered as the most significant according to previously cited works:

a. **Discoverability.** It involves the search and retrieval of OER that fit the content and pedagogical requirements of the subject taught.
b. **Quality.** It includes these attributes of OER: the relevance, accuracy, updated information, and appropriate format for learning purpose.
c. **Language.** The language used to present the content of OER.

3.2 Strategy to Overcome Barriers

The strategy description and the rationalizing of how its application can surpass the barriers for adoption are explained follow.

3.2.1 Description of the Strategy

The strategy is based on the participation of professors in a CoP offered by MERLOT under the denomination of "Community Portals" (Tovar, et al., 2017). At present, MERLOT holds some CoP aligned with different disciplines where educators and students can seek, utilize, curate, review, and rate learning resources that have been included. These CoPs are maintained by a discipline Editor and a related editorial board of peer reviewers who ensure the quality of the OER by reviewing their pertaining to the discipline, the correctness of their content, and their usefulness for teaching and learning.

In 2016, MERLOT created CoPs based on OER utilization in two knowledge areas concerning the interest of our proposal.

a. Information Systems and Information Technology (IT/IS).
b. Computer Science (CS).

These CoPs are related to the knowledge areas aligned with the undergraduate course topics recommended by the Accreditation Board for Engineering and Technology (ABET) for accreditation of degree programs in computer science, information systems, software engineering, information technology, and cybersecurity. In the case of Computer Science, the curricula recommendation is guided by (ACM/IEEE, 2013). Table 1 shows the Computer Science taxonomy of Knowledge Areas, according to ACM/IEE, with their acronym and name.

To prove the proposed strategy, it was applied in two consecutive academic terms (September 2018 – February 2019, March 2019 – August 2019), considering two subjects of the current curricula, "Fundamentals of Databases," that is included in the IM knowledge area, and "Operating Systems," that is included in the OS knowledge area.

Table 1 also exhibits the number of resources available through the MERLOT CoP in CS knowledge areas at the beginning and the end of the application of the strategy. The increasing of the available OER will be analysed later in this document.

The participants in the application of the strategy were the group of students enrolled in each academic term for the mentioned subjects and, the respective professors. While the group of students was different, the professors stayed assigned for the subject in both terms.

Furthermore, a recommendation in this strategy is the creation of a Course ePortfolio in MERLOT to include OER, that have been previously selected, within a Bookmark Collection and create the syllabus information of the course.

3.2.2 How Strategy Overcomes Barriers

The strategy proposed in this work enabled to overcome the barriers to the adoption of OER mentioned in section 3.1.

a. **Discoverability.** The professor, member of the CoP, in the CS discipline, has access to a collection of OER previously approved by the Editor and by the peer review. This fact simplifies discoverability issues, enabling the professor to save time and effort.
b. **Quality.** The two-fold review process of OER carried out by the Editor and academic peers contributes to ensuring the quality of the resources. Further, the provenance of OER is considered an indicator of quality. Mostly resources collected, particularly in CS discipline, have been produced by professors of outstanding universities in the world.
c. **Language**. All collected resources for CS are available only in the English language. It does not represent an actual barrier in the CS domain because English is considered the lingua franca of Computing and students are competent to use it.

Table 1: CS Taxonomy in CoP and number of resources.

Knowledge Area Acronym	Knowledge Area Name	Number of resources	
		Aug. 2018	Aug. 2019
AL	Algorithms and Complexity	45	48
AR	Architecture and Organization	22	25
CS	Computational Science	22	46
DS	Discrete Structures	22	28
GV	Graphics and Visualization	11	13
HCI	Human-Computer Interaction	139	142
IAS	Information Assurance and Security	25	28
IM	Information Management	165	177
IS	Intelligent Systems	402	407
NC	Networking and Communications	173	959
OS	Operating Systems	27	28
PBD	Platform-based development	11	11
PD	Parallel and Distributed Computing	7	7
PL	Parallel and Distributed Computing	4074	4621
SDF	Software Development Fundamentals	44	53
SE	Software Engineering	48	56
SP	Social Issues and Professional Practice	16	18

4 RESULTS OF THE STRATEGY APPLIED

The proposed strategy for OER adoption requires that the professor develop these steps:

a. Get membership in MERLOT by completing the Sign-up form of the Web page.
b. Select the Academic Discipline Portals in the Community Portals. Choose the Computer Science discipline.
c. Create a Bookmark collection. This step requires to select the OER they consider appropriate to support the topics in the syllabus of the subject, from the resources collection within the discipline.
d. Create a Course ePortfolio with OER included in the Bookmark collection. This step requires to complete the information about syllabus subject (topics, prerequisites, pedagogical approach, learning outcomes, and assessment).
e. Request students to become MERLOT members and select the Computer Science Community Portal to grant them access to the Course ePortfolio just created.

