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Exploring the potential of online services in utilizing free software for educational activities

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Abstract. This article delves into the utilization of online services for studying and incorporating free software into educational settings. Free software embodies the principles of freedom and intellectual creativity, yet despite the existence of numerous software products within repositories, their integration into educational activities remains limited. Through questionnaires, analysis of open data, and reviewing existing research on the use of free software, this study identifies factors that facilitate or hinder its adoption in educational contexts. Drawing on the collected data, the article provides insights into the viability of incorporating free software into educational activities and showcases specific examples of its usage. Additionally, the study highlights the value of online resources in familiarizing educators and learners with free software, underscoring the central focus of this investigation. By shedding light on the potential benefits and challenges of leveraging free software in education and emphasizing the role of online services, this article contributes to the discourse surrounding the integration of free software in educational settings.

Keywords: free software, online service, training of Information Technology specialists, online resource

1. Introduction

Modern teaching methods involve the use of information and communication technologies (ICT) in the educational process. The use of ICT has not only changed the methods of traditional learning, redistributed priorities between forms of learning, but new forms of learning have emerged [25]. For any method or form of training that uses high information technology, software is required, without which the technologies lose their meaning. From the interactive whiteboard controller application to multimedia application creation and distribution programs on the World Wide Web.

Free software is a significant feature of the computer industry. Launched as a philosophical concept, free software has not only found its adherents, but also has a large number of software tools used in various directions in its arsenal. The pedagogical universities are use in educational activity: systems for the organization of distance education Moodle, ILIAS, ATutor, Sakai is not an exception [3]; computer mathematics systems Maxima, GNU Octave, GAP, SageMath, Scilab,

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SPP [13, 26]; GIMP, Inkscape graphics packages; Apache OpenOffice, LibreOffice office packages. The question remains about the full and systematic use of free software in the educational activities of professionals [38].

Common problems of free software, legal and philosophical aspects of its existence and use are covered in the works of Raymond [23], Stallman [27], Tanenbaum and Bos [29] and others. In Ukraine the problems of using free software in the education system are highlighted by Fedorenko et al. [2], Habrusiev [5], Horoshko, Kostiuchenko and Shkardybarda [6], Khakhanovskyi and Tonevytskyi [7], Lehka and Shokaliuk [12], Panchenko [21], Semerikov et al. [24], Teplytskyi and Semerikov [31], Velychko, Fedorenko and Kassim [37], Zlobin [39] and others. The current state of the issue of the use of cloud technologies in educational activities was revealed by Glazunova et al. [4], Kiv, Soloviev and Semerikov [8], Kolgatin et al. [9], Korobeinikova et al. [10], Korotun, Vakaliuk and Soloviev [11], Lytvynova [14], Markova et al. [15], Merzlykin, Popel and Shokaliuk [16], Modlo and Semerikov [17], Nechypurenko, Semerikov and Pokhliestova [18], Nosenko, Popel and Shyshkina [19], Oleksiuk and Oleksiuk [20], Popel and Shyshkina [22], Symonenko et al. [28], Tarasenko et al. [30], Vakaliuk et al. [32], Valko, Kushnir and Osadchyi [33], Velychko et al. [35] and others. However, the problem of in-depth exploration of free software capabilities and widespread use in educational activities remains. One possible solution to this problem is to study free software using online services.

2. Research objective and methods

Free software developers have a passive marketing policy regarding the distribution of their product. High-quality and useful free software remains unknown to a wide range of users. The purpose of this article is to explore the factors by which free software is chosen to train pre-service teachers and the factors that do not. Moreover, we present the possibilities of online acquaintance with free software, which can be used by pre-service teachers to include it in their own educational trajectory. This module is offered as a section of the author's course "Application of information and communication technologies in educational institutions" at Donbas State Pedagogical University (https://ddpu.edu.ua/) for educational programs Secondary Education (Mathematics) and Secondary Education (Physics) of the second master's level of education at the Faculty of Physics and Mathematics. The vision of Donbas State Pedagogical University is that the university is "an educational, scientific and cultural leader of Eastern Ukraine, which implements state innovation policy in education in accordance with market demands and trends in the digital society of the XXI century, guided by universal and national values, principles of democracy and European integration, and creates conditions for the formation of highly educated, competitive professionals with an active civil position, patriots of Ukraine!".

Research methods are: analysis of publications on the use of free software in educational activities; analysis of concepts of application of information and communication technologies in education; analysis of free software related to the training of pre-service teachers; systematization and generalization of research information.

3. Results of the study

A characteristic feature of our time is the transition from a traditional to an integrated approach to learning. However, this is not a complete rejection of the acquired pedagogical experience, but only a harmonious combination of approaches, forms and methods of scientific work, research and implementation of sound ideas, methods and techniques of forming a system of higher pedagogical education.

