# **Practical Aspects of Cloud Technologies Applicable to The Students' Independent Work Organization**

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#### Abstract

E-learning is not a new, but a widespread concept as it occupies the most relevant niche among the teaching staff members. Educational institutions may rest assured as to the software and hardware for the teaching and learning activities and the way of their organization and renovation. This article focuses on the students' independent work organized under the effect of cloud services and on an overview of the state of the students' insight into the cloud technologies, being used in the educational process. The present study has involved 62 students from different courses. The Questionnaire titled "Cloud Technologies Through the Student's Eyes" has become the important tool in the present experiment, where the student's independent work has been organized thanks to cloud technologies and consisted of several stages, created by teachers. Students have performed a number of tasks based on cloud services at the initial stage. The next stage has involved the students' survey relative to the cloud technologies using in the educational process. Finally, it has been turned out how students are familiar with cloud technologies and how they see their place in the educational process. There has been determined the degree of students' knowledge of cloud services, their applicability and options. Cloud environments most popular among students have been found by the survey. Students also have identified cloud services as the most wanted in the classroom, and requiring teachers' attention.

#### **Keywords**

students' independent work, cloud technologies, web services, service models, e-learning

## 1. Introduction

In times of the rapid introduction of information technologies in various spheres of life, a special attention is paid to the problem of the students' independent work (SIW), being organized in higher educational institutions (universities). The educational system modernization forces scientists to look for ways to solve a pressing issue. Today, one of the most important tools for

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solving this issue can be the use of cloud technologies. They are more and more popular among teachers due to their dynamism and multifunctionality as they are based on a service-oriented architectural model, the so-called SOA, which provides a much lower cost of software (SW), and hardware; organizes information security (questionable service); and offers a variety of education services. The report "E-learning Market - Global Outlook and Forecast 2021-2026" proves that, the global e-learning market will grow at an average annual rate of more than 13 percent during 2020-2026. The main suppliers will be the Apollo Education Group, British Council, Oracle, Pearson, Aptara, Adobe Systems, Blackboard, Skillsoft and NIIT. "The attention has been fixed on cost-effective and efficient cloud solutions that save time to get out the greatest part from learning segments" [1]. Thus, there will be even greater reinforcement for e-learning.

There are many definitions of cloud computing today. For example, it is determined as a form of computing in which users' needs can be met by organizations, providing cloud services. The user can freely purchase or expand their capabilities by using any services given by the provider [2]. The current idea of services is different. Now, we are moving from an object to a service, which is provided remotely thanks to the Internet networks. Moreover, there is a rapid growth in their use in the educational process at its structuring. Thanks to these technologies, education becomes closer to the student, because of learning, which is more accessible and interesting. In connection with global trends and modern challenges, educational institutions must prepare a "future specialist", by using the existing tools, implementing modern technologies, organizing educational activities, using the developed services, and structuring their information and communication competencies. These technologies have recently entered the field of education, so the relevance of the topic is beyond doubt.

Now, the issue of the student's independent work effectively organized in universities is relevant, as for several years running, there have been intentions to increase it due to various reasons: the general education, critical situations (COVID-19, war in Ukraine), etc.

#### 2. Analysis of Recent Researches and Publications

The Amazon developments, which protested the computing cloud for the first time, have become the beginning of the spread of cloud technologies [3]. Now, cloud technologies provide free services important for universities, making it possible to solve a number of problematic issues with hardware and software. This is particularly true for educational institutions that cannot constantly update and maintain software and hardware at the proper level. Therefore, many scientists are interested in the study of modern technologies that penetrate into the teacher's and student's daily routine [4, 5, 6, 7]. Research findings [8, 9] are devoted to the use of "clouds" in universities, namely, their positive impact on students and the quality of education. Simultaneously, many scientists are concerned about the security issue in the system of cloud environments, we mean countermeasures [10].

Both Singla C. and Kaushal S. [11] have focused their attention on educational technologies, represented by different models for a mobile learning. But they have come to the conclusion that it is possible to improve the education quality with the help of mobile cloud technologies (MCC). Additionally, Murah M. has described the positive experience of using cloud computing in teaching advanced training courses [12].

