

# Creation of open educational resources during educational practice by means of cloud technologies

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**Abstract.** Practical training is an integral part of the professional training of future teachers. During the practical training, trainees not only implement their own theoretical training in practice, but also increase the level of information competence. The rapid use of e-learning resources for distance learning during epidemiological constraints caused by biological threats poses new challenges to education in the availability of e-learning resources. The development of electronic educational resources is a difficult task, one of the ways to solve it is to involve future teachers in this process during the initial practice. The experiment of creating open educational resources by means of cloud technologies during the training practice showed the probability of solving this problem. Restrictions in direct contact between participants in the experiment, both due to epidemiological restrictions and through practical training in various educational institutions, are solved through the use of cloud technologies. The latter provides an opportunity to easily disseminate developed open educational resources and disseminate best practices in creating educational content.

**Keywords:** educational practice, development of electronic educational resources, open educational resources

## 1. Introduction

Information and communication technologies are a powerful tool for intensifying the educational process and related organizational processes and activities within the framework of education becoming more open. However, informatization and introduction of the latest tools, materials, and tools into the educational process cannot be considered the ultimate goal of open education and e-learning. Modern educational practice needs tools not only for publishing and storing educational resources. It is necessary to have a developed set of tools for teamwork with a variety of materials according to clearly defined criteria within educational systems that can be used both in educational institutions and outside them. In addition to providing free access, it is necessary to provide users with the opportunity to work collectively with materials, modifying them and adapting them to the needs of their own educational activities.

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The initiatives of the University of Tübingen in Germany, the Massachusetts Institute of Technology, and the Hewlett Foundation, launched in the early 2000s, have now evolved into the Open Content Initiative or as Open Educational Resources (OER). We will use a term which, in our opinion, is more successful “Open Educational Resources” or “Open E-Learning Resource”. OERs are resources used to teach educational material, teaching materials, or research resources that are in the public domain or have been released under an intellectual property license that allows their free use or reassignment to others.

## 2. Theoretical foundations of the study

The development of open electronic resources is a complex and multifaceted problem. Specialists of various specialties related to the theory of education, psychology, ergonomics, information and communication technologies, etc. are involved in the creation of electronic educational resources [1–8, 11, 12]. A number of questions were asked about the process of creating and using open educational resources by Wiley et al. [15]:

- Do students assigned to create, revise, or remix artifacts find these assignments more valuable, interesting, motivating, or rewarding than other forms of assessment? Why or why not?
- Do students who make their assignments publicly available demonstrate greater mastery of learning outcomes or show more enthusiasm for their work than students assigned traditional assessments? Why or why not?
- Do students who openly license their work find additional learning benefits? Does openly licensed student work produce additional benefits to the broader community?
- Are there any drawbacks (real or perceived) that are voiced by students or faculty that participate in OER-enabled pedagogy?

Partial answers to these questions can be found in the works of Velychko, Omelchenko and Fedorenko [13], Velychko et al. [14]. In particular, in the work “Open Access to ICT and Electronic Educational Resources as a Guarantee of Sustainable Development of Society” proposed stages of development of open electronic educational resources during the educational activity (see figure 1 at [13]). Continuing the study of this issue, we explored the possibility of creating open educational resources during the initial practice by means of cloud technologies.

Electronic learning resources are the foundation of e-learning, without such resources the educational process cannot be an educational system. The advantages of open education are its specific features, namely:

- information and communication technologies;
- technologies of interaction of participants of educational process;
- specialized teaching aids;
- network structures of organization and management;
- specific presentation of educational information;
- specialized quality control of education.

Thus, open education is fundamentally different from traditional and more in line with the goals, objectives and content of the information society. The main advantages of open education include:

- mass and accessibility (open education has almost limitless possibilities of wide coverage of the population and territories, organization of free access to information and educational resources);
- adaptability and flexibility (the open education system has a wide range of opportunities to adapt to changing environmental conditions, capable of significant transformations of all important elements of the educational process);
- internationality and globalization (free functioning of the system of open education outside state borders);
- planetary openness and availability of information and educational resources;
- modular structure and asynchrony (modular principle of constructing the content and organization of the educational process allows to form individual curricula and programs that best meet the personal needs of students, as well as to spread over time the various elements of the educational process);
- economic efficiency (educational results are achieved with less, compared to traditional education, time, money, etc.).