Consider the general directions of use of information and communication technologies, adapting them to the use of free software in the training of pre-service teachers of mathematics, physics and computer science. Such areas include:

- *creation of new pedagogical technologies and teaching aids.* Information and communication technologies based on the use of free software are the technological basis for developing conditions for effective use of ICT in the educational process of pre-service teachers of mathematics, physics and computer science, which will eliminate a number of methodological difficulties at all levels of education and training.
- *increasing the democratization of education.* The process of modern times, covering all aspects of the life of educational institutions. It is based on self-organization, cooperation, openness, diversity and the principle of equal opportunities through the use of free software. This is a long but long-awaited process. The purpose of this process is to normalize relations between society and educational institutions, covering all levels of the internal structure of education and streamlining relations between all parts of the educational process.
- *self-education and lifelong learning.* Information and communication technologies of education, built on free software, are one of the main means of forming the ability to education and self-education in the training of pre-service teachers of mathematics, physics and computer science, especially given the rapid continuous process of informatization of society. The use of ICT – direct feedback, computer visualization of educational information, archival storage of educational and scientific information with the possibility of its transmission and use, automation of computational and information retrieval activities with the possibility of multi-act repetition – creating a prerequisite for intensification of the educational process.
- *individualization of training.* Maximum consideration of individual needs and capabilities of the individual, flexible adjustment to his needs and interests. It is based on the use of specific educational technologies, modern teaching methods, technical means and methods of information transfer, information and communication technologies, electronic educational resources. Individualization of training of pre-service teachers of mathematics, physics and computer science is achieved through such forms of e-learning as distance learning, blended learning, mobile learning, synchronous and asynchronous learning tools, mass open online courses, use of free software and more.
- *increasing the level of electronic educational resources.* Due to the introduction of ICT in the educational process it becomes possible to use educational, scientific, informational, reference materials and tools developed in electronic form using free software, reproduced by electronic teaching aids and necessary for effective organization of the educational

process of pre-service teachers of mathematics, physics and computer science, which contributes to the filling of the educational process with quality teaching materials.

- *the creation of a favorable psychological climate* is achieved by taking into account the psychological and physical capabilities of pre-service teachers of mathematics, physics and computer science, direct communication with teachers, free schedule, self-determination of workload, availability of licensed software. ICT such as chats, mass open online courses, distance learning, blended learning, mobile learning, webinars, web conferencing etc. can be used in this direction.
- *software and didactic support of self-educational activities* is to develop and implement in the educational process of pre-service teachers of mathematics, physics and computer science electronic educational resources, the formation of skills in using ICT in self-educational activities based on free software, planning research, creating motivational basics, use of information and communication technologies for search, processing, storage, transmission and processing of information.
- *development of creative abilities of students.* Knowledge and skills stimulate those who want to learn to search for creative activity. One of the mechanisms to stimulate creative activity and in accordance with the development of creative abilities of pre-service teachers of mathematics, physics and computer science is to provide a new, more convenient and powerful tool in the form of information and communication technologies based on free software. Free software can not only make it much easier to achieve a goal or solve a problem, but also a powerful way to put forward, validate, and refute new creative ideas.
- *community expansion.* Search for the necessary educational information on the resources of the Internet; communication with like-minded people and professionals who study at their own request; participation in communities of free software developers creates the preconditions for expanding the community of like-minded people. The Internet is the most powerful tool for "networking between members of the open electronic community, providing them with virtual cooperation, an environment that provides information resources and services to all users without exception for an unlimited range of applications" [1] and is a powerful practical experience of communication, search , information exchange and application of free software for pre-service teachers of mathematics, physics and computer science.
- *raising the cultural and educational level.* The cultural level of the individual is manifested only in the activity, therefore, to consider information culture as a quality is appropriate from the standpoint of the ability to work with information coming from different sources, has a different meaning and different forms of presentation. Increasing the role of search, transmission, storage and processing of information encourages the formation of information competence in pre-service teachers of mathematics, physics and computer science through the widespread use of free software.
- *continuous professional development.* Thanks to such forms of learning as distance, blended and mobile, mass open online courses, etc., pre-service teachers of mathematics, physics and computer science get the opportunity to continuously improve their skills and level of self-awareness in certain fields. The study of information processing technologies based on the use of free software stimulates both to maintain their own knowledge and

skills in use, and to the development of free software. The basis of such training is to adjust the learning process to the needs and capabilities of those who are taught and who do not have the opportunity to attend classes organized in the traditional form (lectures, seminars, laboratory and practical work, colloquia, etc.), and study at a convenient time, a convenient place, a convenient pace, which provides great advantages also for those wishing to continue their education without separation from production, to study in a certain educational institution, with a certain teacher, etc.

- *exchange of experience and creation of conditions for creative activity.* Virtual educational communities are a common and popular phenomenon today. They are not limited to a single educational institution, but have a wider range of activities, covering different levels, target groups and structures of the educational system. Virtual educational communities are aimed at gaining new knowledge; training and improvement of ICT skills; exchange of experience; discussion of professional activity; joint development and improvement of teaching methods, teaching aids, etc. and will become a powerful practical assistant for pre-service teachers of mathematics, physics and computer science in their professional activities.

It should be noted that the content of virtual space in general, and educational in particular, is changing very rapidly; exchange of creative ideas and their implementation allow not only to widely reveal the didactic potential of ICT in the training of pre-service teachers of mathematics, physics and computer science, but also stimulate creative action. Of particular importance is the use of ICT in the educational process of pre-service teachers of mathematics, physics and computer science takes into account and the development of informal, creative components of thinking: the implementation of problem situations or problem setting; self-determination of criteria for selection of the necessary operations that contribute to the solution of situations or tasks; generation of assumptions and hypotheses in the process of finding the main idea of the solution; material interpretation of a formal solution, etc.

Open Education Ideas provide free access to e-learning resources for everyone to learn. Such access is provided by ICT based on free software.