As a way of example, some screen captures of the steps described are presented. Figure 1 shows a screen capture of the MERLOT Computer Science Community Portal.

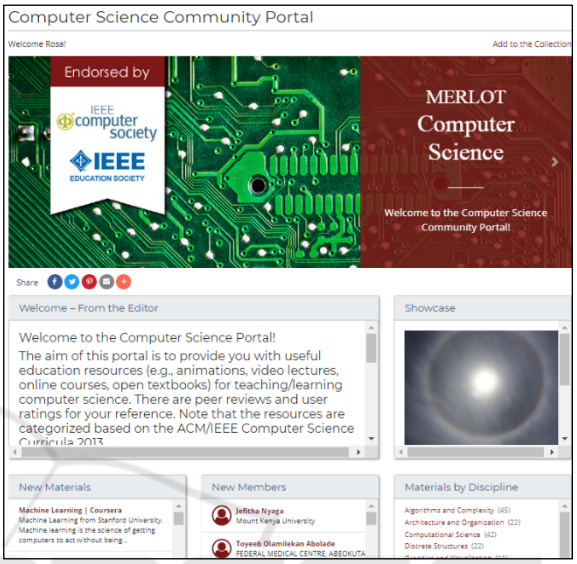

Figure 1: MERLOT Computer Science Community Portal.

Figure 2: ePortfolio for Fundamentals of Databases.

Figure 2 shows a screen capture of the Course ePortfolio named IM-Databases, which have been created by the professor for the Fundamentals of

Databases subject. Only a partial list of selected resources is displayed in the image.

For each subject involved in this proof, "Fundamentals of Database" and "Operating System", a sample of OER selected for the Course ePortfolio is summarized in Table 2.

4.1 Professors Evaluation

The observations expressed by professors concerning the development of this proof of the strategy are mentioned. These were the positive comments:

a. The variety and academic rigor of OER. Professors found educational resources in multiple formats to cover their teaching purposes. They appreciated the advantages of simulation software for learning since students can explore, experiment, and model real situations. They awarded that the creation of this kind of resources involves high production costs, so it was valuable to get them for free.
b. The right categorization taxonomy for OER used in CS simplified the search issues. Nevertheless, it was important to invest time to select the appropriates resources.
c. The interrelations promoted in the CoP. Professors gained expertise in their field. It has aroused their interest to participate more actively as reviewers and contributors of resources.

These were the negative and neutral comments:

a. The different approach of OER. Professors affirmed that it is tough to comply with the syllabus using OER (approximately 45% could be covered). It is because there were differences in approaching the topics of the syllabus.
b. The time to prepare the teaching based on using OER is not profitable for the first time. Professors agreed in the effort demanded to apply OER in their subjects, for the first time. Nevertheless, in the next academic term, when they taught the subject again, the effort was considerably lesser.
c. The use of OER in teaching is feasible for those who have expertise in the subject. Professors claimed that it is not an advisable teaching strategy for a professor who is a novice teaching the subject.
d. The lack of metadata for OER. Professors observed that resources' metadata included in the informative web page displayed in MERLOT were incomplete. Notably, the lack of license associated with the publication of the resource was missing. It would expect they have a Creative Commons license.

4.2 Students Evaluation

The proof of the strategy involved 56 students of Fundamentals of Databases courses and 46 students of Operating Systems courses, considering both academic terms. No student took both subjects at time because these are at different levels in the curricula. In total, 102 students participated in this experience. Because of the lack of space, the results of the evaluation by students are presented for the total of students.

In this work, the evaluation of the acceptance of the use of OER by students had a qualitative

Table 2: Sample of the selected resources for Course ePortfolio.