Open educational resources according to the definition of “The General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO), meeting in Paris from 12 to 27 November 2019, at its 40th session” defines Open Educational Resources (OER) are learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation and redistribution by others [10]. Open License is a standard way of granting and restricting the rights to use, transform, reuse or distribute creative results (sound, text, images, multimedia, etc.). Open licenses are designed to protect copyright in environments where content (especially digital) can be easily copied and made available for public access without the author’s permission. Open licenses are expected to help guarantee permission to copy and share in a structured legal form, an approach that is more flexible than is available today, when all rights are automatically granted. Licenses in each case provide certain rights, exempting from the restrictions of traditional copyright. OER is an integral part of this process. OERs provide greater flexibility in the use, reuse, and adaptation of materials to local contexts and learning environments, and authors receive well-deserved recognition.

Ukraine has a low culture of digital content consumption, as exemplified by the significant percentage of unlicensed software use. According to The Software Alliance, the estimate of unlicensed use of software in Ukraine in 2017 reached 80%, which is equivalent to \$ 108 million, with an average of 57% in Central and Eastern Europe [9]. This culture of digital content consumption also applies to electronic educational resources. Authors often face the question from colleagues – how to protect the developed educational resources from illegal use. Technological tools to limit digital content transactions exist, but they are unable to address this issue at a fundamental level. The introduction of comprehensive digital content licensing,

we believe, will help to address this issue. Compliance with open licenses should help shape the perception of licenses for digital content and the possibility of its use, depending on the license. It is the obligation to license digital content that leads us to legal relations in the field of electronic educational resources and to a civilized process of their creation, distribution and use.

Open educational resources should not only have the appropriate licenses, but also a place where they can be downloaded and downloaded, provide an assessment and describe the experience of use. Like many digital content, open educational resources are stored in appropriate repositories. Examples of open educational resources repositories include Open Discover Space (<https://portal.opendiscovery.space.eu/en>), MERLOT (<https://www.merlot.org/merlot/>) and OER Commons (<https://www.oercommons.org/>). Unfortunately, there are no repositories in this area in Ukraine. Universities, regional institutes of postgraduate pedagogical education, city and regional departments of education create their own repositories. At the same time, repositories take on a local character and do not have wide publicity in the educational environment. Nevertheless, in Ukraine the pedagogical community is uniting and has opportunities to improve and expand their professional competencies on open educational platforms “EdEra”, “Vseosvita”, “Na urok”, “Prometheus” and others.

Skills in working with open educational resources should be acquired while studying in a higher education institution. Future teachers have a special advantage and responsibility.

Practical training of future teachers is one of the important stages of the educational process. On the one hand, during practical training, future teachers are able to implement the acquired theoretical skills, and on the other hand, gain experience in practical work, which affects the integrity of the existing competencies of future teachers. During practical training, especially during the period of sanitary restrictions caused by biological threats, the role of information and communication technologies increases during communication between students, mentors and trainees, between trainees and supervisors, and between trainees to share experiences and materials. The latter provides an opportunity to create tasks for the joint creation of electronic educational resources and their joint use. Such activities are aimed at increasing the level of formation of information, communication, organizational competencies. Tasks for joint creation of electronic educational resources provide an opportunity to get acquainted with the means of sharing digital content, practical use of cloud technologies, critical analysis of the suitability of certain cloud technology services for the development and creation of electronic educational resources.

Cloud technology services have both advantages and disadvantages, we will single out those that are critical to our tasks. The advantages include: no need for powerful computers (relevant for providing educational institutions with modern computer equipment), losing the meaning of using unlicensed software (relevant in the absence of such an item of expenditure), mobility of use (from any suitable network point), the ability to work together on documents. The disadvantages of cloud services in educational activities include: dependence on Internet connection (stability of broadband access is critical for collaboration on documents), not every cloud application provides the ability to save the results in a user-friendly form on the desired media, there is a risk that the cloud service provider will terminate the service. And if you need to take full advantage of cloud services, you need to prepare for the disadvantages of having an alternative Internet connection, using open data formats and saving them, even with another cloud service, creating backups.

The concept and phenomenon of joint activities are actively studied by psychology and pedagogy. When considering the concept of “joint activity”, attention is paid to two aspects: the subject activity and the processes of forming connections between people who participate in activities and communication. The main “unit” of the analysis of joint activities and its collective subject is the interaction of participants in joint activities. At the heart of the dynamic concept of joint activities is a conceptual “triangle”, which combines three areas:

- subject-oriented interaction (interaction aimed at changing the subject of joint activities);
- entity-oriented (interaction aimed at changing the characteristics of the individual subject of joint activities);
- organizational-oriented (interaction, changing ways and style of performing activities).