Our research has allowed us to identify the factors that hinder and facilitate the use of free software. One of the stages of the study was to conduct an anonymous survey of higher education teachers regarding the use of free software in their professional activities. The developed questionnaire as a form was made freely available (https://goo.gl/forms/F0BVkSnvwpHTo6H82) using Google Forms, a link to which was circulated via the "Kryvyi Rih conferences and workshops" (https://groups.google.com/group/cc_seminar) and "Scientific journal Physical and Mathematical education" (https://groups.google.com/group/fmo-journal).

The data collected to date have allowed us to determine the following results. 93% of respondents teach science and mathematics. Young teachers, who already have experience in teaching, predominate by age (figure 1). 92% use free software in their professional activities. 95% recommend free software to their students for extracurricular activities.

Considering the benefits of using free software, the following were highlighted for conducting the questionnaire:

- legal (licensed purity, non-discrimination, etc.);

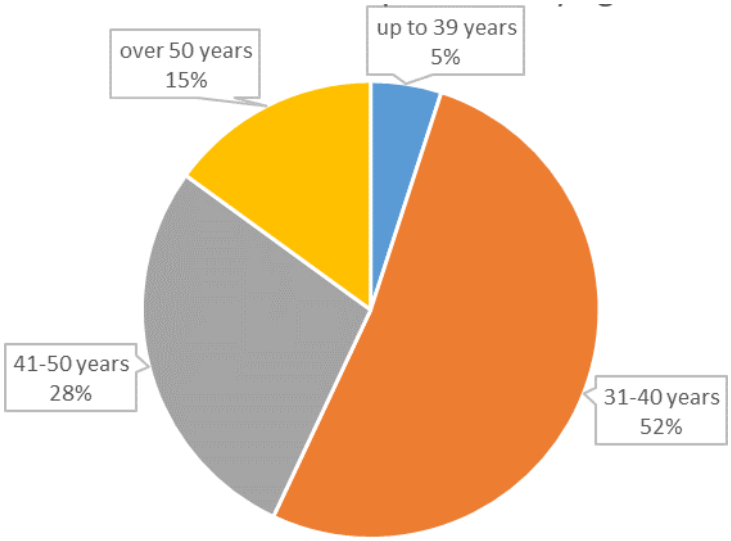

Figure 1: Distribution of respondents by age.

- technical (open standards, increased security, vendor independence);
- training (providing the necessary functionality, open source);
- social (trend, modern gadgets).

Respondents identified the following factors as facilitating the use of free software (figure 2): legal preference was given the highest importance (82,4%). This result is predictable. According to estimates of the Software Alliance (bsa.org, BSA GLOBAL SOFTWARE SURVEY 2018), 80% of the software used in Ukraine is not licensed purity.

78% of the respondents chose among the advantages of free software its educational attractiveness. This result indicates that sufficient free software is available for educational activities.

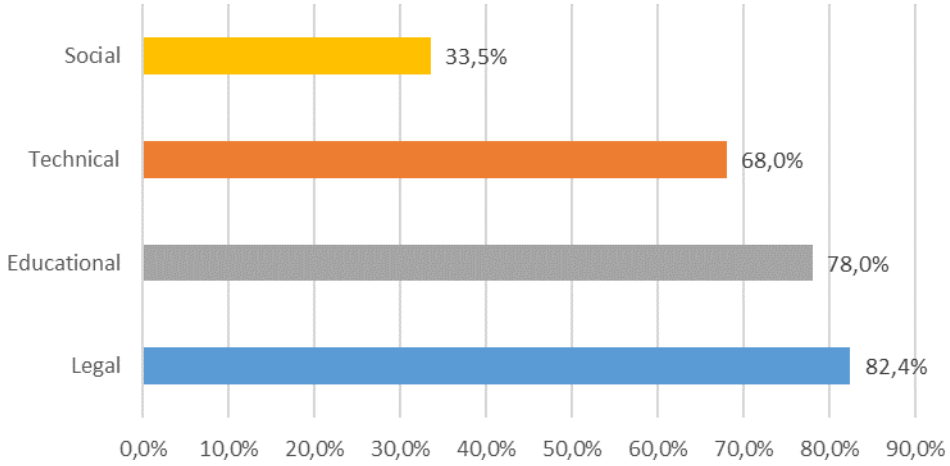

Figure 2: Factors promoting the use of free software.

Also important is the availability and openness of software source code.

The analysis of the survey answers indicates that there are technical advantages of using free software in the process of training future professionals. This is noted by 68% of respondents. Open storage standards are an important factor in the software selection process. This gives you confidence in the continued use of your own work. User gains independence from software developers.

The low percentage (33,5%) belongs to social preferences. The reason is marketing policy. When promoting new high-tech devices, it does not emphasize that their work is based on free software because of its low social popularity.

The survey revealed a number of shortcomings in the use of free software in educational activities (figure 3). We identified the shortcomings in the following groups:

- financial (funds for migration, training, etc.);
- technical (changing the format of existing data, support for peripherals);
- software (lack of specialized software);
- methodical (lack of methodological support for application).

The lowest percentage (21,5%) belongs to financial expenses. This low level of concern about financial issues is due to the lack of responsibility for the use of unlicensed software.

40,6% of respondents are not aware of the existence and localization of specialized free software. At the same time on the resources GitHub.com (more than 100 million projects), SourceForge.net (502,000 projects), openhub.net (498,000 projects), bitbucket.org (170,000 projects), launchpad.net (44,000 projects), Savannah.gnu.org (4,000 projects) posted a large number of software products under free licenses.