Name	Provenance	Type	Include tests /exams
SUBJECT: DATABASE FUNDAMENTALS – ePortfolio IM-Databases			
Introduction to Databases	University of Stanford, US	Online Course (Video lectures)	Yes
Advanced Databases	The Saylor Foundation, US	Online Course	Yes
A Gentle Introduction to SQL	Napler University, UK	Online Tutorial	Yes
SQL Interpreter and Tutorial	University of Washington, US	Online Tutorial	
Introduction to Modern Database Systems	The Saylor Foundation, US	Online Course	Yes
SQL Tutorial	W3C School	Online Course	Yes
Database Design and Implementation: A practical introduction using Oracle SQL	Oracle CIO	Open Access Textbook	Yes
SUBJECT: INTRODUCTION TO OPERATING SYSTEMS – ePortfolio OS-IntroOS			
Animations for Operating Systems	University of Virginia, US	Animations	No
CPU-OS Simulator	Edge Hill University, UK	Software application	No
Operating Systems and System Programming	University of California, Berkeley, US	Video lectures	No
Computer Structures and Operating Systems	University of Münster, Germany	Presentations	Yes
Operating Systems and Middleware	California State University, US	Open Access Textbook	Yes

Table 3: Questionnaire for students' evaluation.

Program: Use of OER in courses of Computer Engineering Name of the course: Fundamentals of Databases / Operating ¨Systems Academic Term: 2018-B (September 2018 – February 2019) Questionnaire of opinion: Please, answer each question by checking the box that best describes your perception.					
Q1. How was your knowledge on OER before taking the course?	Excellent	Fairy	Good	Moderate	None
Q2. How was your knowledge on CoP before taking the course?	Excellent	Fairy	Good	Moderate	None
Q3. How do you value the achievement of learning outcomes with the use of OER?	Excellent	Fairy	Good	Moderate	None
Q4. How do you value the use of learning resources published by prestigious Universities?	Excellent	Fairy	Good	Moderate	None
Q5. How do you value your membership in MERLOT CoP for Computer Science?	Excellent	Fairy	Good	Moderate	None
Response freely about these questions:					
Q6. Did you obtain benefits from learning by using OER?					
Q7. Did you perceive obstacles in this learning experience by using OER?					

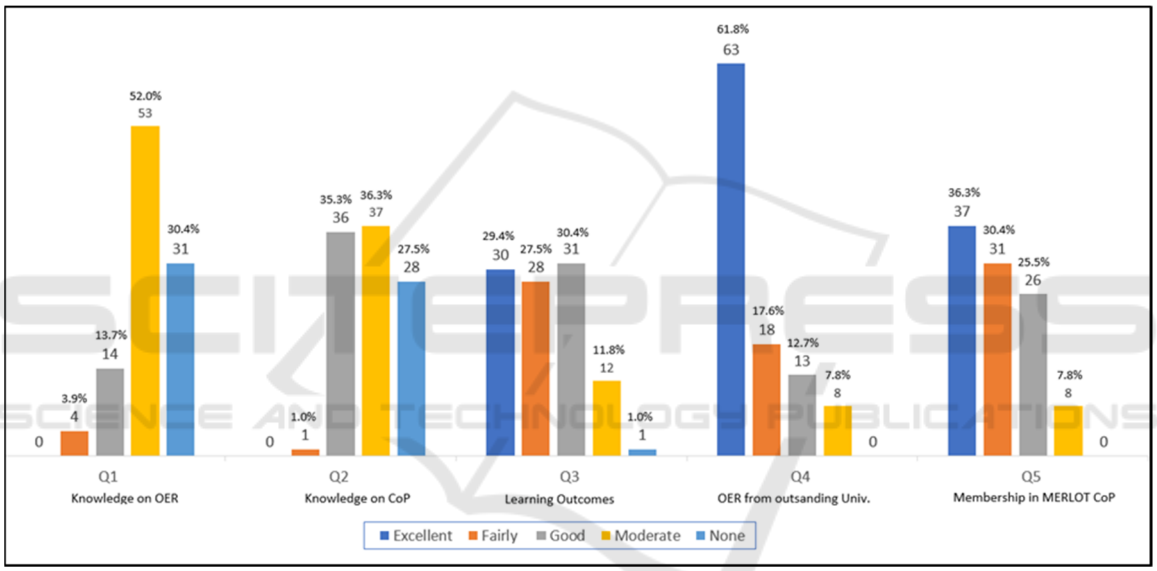

Figure 3: Results of questionnaire.

approach. To evaluate the rate of acceptance of OER in the learning process, students were evaluated through a Goal, question, metric (GQM) approach (Koziolek, 2008) by using a Likert scale.