Considerable attention is paid to the impact of joint activities on intellectual development, the formation of social intelligence and social competence of the subject of education. For all the development of the concept of “joint activities”, the organization of such activities is not considered in terms of developing technical means that specifically support and strengthen the joint nature of activities. In this regard, the concept of “joint network activity” develops the concept of “joint activity”, including special network tools. Joint network activity requires its design based on the following conditions:

- the availability of new pedagogically sound technical means of joint activities on the Internet, which open opportunities for enriching the activities of programs, objects, data and communications;
- the presence of new organizational forms and scenarios of educational network activities, focused on the formation of participants in the joint activities of the social network.

### **3. Research results**

Pedagogical practical training should be considered as a type of practical activity of students aimed at solving various pedagogical problems. The specificity of this activity is that it identifies with the professional activities of teachers. At the same time, pedagogical practical training is a form of professional training in a higher education institution, the purpose of which is:

- to deepen and consolidate the theoretical knowledge that the student received at the university, and learn to apply this knowledge in practice in educational work with students;
- to equip students with the ability to observe and analyze the educational work carried out at school with students;
- to prepare students for lessons with the use of methods that enhance the cognitive activity of students;
- to develop and consolidate in students a love for the teaching profession, to encourage the desire to study advanced pedagogical experience and improve their pedagogical skills.

Various educational institutions and epidemiological restrictions make their adjustments in the process of practical training. It was a good practice from time to time to gather in a higher education institution and discuss problematic issues with classmates and methodologists, share experiences and more. The present requires communication and common tasks at a distance. To solve this problem it is necessary to use information and communication technologies and means of joint activities. Cloud technologies will be useful for the implementation of the set tasks. Using cloud technologies, we are able to establish communication and common places to work in groups.

Tasks offered to students of educational programs 014 Secondary education (Mathematics), (Physics), (Computer science) of the Faculty of Physics and Mathematics of Donbas State Pedagogical University, who underwent training and production practice in general secondary education institutions of Donetsk, Kharkiv, Luhansk and Dnipropetrovsk regions provided for three areas of activity: the creation of joint electronic educational resources, information visualization, organizational online platforms.

The use of presentations, even made in dynamic systems, do not provide an opportunity to involve students in active learning. Quite different opportunities are provided by whiteboards, thanks to which in the online format of learning the participant of the educational process takes part in discussing problems, solving problems, etc. We selected and offered 10 cloud services to create training material for the training session (table 1). Before the classes, the trainees had to get acquainted with the proposed list, explore the functions and capabilities of each of these cloud facilities and create training material for the class. For comparison, the trainees prepared the teaching material in the form of a presentation and demonstrated it to the students, while the students performed the tasks on paper. After the lesson, students were asked which of the suggested options for the lesson they liked the most. The survey of the class showed that 70.0% of the surveyed students out of 374 who took part in the survey preferred the lesson where the “whiteboard” was used.

To visualize the information and create interactive content, the systems presented in table 2 were studied. Visibility is one of the conditions of electronic educational resources. The development and creation, even of static, e-learning resources is one of the tasks of e-learning.

**Table 1**  
Whiteboard cloud services.

Name	Free usage	Localization	Download object	Embedding in systems
<a href="#">Padlet.com</a>	freemium	Yes/Partly	No	Yes
<a href="#">Linoit.com</a>	free	No	No	Yes
<a href="#">Idroo.com</a>	free	No	Yes	Yes
<a href="#">Miro.com</a>	freemium	No	Yes	Yes
<a href="#">Whiteboardfox.com</a>	freemium	No	No	Yes
<a href="#">Jamboard.google.com</a>	free	Yes	Yes	Yes
<a href="#">NoteBookCast.com</a>	free	No	No	Yes
<a href="#">Conceptboard.com</a>	freemium	No	No	Yes
<a href="#">Groupboard.com</a>	freemium	No	No	Yes
<a href="#">Classroomscreen.com</a>	freemium	No	No	Yes

The limited space available for inspection requires the use of presentation technologies in the form of scrolling. Accordingly, the method of their application should change, in contrast to the fact that students see a large paper poster. The constant use of the same patterns, design styles, etc. in educational activities leads to a loss of visual interest in the educational material. The use of various design styles, fonts, icons, etc. increases students' visual activity. Each of the proposed systems has its own unique design style. Even by creating infographics in different systems based on common data, we get fundamentally different digital products.