The downside of free software is technical issues. These include the transition to new file formats (open file formats) and software for working with peripherals. This concern was expressed by 52,3% of respondents. Open file formats are currently well developed. Proprietary and closed form owners are taking steps to legalize their openness due to the development of

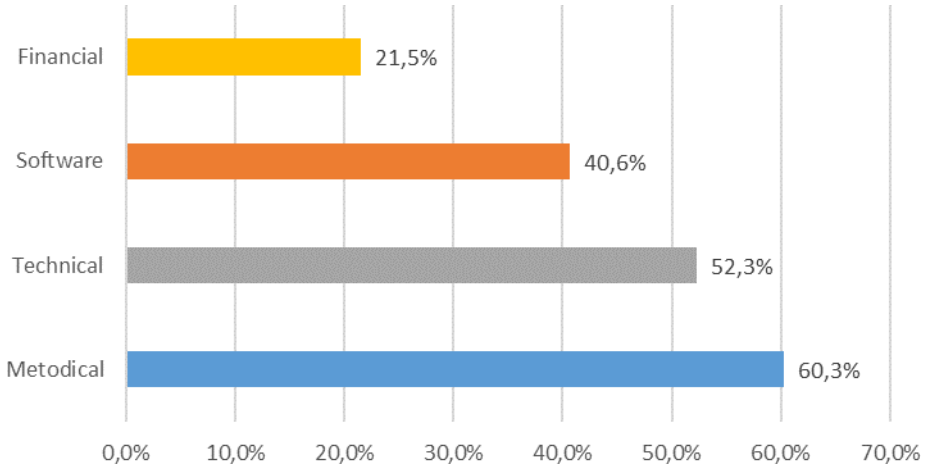

Figure 3: Factors interferenting the use of free software.

open file format standards. User-generated data can be stored and used for a long time. Users need to have confidence that they can be used for a considerable period of time. Own data must be created using open file formats.

Currently, free and open file formats are available in proprietary software as both input and output data streams. Moreover, standards for open file formats are being actively developed by proprietary software owners. This policy allows you to extend the life of your own documents and not be tied to a particular software developer.

A technical problem is the variety of peripherals and the lack of peripheral software. Peripheral developers are trying to keep the technology developed secret. The necessary technical information is not provided for public use. This fact makes it impossible to create free software for peripherals.

The biggest drawback is the lack of methodological support for the use of free software in educational activities. It was identified by 60,3% of respondents. The lack of free software at the beginning of the informatization led to the installation of proprietary system software as the base. Therefore, proprietary application software has also become widespread. Methodological support for the use of software exists in most proprietary software. Today, the situation with the use of free system software has not improved. According to the StatCounter resource (http://gs.statcounter.com), only 1,84% of desktop computers in the world have the Linux operating system installed.

The situation is similar in Ukraine. Only 2,66% of desktop systems are running Linux. However, the situation is beginning to change. The results of scientific and methodological research on the use of free software in education are presented at the annual FOSS Lviv conference (http://conference.linux.lviv.ua/) and more [34, 36]. Thus, at the Luhansk Taras Shevchenko National University, pre-service teachers of Mathematics, Physics and Computer science study the Linux operating system, the Maxima computer mathematics system and the Lazarus, Geany programming environment. At Pavlo Tychyna Uman State Pedagogical University, the course "Computer Network Administration" is taught on the Linux operating system. Nizhyn Mykola Gogol State University uses the OpenOffice.org software, Hot Potatoes, to study the subject of Electronic Information Processing. The basic discipline of "PC operating systems" is taught using the Linux operating system as a complete alternative to the proprietary Windows system. The courses "Using Information Technology in Education and Science", "School Computer Science and Teaching Methods" demonstrate the possibilities of using OpenOffice.org and Scribus as an alternative to Microsoft Office, GIMP as an alternative to Adobe Photoshop, Inkscape as an alternative to CorelDraw and more.

GeoGebra Institute operates at the Department of Informatics at H. S. Skovoroda Kharkiv National Pedagogical University. The National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic University" operates the "Linux Professional Institute" (LPI). At the Bogdan Khmelnytsky Melitopol State Pedagogical University, there are such disciplines as "UNIX-like operating systems" and "Programming for open systems" in the bachelor's curriculum.

At the Poltava V. G. Korolenko National Pedagogical University is widely used by GIMP when teaching Computer Graphics and Design, and geometry is supported by Maxima Computer Mathematics. The Maxima computer mathematics system is also widely used in the teaching of students of Physics and Mathematics at Ivan Franko Drohobych Ivan Franko State Pedagogical University.

At Sumy State Pedagogical University named after A. S. Makarenko uses software products such as GeoGebra, Dr Geo, C.A.R., Kig and KSEG to train future math, physics and computer science teachers. At the National Pedagogical Dragomanov University systems of computer mathematics Maxima, Sage, Scilab, Scidavis and many others are used in the study of the disciplines of mathematical and informative cycles. Teachers of Kryvyi Rih State Pedagogical University base their teaching on the Maxima computer mathematics system for basic mathematical training of pre-service teachers of mathematics, physics and computer science. All of the above software products are free software products.

The expediency of using free software in the educational process of future professionals is quite high. Free software gives freedom to its users to choose to use and study both the free software products themselves and their applications. It is a direct factor in stimulating the desire for learning and self-education. The use of free software in the training of future professionals will increase the level of information culture, will teach themselves to choose forms and methods of education, will form skills for the use of free software in further professional activity, will be able to be competitive in the labor market and meet the requirements of social ordering information society in the modern specialist.