The questionnaire was applied at the end of each academic term to all students involved in this proof of the strategy. The questionnaire content is presented in Table 3. It embraced three groups of questions:

G1. Two closed questions (Q1 and Q2) to explore the initial level of knowledge that the student had about the OER and CoPs.

G2. Three closed questions (Q3, Q4, and Q5) to know the students' appreciation concerning this learning experience.

G3. Two open questions (Q6 and Q7) to receive feedback from students about the use of OER in the learning process.

All results for G1 and G2 (closed questions) are presented in Figure 3, a grouped bar chart. Each group of bars that represent a question is labelled with a descriptive text. For each question, a bar in different colour represents the number of responses (and the respective percentage) for each level of appreciation. The total number of students answered the questionnaire, it means 102 responses.

For closed questions in G1 (Q1 and Q2).

Considering the sum of responses obtained for "Knowledge", in the scale good and moderate, it is observed that students were less informed about the OER concept (65.7%) than about the CoP concept (71.6%).

Nevertheless, around 30% of students did not have any knowledge about those terms. It is worthwhile to remark that students have not participated in CoP until this experience despite the importance of teamwork in the computer science professional activities.

Concerning Q3, it is observed that students have a positive opinion on the learning outcomes achieved through this experience of the use of OER. The highest percentages correspond to excellent (29.4%), fairly (27.5%), and good (30.4%) appreciations.

In Q4, students' responses show a remarkable valuation for the use of OER published by prestigious universities (61.8%), and 30.4% have a positive opinion (fairly and good).

For Q5, students also recognized the value of participation in the MERLOT CoP. The excellent, fairly and good appreciations represent 92.2% of responses.

For open questions in G3 (Q5 and Q6) the aspects noted below have been pointed out by most students.

Concerning the benefits of using OER, in Q6, students highlighted that the learning based on OER prepared in prestigious universities added value to their education. It became a worthwhile experience for them. Students also recognized that simulations and online courses as valuable materials to enhance their learning.

Concerning the obstacles of using OER, in Q7, students mentioned that the language was a barrier for comprehension of the content of the resources. However, they were aware that the domain of the English language is a key competency for their career and, consequently, they were gratified to surpass the challenge of the language in their learning. Students did not identify additional barriers.

It is important to mention that the summative evaluations of students in the subjects of this proof of the strategy, did not show variance respect previous academic terms. All students approved the courses.

5 CONCLUSIONS

In this proof of the strategy, we have tested its efficacy to surpass the most recognized barriers for the adoption of OER in HE, as part of subjects in the curriculum of Computer Science Engineering.

The novelty of this strategy was the introduction of a CoP that supports the tasks of discovery and quality control of OER, which be reused as learning materials in the subjects of the curricula.

Therefore, we aimed to engage professors and students, within a CoP where they could interact with other members grouped by the same academic interest. In this case, we joined to the MERLOT Community Portal for Computer Science discipline.

The taxonomy applied to classify the resources aligned with the (ACM/IEEE, 2013), provided a helpful base to select the appropriate OER for the subject that the professor needs. In this way, some barriers, as the discoverability and quality of resources, could be surpassed.

Professors and students positively evaluated the proposed strategy. Professors remarked that the participation of students in the CoP and the use of OER motivated students for self-learning, encouraging their critical and reflective thinking

Students recognized the attainment of learning outcomes and shown their enthusiasm to participate in the MERLOT CoP for enlarging their relations with other academic actors of foreign Universities.

The participation in this strategy for OER-based learning has persuaded to professors and students to advocate the OER adoption. Hence, they can boost the spreading of this strategy to include most of the subjects of the curricula.

Arguably, OER-based education has a significant chance of success if it provides a trustworthy, ongoing assessment of the student's work. That is the professor's role. Moreover, once professors embrace OER as a valid alternative to the preparation of their materials, or the payment for textbooks, the learning in HE could be improved. For instance, professors will have more time to dedicate it to other research activities. Also, students will be more independent to face their learning, able to deep in their interests, creativity, and responsibility will increase, and, working in a collaborative group within a CoP, they will experiment the value of sharing knowledge.

On the other hand, it is necessary to mention that, as shown in Table 1, the number of OER in the knowledge areas concerning this CoP increased in a year, but not in a significative number. Nevertheless, this increase was extraordinary for Networking and Communication (from 173 to 959 learning resources).

