Open Educational Resources - in Engineering Education, Case Study at UC/AGH, UB and ULBS

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ABSTRACT

To change the educational scene in the epoch of the digital generation there is the possibility of using Open Education (OE) and Open Educational Resources (OER). The term "open educational resources" refers to resources with free access to use, adaptation and redistribution. The objectives of the research are to determine the degree of knowledge and use of OER in three Engineering Universities in three countries (Poland, Hungary and Romania) and to find out whether there is a relationship between the institutions in terms of knowledge and use of OER. The measurement is made by applying the survey method on a sample of n = 192. As a tool we use the questionnaire with 15 questions structured in three chapters: knowledge of OER; using OER; opinions about OER. In this analysis we summarize: the presentation of the degree of familiarity with some OER-related concepts, the use of special search engines, the use of free software sources, the frequency of use of OER and opinions on different types of OER that could be exploited in the future. For the description of relationship between nominal variable we use contingency tables and diagrams and compare the frequency data with the Pearson Chi-square test.

Keywords: Open Educational Resources, special OER search engines, free software sources, digital generation.

1. INTRODUCTION

According to Harari (2018) we live in times of revolutionary changes of information and biotechnology, we deal with unseen technological challenges. The technological and software changes defining our contemporary society imply the need to redefine the educational reality for all the participants to the educational scene, meaning that all the roles need to be updated and the training offers have to be integrated into the current context. In the context of the digital era, Prensky proposed an interesting paradigm for the actors of education. Most of today’s learners belong to the digital native category (Prensky, 2001), meaning the ones born and raised in the era of digital technology, the others being mentioned as digital immigrants. The characteristics of these digital natives are: (1) The way the information is processed – they are used to take over and communicate with friends very quickly, text messages have become a form of primary communication, the information is analyzed very quickly; They were born with multitasking skills (both cognitive and sensory) and practiced them all their lives. (2) They prove a series of cognitive behaviors oriented towards efficiency and avoiding redundant information. (3) They have a personal identity in the virtual electronic environment and virtual...
social relationships are extensions of what they are and defines them. According to Prensky (2005), it is important for teachers to be willing to teach school students and university students: where and how to find important information; how to critically evaluate them; how to use them in appropriate contexts.

From an educational point of view, the social media acquires a special status. Digital native school students and university students are willing to talk and share what they know, they want to learn from each other within a wide learning community. There is a tendency to extend this learning desire from the social media context to the educational environment. Social media is defined as "a group of Internet-based applications, built on the ideological and technological foundation of Web 2.0 and enabling the creation and exchange of user-generated content" [6]. The most important forms of the social media are: (1) website blogs and formulas, (2) microblogging sites, (3) social networks (Facebook, Google+, Instagram, LinkedIn etc). Social networking sites that offer user-defined content: social bookmarking, social curating, (5) Wiki (Wikipedia, online galley and open encyclopedia). According to Artega Sánchez, Cortijo and Javed (2014 - in Ceobanu 2016), even if Facebook was not designed for educational purposes, it can promote the collaborative learning model, it increases the motivational level of learners. The study by Karvounidis, Chimos, Bersemis and Douligeris (2014) demonstrated a positive influence of the use of Web 2.0 tools (blogs, wikis and podcasts) in academia's academic context. Pawlowski (2013), in Open Education 2030, mentions the need for joint cross-border actions involving communities in different European countries in order to remain on the global education market. Dușe and Dușe (2015) talk about the need for European education systems to provide learning experiences offered to students closer to labor market requirements, the contribution of ICT to be more emphasized, inter alia in engineering education, both in teaching and learning, with an additional focus on the use of open educational resources.