To get acquainted with the free software, it is not necessary to download it to your own personal device. You do not have to visit the computer systems labs where the appropriate software is installed. Cloud technologies make it possible to use the software as a network service. OffiDocs Cloud (https://www.offidocs.com/) is a flexible and powerful platform. It allows you to browse the web with applications using only a web browser. OffiDocs provides users with Internet applications for any device (desktop, tablet, mobile, etc.) such as LibreOffice, GIMP, Dia, AudaCity, OpenShot and many more through a web browser.

A prerequisite for using a cloud service is logging in with an ID. It is available from any cloud application. Cloud applications are categorized as productivity, images & graphics, video & audio, messaging, education, games, utilities, programming.

Each of these sections of the cloud application is noteworthy. Just as interesting are mobile apps, extensions, resources and templates. Let's take a closer look at the cloud-based LibreOffice suite of services included with the file manager. It is worth noting that there are two options – the first (figure 4) is adapted for use in browsers, and the second, launching applications with Gnome interface with image translation in the frame of a hypertext document. Cloud service integration includes integration with Google Drive and Dropbox cloud file repositories.

With the ability of a cloud-based environment to study free software, it becomes available to perform standard operations to create electronic educational resources. There is a possibility to use various ways of registration of the textual information (styles, fonts, font sizes, etc.). Text documents and presentations can be supplemented with illustrations (you can use the resource http://editor.pho.to/en/edit/ to process the illustrations). Once created, documents can be downloaded to your own device in ODT, PDF, and more. With http://odfviewer.nsspot.net/ you can view downloaded documents in ODT format. Use the https://smallpdf.com/edit-pdf service to view and compare PDFs visually.

Image creation, video editing and audio editing programs are just as functional. The typical task of using this cloud application is to create an online educational resource for one of the training topics using the learned applications.

Another cloud service that allows you to get acquainted with free software is the service

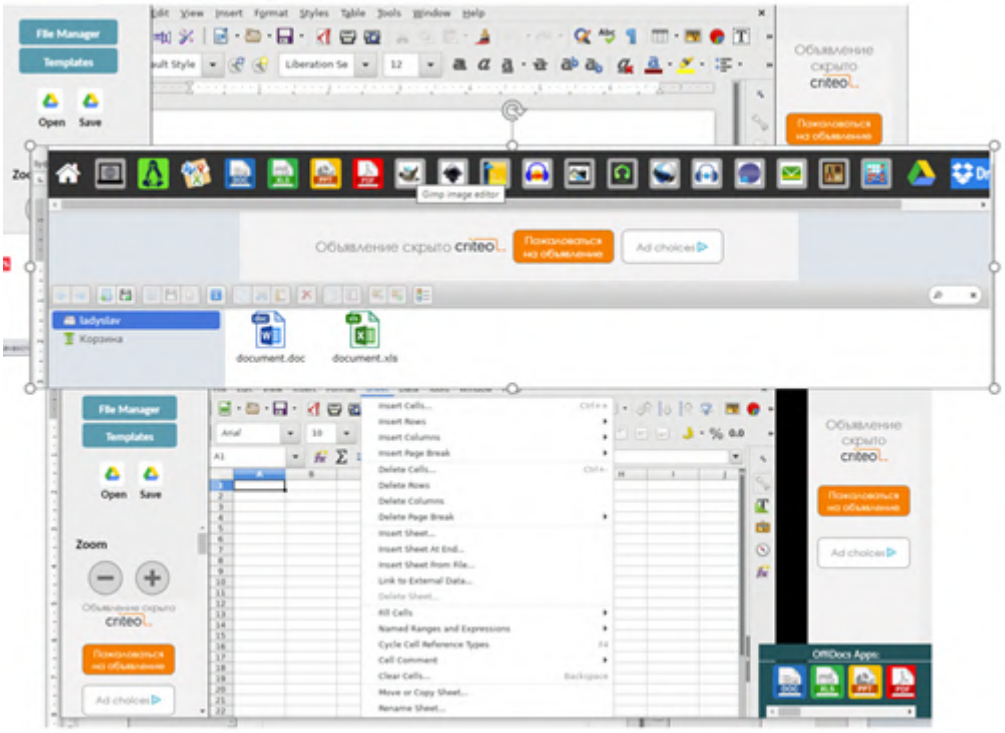

Figure 4: An example of how a file manager works in LibreOffice.

https://www.rollapp.com/ (figure 5). In this dream, educational applications, utilities, office applications, games, graphics applications, development programs are available to users. Free software is available for use in this cloud after user registration. In addition, there is a rating system for evaluating the available software by users.

There are a sufficient number of distance learning support systems Moodle, ILIAS, aTutor, Claroline, Dokeos, Fedena, Sakai and many others. Moodle is created as a platform for technical support of distance learning, respectively, it provides mechanisms to address issues that traditionally arise before teachers and students in a distance learning situation: communication between teacher and students, communication between students, access to teaching materials, implementation tests, planning and organization of the teacher and students.