**Table 2**  
Infographics cloud services.

Name	Free usage	Localization	Download object	Embedding in systems
<a href="#">Easel.ly</a>	Free	No	Yes (wiles)	Yes
<a href="#">Infogram.com</a>	Freemium	No	Yes (wiles)	Yes
<a href="#">Canva.com</a>	Freemium	Yes	Yes	Yes
<a href="#">Crello.com</a>	Free	Yes	Yes	Yes
<a href="#">Genial.ly</a>	Freemium	No	Yes (wiles)	Yes
<a href="#">Chartblocks.com</a>	Free	No	Yes	Yes
<a href="#">Piktochart.com</a>	Freemium	No	Yes (wiles)	Yes
<a href="#">Venngage.com</a>	Freemium	Yes	Yes	Yes
<a href="#">Vizzlo.com</a>	Freemium	No	Yes (wiles)	Yes
<a href="#">Adioma.com</a>	Freemium	No	Yes	Yes

Practitioners faced the problem of downloading created digital objects to their own device. At the same time, their integration into other objects created by cloud technology applications took place without hindrance. The above applications of cloud technologies at the beginning of their founding mostly offered their resources for free, with the growth of their popularity, most of them switched to the financial model “Free – Premium” (Freemium), where some services are provided on a free basis and some on a commercial basis. However, for each of the applications, we were able to obtain a digital object created by us on our own computing device by third-party tricky methods.

The created means of visual presentation of data were used during educational activities. Moreover, students in computer science lessons and outside the classroom were asked to create their own posters, charts, graphs, infographics. The study involved 362 students, of whom 235 students (about 65%) liked to create digital content of this type. The students included the advantages – “beautiful”, “visual”, “useful”. Among the shortcomings were noted – “not clear”, “difficult”, “I have no artistic flair”. Analyzing the answers to the shortcomings, it should be noted that they do not have a meaningful basis, they are answers-justification of their unwillingness to use the proposed applications of cloud services. Regarding the reasons for reluctance, the study was not conducted due to lack of time during the internship.

We also asked the students – “What is the main thing in the application in your opinion?”. The obtained answers are presented in figure 1. Most students (32.6%) were inclined to think about “understandable language” used in the application. Despite the availability of cloud online translation services, the interface in English caused difficulties when using the application. In second place (28.2%) was the ability to work as a mobile application, because today the number



of users through mobile systems exceeded the number of users through a stationary computer system. In third place was the design criterion (23.5%). And although the systems that were proposed were directly related to graphic design, the ergonomics of these systems still need to be improved. In last place was the criterion of “available examples of work” (15.7%). In our understanding, this is the “worst” criterion and it is gratifying that the smallest number of students is ready to do tasks on the model, because the capabilities of the systems are sufficient for creativity and creative presentation of information.



Figure 1: The results of a survey of students on the means of creating infographics.

The task of creating shared electronic resources was to analyze existing cloud applications to create presentations and text documents. To do this, the use of office applications for cloud services was proposed, which is presented in Table 3. In contrast to the previous comparison tables, the advantages and disadvantages collected from the subjective judgments of trainees were considered. It was in these applications that they tried to create electronic educational resources, which were then to become open educational resources. It should be noted that while the interns were already familiar with the Google Docs and Office Online systems, the Zoho Office Suite and ONLYOFFICE turned out to be surprisingly interesting and useful. It was in these office applications that interns tried to create electronic educational resources. Tasks were proposed for groups of three students and the selected topics were similar in content.