The results of this proof of the strategy have been a positive impact on the institutional willingness for OER sponsorship. The academic authorities have decided to involve new subjects in the application of this strategy for the next academic term. Therefore, we can conclude positively about the success of the strategy.

The transformative potential of OERs would be very advantageous for public universities to promote the affordability of knowledge for more people.

REFERENCES

Achieve, 2011. *Rubrics for evaluating open education resource (OER) Objects.* [Online] Available at: https://www.achieve.org/achieve-oer-rubrics

ACM/IEEE, 2013. *Computer Science Curricula 2013.* United States of America: Association for Computing Machinery (ACM) and IEEE Computer Society.

Allen , I. E. & Seaman, J., 2014. *Opening the curriculum: Open educational resources in U.S. higher education,* Massachusetts, US: Pearson.

Atherton, G., Dumangane, C. & Whitty, G., 2016. *Charting equity in higher education: drawing the global access map,* London, UK: Pearson

Atkins, D., Seely Brown, J. & Hammond , A. L., 2007. *A review of the Open Educational Resources (OER) Movement: Achievements, Challenges and New Opportunities.* San Francisco, CA, US: The William and Flora Hewlett Foundation.

Belikov , O. M. & Bodily, R., 2016. Incentives and barriers to OER adoption: A qualitative analysis of faculty perceptions. *Open Praxis,* 8(3), pp. 235-246.

Bradshaw , P., Younie, S. & Jones, S., 2013. Open Education Resources and Higher Education Academic Practice, 30(3), 186-193. Retrieved January 5, 2020 from https://www.learntechlib.org/p/132849/. *Campus-Wide Information Systems,* 30(3), pp. 186-193.

Camilleri, A. F., Ehlers, U. D. & Pawlowski, J., 2014. State of the Art Review of Quality Issues related to Open Educational Resources (OER). *JCR Scientific and Policy Report*, pp. 2-43.

COL, 2017. *Open Educational Resources: Global Report 2017,* Burnaby, British Columbia: s.n.

Jhangiani, R. et al., 2016. *Exploring faculty use of open educational resources at British Columbia postsecondary institutions,* Victoria, BC: BCcampus.

Jonsson, A. & Svingby., G., 2007. The use of scoring rubrics: Reliability, validity and educational consequences. *Educational Research Review,* 2(2), pp. 130-144.

Klein, G., 2015. *Embedded digital resources are in, traditional text out at UMUC,* Maryland, US: WCET Frontier.

Kortemeyer, G., 2013. Ten Years Later: Why Open Educational Resources Have Not Noticeably Affected Higher Education, and Why We Should Care. *EDUCAUSE Review Online.*

Koziolek, H., 2008. Goal, Question, Metric. *Dependability Metrics: Advanced Lectures,* pp. 39-42.

Ozdemir, O. & Hendricks, C., 2017. Instructor and student experiences with open textbooks, from the California open online library for education (Cool4Ed). *Journal of Computing in Higher Education,* 29(1), pp. 98-113.

Ruth, D. & Boyd, J., 2016. *OpenStax already saved students $39 million this academic year ,* s.l.: s.n.

Seaman, J. E. & Seaman, J., 2017. *Opening the Textbook: Educational Resources in U.S. Higher Education,* s.l.: Pearson.

Tovar, E., Chan, H. & Reisman, S., 2017. *Promoting MERLOT Communities Based on OERs in Computer Science and Information Systems.* s.l., s.n., pp. 700-706.

Tseng, F.-C. & Kuo, F.-Y., 2014. A study of social participation and knowledge sharing in the teachers' online professional community of practice. *Computers & Education,* Volume 72, pp. 37-47.

UNESCO, 2019. *UNESCO Recommendation on Open Educational Resources (OER).* [Online] Available at: https://en.unesco.org/news/unesco-recommendation-open-educational-resources-oer [Accessed December 2019].

Wenger , E. & Snyder, W., 2000. Communities of practice: the organizational frontier. *Harvard Business Review,* 76(1), pp. 139-146.

Wenger, E., 2011. Communities of Practice: A brief introduction. *STEP Leadership Workshop, University of Oregon*, Volume 6.

Wiley, D. & Hilton, J., 2018. Defining OER-Enabled Pedagogy. *The International Review of Research in Open and Distributed Learning,* 19(4).

Wong, B. & Li, K., 2019. *Using Open Educational Resources for Teaching in Higher Education: A Review of Case Studies.* s.l., s.n.