The global dimension of engineering education pursues a high level of understanding and insight into the world. It positions the role of the engineer as a person who responds to the demands of society, they depend on solving those problems that require technical and innovative knowledge. Their field of expertise includes theoretical, practical, technical, strategic and conceptual capabilities. These knowledge and capabilities enable them to design solutions, identify different needs. However, society changes, changes in the environment, economic changes require more insistently the formation of broader skills that facilitates contextual performance both in organization and in society. In response to these demands, in engineering education, over the last decade, we have seen the development of a new type of engineering pedagogy with a holistic professional training. Among other things: problem-based learning, project-based learning, student-centered learning, education that includes the student as a consumer. According to Lappalainen (2017), as a new benchmark for the development of engineering education, recent studies propose that pedagogical objectives and activities include the development of personal attributes such as personality, socio-emotional skills and system intelligence. The latest refers to the ability to act intelligently as part of the whole, even when the whole is lacking. In this context, the whole represents an economic and social context on any scale, from small projects to large projects. This new type of education aims at developing a "life-philosophical" thinking that is based on the positivist paradigm in which the personal dimension (the growth of self) provides the foundation for system thinking.

Among the real opportunities to change the educational scene, in the epoch of the digital generation are the opportunity to capitalize on Open Education (OE) and Open Educational Resources (OER). Among the first, in 2002, the Massachusetts Institute of Technology (MIT) launches the OpenCourseWare project: materials and online courses with the possibility of free use and distribution; being followed by many other examples of OER projects in engineering education: (a) The Pennsylvannia State University: Petroleum & Natural Gas Engineering, Course Author: Michael Adewumi; (b) University of Portsmouth: Scool of Enginering / Postgraduate Research Opportunities; (c) UNSW Australia Enginiering: School of Petroleum Engineering, Open Learning Program; (d) Massachusetts Maritime Academies: Engineering etc.
The term "open educational resources" - used for the first time in 2002 by UNESCO - refers to educational resources (lesson plans, guides, training modules) with free access to use, adaptation and redistribution. The open source is a concept and a practice that allows user and developer access and redistribution, with the central principles of collaboration and circulation. According to Bucher (2011) and the Best practice guide of OER (2014) on www.acces-deschis.ro/ro/OER a complete list of all OER initiatives and databases is impossible to be issued due to their dynamic nature. The number of freely available materials increases every day, finding materials of interest remains the responsibility of the user. An important role in the future will be played by specialists who will facilitate access and whose efforts will lead to the development of automated or semi-automated tools to identify resources as closely as possible to needs. To reach the search results, the user is good at using a specialized search engine. Most of the large OER databases are institutional digital deposits, which focus on disseminating the materials developed by the organization. In addition to large databases, users also have a number of online catalogs, which, although they do not contain OERs themselves, link to various OER world warehouses, whose resources have passed a quality test, according to criteria search entered. OER types include: Open Courses, Open E-Books, Open Video, Open Audio, Open Photo / Open Photo, Open Social Community Forums.

On the 5th June 2019 an intergovernmental Expert Meeting adopts revised Draft Recommendation on Open Educational Resources and that will be submitted to the UNESCO Conference in November 2019. The draft Recommendation text sets out a transformative vision of OER, one that contributes to the 2030 Sustainable Development Agenda.

The present research strategy applied in this work tries to describe and explain phenomena in the field of engineering education. The objectives are:

- Determining the level of knowledge and use of OER in three Engineering Universities from three countries: Poland, Hungary and Romania.
- Considering the involved population (students and teachers) in the education process of the three Technical universities (UC/AGH; UB; ULBS) we wish to find out if there is a significant association between the membership of one of the three universities and OER usage.

We have a research model with independent measurements. The variables are categorical, the measured cases are classified in one of the nominal cases, they can also be considered qualitative.