Within the system, all learning materials and user activities are grouped into so-called "courses" – basic units that may or may not correspond to the concept of "course" or "discipline" within the traditional learning process (for example, to teach students of different specialties and the same discipline will most likely need to create several courses). The course has the following properties:

- information content, broken down by topic or week,
- a set of participants, among whom one or more are usually endowed with additional rights (teachers),
- statement of the results of control measures,

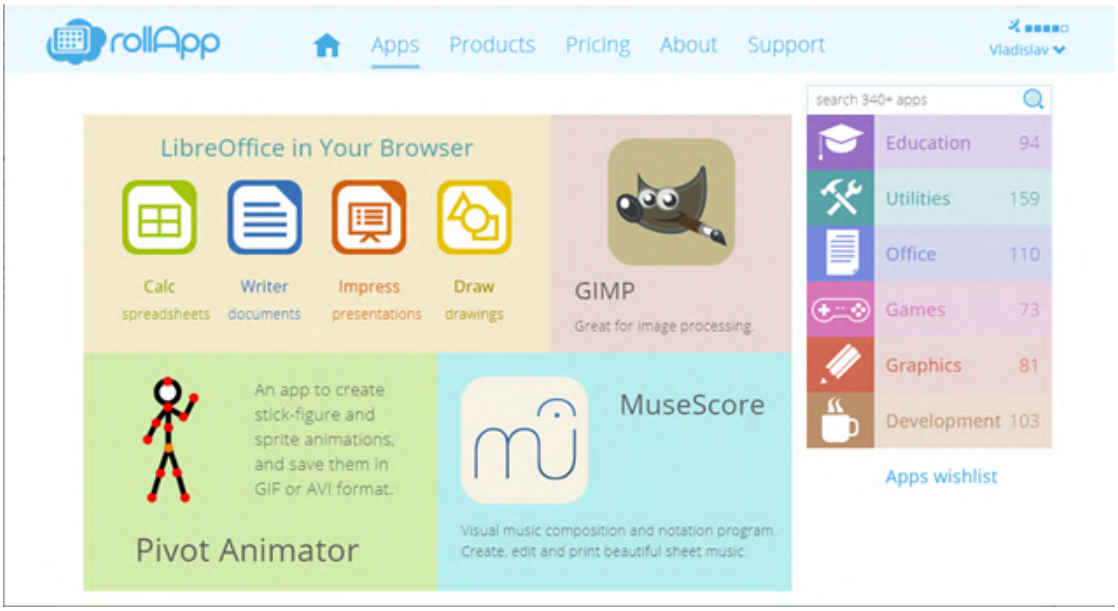

Figure 5: RollApp cloud service.

- calendar of events.

From a visual point of view, the course can have its own style of page design (theme) and its own interface language (among those languages installed on the server).

The basic types of materials and activities that may consist of the course include the following:

- static materials (text and web pages, documents of various formats, audio and video materials, other files);
- interactive elements (forums, chats, tests, tasks, lectures, wiki, blogs, databases, polls, other components).

The capabilities of the system can be expanded and supplemented by installing additional modules.

Get acquainted with the capabilities of the Moodle system using the test system http://qa.moodle.net as a teacher. To do this, use the “teacher” login and “test” password. In the Activity examples section, add a new topic to the forum. See examples of objects such as lessons, tests, tasks, and resources. Keep in mind that your presence on the site is limited (figure 6).

ILIAS (short for Integriertes Lern-, Informations- und Arbeitskooperations-System, www.ilias.de) is an open source distance learning system distributed under the GNU GPL license. The system appeared in 1998 and has been developing quite actively since then.

ILIAS has a very wide range of functionality, has a large number of tools for communication: forums, chats, blogs, podcasts, as well as an internal messaging system. In addition, ILIAS can be very successful in collaborating with features such as grouping users, sharing files, including sharing any files, and wiki tools.

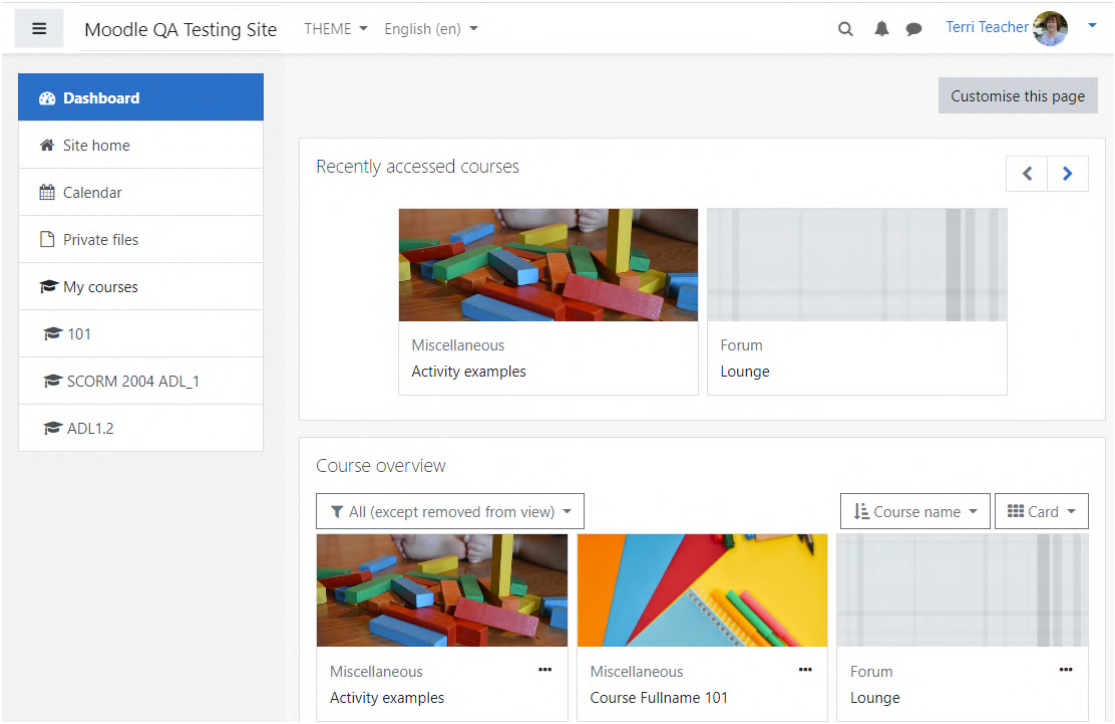

Figure 6: Moodle QA Testing Site.