After the end of pedagogical practice, a survey of students on the joint creation of open



**Table 3**  
Cloud office applications.

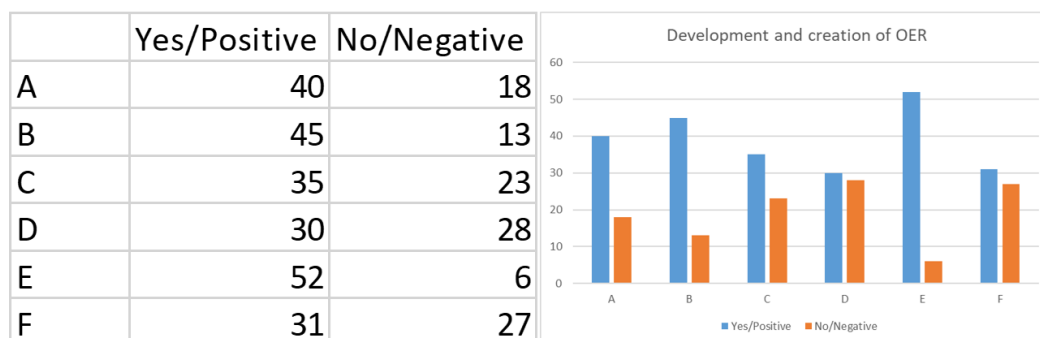
Name	Advantages	Disadvantages
Google Docs (docs.google.com)	Free and no significant restrictions; Convenient, non-distracting design; Well-thought-out collaboration in the cloud; Integration with Google services regular innovations; Templates gallery.	Occasionally there are failures; There is no possibility to personalize the workspace (branding).
Zoho Office Suite (zoho.com)	Extensive list of additional applications; Interesting features in the paid version; Free version available; Convenient work with projects thanks to Workspaces.	Lack of localized documentation and incomplete localization of applications; The mobile version only works in read mode Numerous disadvantages of Zoho Sheet.
Office Online (office.microsoft.com /online/)	Excellent compatibility with MS Office formats; Responsive, stable touch interface and convenient Ribbon tape; Close integration with Office 365 and Microsoft services.	Working with documents needs to be reviewed; A small selection of import and export formats, limited by proprietary licenses; No automatic saving, inconvenient version control; Functional “gaps” in Excel; Fuzzy commenting system.
ONLYOFFICE (onlyoffice.com)	User-friendly interface; Import documents from other services.	No spell check; Quite high rates for individual use of the service; There are no full screen and compact modes; Documentation in English; Weak functionality of Spreadsheet Editor and Presentation Editor.

educational resources was conducted. They were asked the following questions:

- A. How do you feel about open digital content (Positive / Negative)?
- B. Did you have experience of using open educational resources during pedagogical practice (Yes / No)?
- C. Have you used digital resources despite not having this action with a license agreement (Yes / No)?
- D. Are you ready to create open educational resources (Yes / No)?
- E. How do you feel about the joint development of electronic educational resources (Positive / Negative)?
- F. Is it appropriate to use unlicensed software to develop open educational resources (Yes / No)?

58 students of the Faculty of Physics and Mathematics of Donbas State Pedagogical University took part in the survey. The results of the survey are presented in figure 2. Questions A–C were related to the use of open educational resources, and questions D–F were related to their

development. We tried to determine whether students would be willing to use open educational resources to develop them. Using the Mann – Whitney U test, we compared the responses in the two groups (A–C) and (D–F). The results of calculations  $U_{emp} = 18$ ,  $U_{0.1} = 3.0$ ,  $U_{0.05} = 7.0$  indicate the absence of significant differences between groups, and therefore students who are willing to use open educational resources are ready to develop them.



**Figure 2:** The results of the survey of trainees.

The analysis of the answers tells us about one unpleasant point, which is mentioned in questions C and F. Students do not pay much attention to the issue of licensing a digital product, and it does not matter whether it is an electronic educational resource or software. To justify it, it should be noted that similar surveys conducted three years ago about free software spoke of an even worse attitude to the licensing of software.

## 4. Conclusions

Open educational resources are a product of the digital world, which has a huge potential for further achievement of UNESCO’s goals in the field of education. They help countries, institutions and teachers to share quality education and materials free of charge. They challenge teachers to integrate digital technology into their courses and programs, and enable students to access quality content offline. They are also an incentive for teachers, students and institutions to work together to create original material. It is important that governments use OER opportunities for their socio-economic development purposes. UNESCO can assist in this process by issuing Recommendations that will encourage governments to develop strategic policies to engage OER in the core system of their education systems, encouraging institutions to take full advantage of this development to achieve global development goals.

The result of creating open electronic resources in the interaction of future teachers during the internship was not only the availability of educational content, but also increasing the level of professional competencies in ICT, collective interaction, project activities, creative thinking. The results of the surveys indicate the need to continue this practical activity with the study of the criteria for the effectiveness of the use of open electronic resources and their quality.

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