2. RESEARCH INSTRUMENTS AND DESCRIPTION OF POPULATION

As a tool we use the questionnaire with 15 questions structured in three chapters: Knowledge OER; Using OER; Needs/opinions about OER; In this analysis, we summarize the presentation of the degree of acquaintance with some concepts related to OER, the use of special OER search engines, the use of free software sources, the frequency of use of OER and opinions on different types of OER that could be capitalized in the future. Thus, we analyze questions no. 1, 2.b, 4, 7 and 11 with elements corresponding to the operationalized concepts: the category of belonging to one of the universities (UC/AGH, UB, ULBS) and OER (knowledge, use, opinions). Trying to describe relations between nominal variables we call them to be presented as contingency / association tables and bar/column diagrams. Comparison of the frequency data is done by using the Person Chi-square test. The form of the questionnaire is Word Document in Romanian for ULBS, English for UC/AGH and Google Forms in Hungarian for UB (https://goo.gl/forms/BGjbMvfVUF18oEcl2).

The measurement is made using the survey method on a sample of 192 people (n=192). Professors, students, PhD or Ms students from the University Engineering Institutions were asked: CRACOW UNIVERSITY of Technology (UC/AGH), ÔBUDA UNIVERSITY "Rejtő Sándor Faculty of Light Industry and Environmental Engineering" (UB) and UNIVERSITAEA "LUCIAN BLAGA DIN SIBIU” Facultatea de Inginerie (ULBS), according to table no.1
3. RESULTS AND DISCUSSIONS

a. Are the subjects familiar with the following: free license, license terms, website: www.creativecommons.org, copyright?

Familiarization with OER-related concepts: free license, licensing terms, copyright is for more than 50% respondents to each institution. The knowledge of www.creativecommons.org is under 20% at each university. Figure no. 2 shows the percentage frequency of the extent to which those with OER concepts are familiar: free license, license terms, site: www.creativecommons.org, copyright. In the case of the acquaintances of those with a "free license", we wanted to find out if there are significant differences between one of the institutions and the "free license". After obtaining the Pearson Chi-square coefficient $X^2 = 13,897; df = 2, p = 0,001 (p <0,05)$ we can state the significant difference between the frequencies observed and those expected when belonging to one of the universities (ULBS, UC/AGH, UB). UC/AGH respondents tend to be the most familiar with free licenses, the least familiar with UB.

b. Knowledge and usage of RED search engines

Frequency of search engines OER for general search engines (Google, Bing) is higher than for special search engines in each institution. Table no. 2 shows the percentage of use of the OER search engines, and Figure no. 1 summarizes data on the use of special OER search engines by institutions.

| Institutions | Google | Bing | Globe | Folk semantic | Discover ED | Creative Comon | Open Coursware | Other engines |
|--------------|--------|------|-------|---------------|-------------|----------------|----------------|---------------|
| ULBS         | 98,91  | 22,83| 14,13 | 5,43          | 9,78        | 11,96          | 7,61           | 11,96         |
| UC/AGH       | 100    | 8,82 | 2,94  | -             | -           | -              | -              | 26,47         |
| UB           | 98,48  | 18,18| 4,55  | -             | 3,03        | 4,55           | -              | 1,52          |
| Total        | 98,96  | 18,75| 8,85  | 2,60          | 5,73        | 7,29           | 3,65           | 10,94         |

The use of special search engines OER has the highest ULBS (34.78%) and lowest UB (12.12%). According to Pearson Chi-square analysis $X^2 = 10,491; df = 2; p = 0,005 (p <0,05)$, the difference is significant.
c. Which free software sources (Learning Systems / LMS Tools) are used?

Respondents from ULBS use each of the free software sources presented in Table 3. With the exception of Dokeos and Atutor, all other learning systems are used to a certain extent by respondents in UB. Respondents from UC/AGH uses: Moodle, Bodington, Atutor, Olat and others. It is understandable that the highest percentage (27.17%) of Moodle Ro belongs to ULBS.