Of course, at a high level and the capabilities of the system in terms of e-courses and tests. Courses can be formed in the simplest form in html format or taught in the form of specific files. But in addition, basic international standards such as SCORM 1.2, SCORM 2004, AICC are supported. The system has a test designer that supports different types of questions. It is also possible to import into the system of external tests or export them in IMS QTI format. Course and test management capabilities, including course review and reports, are also quite extensive.

In addition, the system can use tools such as: Personal workspace, News, E-portfolio, Calendar, Personal notebook and more. To install ILIAS, you need an Apache server with PHP support and a MySQL database. ILIAS has been translated into many languages, including Ukrainian. Get acquainted with the capabilities of the ILIAS system using the test system http://demo.ilias.de using “gwyneth” login and “iliasdemo” password (figure 7).

ATutor is a Web-based Learning Content Management System (LCMS). Its use allows teachers to easily organize various training courses. Students receive an adaptive and simple learning environment. The new system will not give the administrator any special worries either. Appearance can be changed in just a couple of mouse clicks, the availability of source code and open tools used to build a course server, allow you to make more serious changes in case of emergency. For everything you need to create and manage courses and the learning process, it includes messaging tools. Particular attention is paid to security. With the help of additional modules you can increase the functionality. The choice of the latter is wide, from payment, to work with photos, exchange of information with other educational systems, conferences and

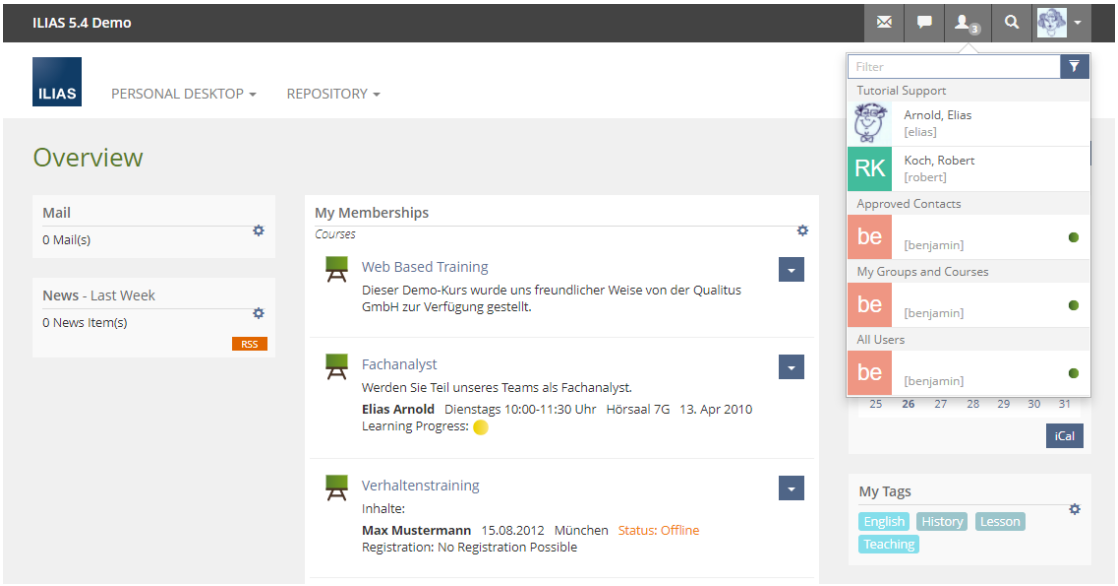

Figure 7: ILIAS Testing Site.

others.

In addition, from the very beginning, the developers have taken a course to support the product of various standards, which would allow in the future to easily integrate third-party developments. So ATutor's first LCMS is fully compliant with the W3CWCAG accessibility specification (Web Content Accessibility Guidelines, http://www.w3.org/WAI/WCAG1AA-Conformance) in accordance with these recommendations, the resource should be available, including for users with various disabilities health. Also, compliance with W3C XHTML 1.0 specifications ensures that ATutor will work or integrate with any other applications that support the standards as needed. Some such applications are available on the project website and about them below. To be able to use courses written for other e-learning learning systems, the system supports the IMS (InstructionalManagement Standards, www.imsproject.org) and SCORM (SharableContentObject ReferenceModel, www.adlnet.org) specifications.

Learn about the capabilities of the ATutor system using the test system. In the ATutor Demo Course. Use this course to review available materials, edit existing text files, and post on the forum. There is a public demo installation of ATutor which is shared with others and resets itself hourly. You can access it by visiting the following link https://s1.demo.opensourcecms.com/s/95 login "opensourcecms" and password "opensourcecms" (figure 8).