### Table 3. Use of free software sources (LMS Tools)

| Free software sources | ULBS  | UC/AGH | UB    | Total |
|-----------------------|-------|--------|-------|-------|
|                       | Frequency % |       |       |       |
| DidaTec               | 13.04 | -      | 3.03  | 7.29  |
| Moodle                | 10.87 | 38.24  | 84.85 | 41.15 |
| Moodle Ro             | 27.17 | -      | 3.03  | 14.06 |
| Bodington             | 4.35  | 5.88   | 1.52  | 3.65  |
| Caroline              | 3.26  | -      | 1.52  | 2.08  |
| Dokeos                | 2.17  | -      | -     | 1.56  |
| LRN                   | 3.26  | 1.52   | -     | 2.08  |
| Atutor                | 3.26  | 1.52   | -     | 2.08  |
| OLAT                  | 2.17  | 11.76  | 3.03  | 4.17  |
| Other sources         | 7.61  | 8.82   | 3.03  | 12.50 |

The differences between the membership of one of the university institutions participating in the research are greatest when using the Moodle system. The value of Pearson Chi-square is $\chi^2 = 86.998; df = 2; p = 0.00 (p <0.05)$, UB’s tend to use the most of the Moodle learning system.

d. How often do you use RED?

The answer to the question of the frequency of OER usage is often, not so often or hardly any. UC/AGH (47.06%), ULBS (33, 70%) and then UB (16.67%) are the most frequent use frequencies. As the frequency of use not so often, the highest percentage is UB (42.42%), followed by UC/AGH (23.53) and ULBS (19.57). Nearly none uses OER according to the answers: ULBS (46.74), UB (46,42) and UC/AGH (23,53), shown in Figure 2.
e. Which types of RED could be used in the future?

In the opinion of the respondents, the types of OER mentioned in the question, also presented in Figure 3, could be used in the future very well/well: open courses (66.67%), open e-books (56.25%), open audio/photo/video (65.63%), open software (58.33%), open community forums (44.27). There are fewer people who believe that these types of OER can not or almost never make good use: open courses (12.50%), open e-books (19.79%), audio/photo materials/open video (0.42%), open software (20.83%), open community forums (23.96%).
CONCLUSIONS

Different educational institutions or those in the economic sphere are trying to find new opportunities in online courses, platforms and portals in the field of courseware. Among the benefits of open educational resources we can highlight: low costs, potential to improve access to different materials, performance through the use of data that can be accessed much easier and much faster, community development by offering a new model of collaboration and cooperation between teachers and between students. Developing open educational resources can fulfill the mission of making learning and knowledge available to everyone.

In the present paper we have attempted to present, according to the proposed objectives, the level of knowledge and use of OER in three Engineering Universities in three countries and the extent of the existence of relations between membership in one of the institutions regarding the knowledge and use of OER. Of the OER-related concepts, each institution is more familiar with the concepts of free license, license terms, and copyright. Less well known is the site www.creativecommons.org. General Search Engines (Google and Bing) are more often used than special OER search engines: Globe, Folksemantic, DiscoverED, Creative Comon, Open Coursware. Of the special OER search engines only Globe is used by each institution. The special OER search mats are mostly used by ULBS (34.78%), followed by UC/AGH (29.41%) and UB (12.12%).

Of the free sources of mentioned software, three are used by the respondents of each institution: Moodle, Bodington and OLAT. Regarding the degree of use of the free source of Moodle software, there are significant differences between institutions, UB tend to make the most of this learning system (84.85%) then UC/AGH (38.24%) and ULBS (10.87%). Among the opinions on OER, we analyzed what types of OER could be used in the future. These could be open courses, open e-books, open audio/photo/video, open software and open community forums. Significant differences between institutions on the use of open social forums do not exist, the respondents of each institution tend to believe that open community forums can contribute to the valorisation of open educational resources.

To conclude, ULBS tends to use the OER search engines to the greatest extent, UB's are those who use significantly the free sources of Moodle software, and those at UC/AGH are those who are most familiar with the OER concept of "free licenses," the frequency of "often" use here is the largest. Also, UC/AGH tends to believe that the open forums might be "very good/good" use in the future, even if everyone believes this and the difference between universities at this point is not significant.

Given the benefits of Open Educational Resources (OERs) both from the point of view of institutions and learners, it would be desirable for these resources to be as widely used both in higher education institutions as in pre-university education.
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