Global biological threats pose to pre-service teachers not only the need to have distance learning systems but also the means to create e-learning resources. Among the free software, there are various tools for creating electronic educational resources from programming languages to specialized software for this activity. Such systems include Xerte Online Toolkits and eLearning XHTML editor.

Xerte Online Toolkits or XOT (https://www.xerte.org.uk/index.php/en/) is software developed in the academic environment of the University of Nottingham and distributed under the Apache

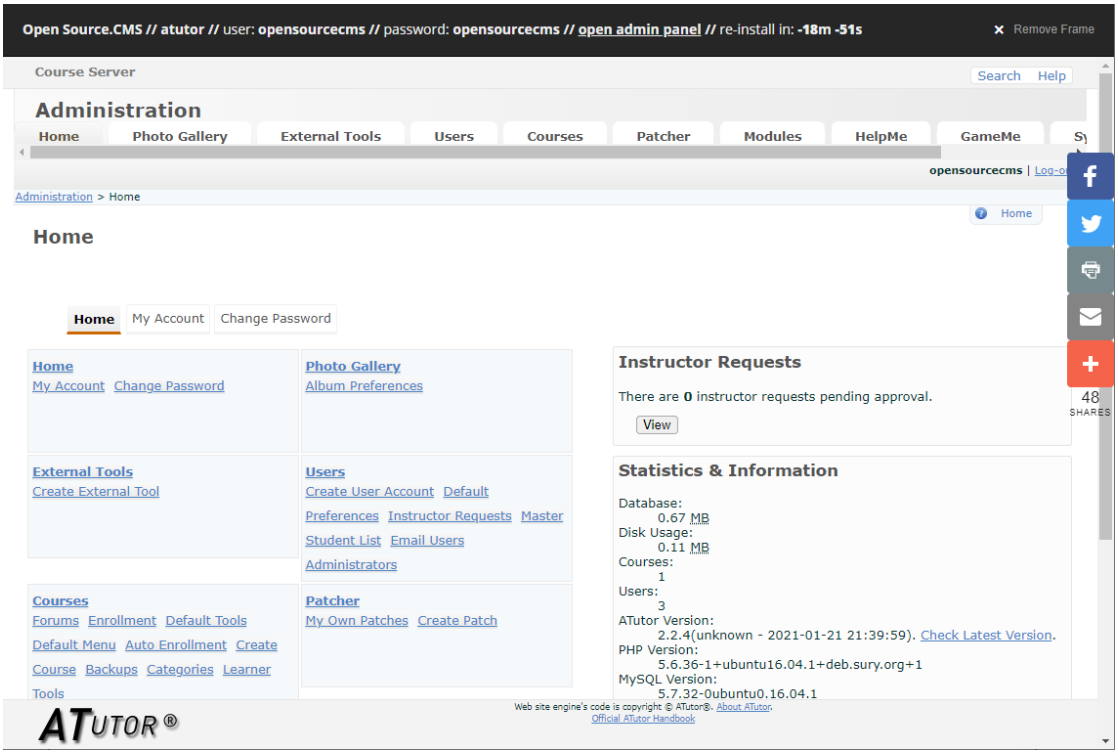

Figure 8: ATutor Testing Site.

License. The main purpose of a full-featured XOT development environment is to create interactive learning objects. The current version of XOT 3.9 provides the opportunity to create modern training courses with a rather complex structure and a variety of, including interactive, learning objects, the development of which does not require in-depth knowledge in the field of programming. To develop such a course, the author only needs to use a browser, and all operations to create training courses are performed using intuitive actions. In addition, demonstration examples are offered to get acquainted with the capabilities of the system and its testing.

eLearning XHTML editor or eXe (https://exelearning.net/en/) is a web-tool for designing, developing and publishing web-oriented teaching materials. The eXe system was developed in the academic environment of the University of Auckland and the Auckland University of Technology. Development is now supported by government agencies and companies in Spain and other countries. It can generate interactive learning material in XHTML or HTML5 format and provides the ability to create learning resources that contain text, images, interactive components, image galleries, or multimedia clips. Such files can be exported to various digital formats to be used independently on the instructor's website. They can also be integrated into a learning management system (LMS). The current version of eXe 2.5.1 supports such formats as IMS Content Package, SCORM 1.2, SCORM 2004, IMS Common Cartridge formats, ePub3 or web-resource in HTML5 format.

Since the purpose of our study was to get acquainted with free software, we provide at the end of the resource, which contains links to available free resources and free programs in the section "Best Free Online Applications" – https://www.techsupportalert.com/.

4. Conclusions and prospects of future research

Research on the application of information and communication technologies is always modern and multifaceted. Software developers create and upgrade existing computer programs on a daily basis. Forms and methods of application of information and communication technologies in educational activity change. The given directions of application of the free software in educational activity and the carried-out researches outline the directions of the further researches on this question.

The results of many years of use of the OffiDocs cloud service at the Faculty of Physics and Mathematics of Donbas State Pedagogical University testify to its wide opportunities to get acquainted with free software and its application in the educational activities of pre-service teachers of mathematics, physics and computer science. Having an alternative to cloud applications from Google and Microsoft allows you to study information processing technologies, rather than certain software. You do not need to study the software interfaces, because they are intuitive. The latter provides an opportunity to fundamentalize training in information and communication technologies and prepare future professionals for further professional activity.

The opportunity to get acquainted with free software with the help of online services not only expands our understanding of existing applications, but also provides an opportunity to initially evaluate its functionality.

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