One of the most important educational process components is the students' independent work, which is built on the use of all the educational institution resources despite of the fact that there is a shortage in computing laboratories, software and hardware tools. Both Encalada, W. and Sequera, J. [13] have presented a model that uses the so-called "social cloud", which focuses on the software services, the platform and infrastructure as services. Considering the results obtained, the students have approved the present innovations. The use of cloud computing services will better the implementation of network activities to allow the collaboration with various resources in the public domain [14]. Cloud computing are studied many-sided, offering useful opportunities for the qualitative educational process [15]. Cloud technologies with enormous advantages for students, work without being tied to one workplace and make possible of e-learning. Students can use various web services in their work, such as GoogleDocs, Office 365, and they are free. Researchers note that the use of cloud technologies is an effective way to meet the urgent needs of educational institutions [16]. Cloud technologies provide a balance in the educational process, particularly, in e-learning. Additionally, the researchers specify that the learning environment, organized with the help of cloud services, motivates all the participants to be creative. Agah Tuğrul Korucu [17] has described the perception and factors influencing on cloud services, used by the information technology (IT) educators as the first spreaders of these technologies and their benefits.

The findings of the research cited in the [18, 19] include a consistent taxonomy and overview of the main characteristics of cloud technologies in terms of motivation and barriers to their implementation in higher education institutions. Furthermore, many factors have been identified that influence the implementation of cloud computing technology in the education sector.

The document [20] includes the authors' justification for the use of cloud computing platforms as a solution for educational institutions, which can have a significant impact on the teaching and learning environment. Alam Ashraf [21] examined several contemporary technologies and weighed their benefits and drawbacks in this article, concluding that some platforms are here to stay, while others may perish due to operational issues." "The example of my own experience, "cite:el2018using," demonstrates the analysis of the teacher's problems encountered when deploying e-learning systems. All of these are review articles that demonstrate the theoretical nature of cloud computing. However, our task is to put in place modern cloud services to help students organise their independent work, because this type of educational work is in disarray. The increase in motivation to perform independent work influences the success of the educational outcome.

The researchers [22] used content analysis to review literature in peer-reviewed journals and interviews with faculty members who use online resources to support pervasive knowledge dissemination. Also, students have the opportunity to participate in learning processes that play an active role in creating and improving the collaborative learning platform, as well as in sharing and disseminating knowledge." This is quite an experience for students.

Over the past ten years, the trend of researching cloud technologies has only increased. The number of publications in digital libraries is growing every year.

As the issue of students' independent work organized thanks to the cloud technologies remains unexplored, it needs theoretical and practical justifications.

The article purpose is to study the state of cloud technologies applicable to the educational process, on the example of the students' independent work being organized in a higher educational

Table 1Participants' Demographic Data.

	Count	Percent
Gender		
Male	21	33.9
Female	41	66.1
Total	62	100
Course of Study		
The first course	9	14.5
The second course	9	14.5
The fourth course	9	14.5
The first year of Master's degree	30	48.4
The second year of Master's degree	5	8.1
Total	62	100

institution. The study tasks are to organize the learning environment through cloud services; to find out the students' vision of cloud technologies being used in the educational process; experimentally check the students' independent work organization and its effectiveness.

#### 3. Research Methods

Both the survey and observation have become the leading empirical research methods. A learning environment has been organized for students to work independently by selecting cloud services. A significant advantage of the study is to conduct a depth of description with respect to several features that allow you to study events that are not controlled by the researcher (independent performance of tasks, execution time, etc.). The experiment has involved respondents of different courses and areas of study: secondary education (Computer Skills), Computer Sciences and Information Technologies, secondary education (Mathematics), Ecology, Chemistry, Biology from T.H. Shevchenko National University "Chernihiv Collegium" and Rivne State Humanitarian University. The target audience has been presented by 62 students. The control group (CG) has included 35 students with Master's degree, experimental group (EG) – 27 students of other courses.

The basic tool for obtaining results is a Questionnaire based on 18 questions. It is for determining the students' impressions. The present Questionnaire has involved opened and closed questions and questions with scales (5 - very useful, 4 - useful, 3 - not very useful, 2 - non-useful, 1 - unfamiliar with services). Table 1 presents the demographic data of the participants in the group under the study.

Processing of the results has been carried out according to the following scheme: processing of questionnaire responses (sorting out defective questionnaires); entering data into a special form for a computer verification; calculating of average values with the analysis of results. The SPSS software has been used to analyze the obtained statistical data.

### 4. Research Findings

A "cloud" is usually called a place allotted somewhere on the Internet with a list of free or paid services. Cloud technologies give users the ability to store and access information, software via the Internet and many other services [23, 24]. At the same time, the user saves space on his/ her computer and money and can access it from any PC at any time [25]. Thanks to cloud technologies [26, 27], teachers and students easily interact, feedback is better established, which is important for learning. For educational purposes, "Software as a Service" is actively used - the software as a service and "Infrastructure-as-a-Service" - the infrastructure as a service [28, 29]. Popular cloud services from Google and Microsoft are services like Google Apps and Microsoft Live@edu. Their use solves the issue of pirated programs in educational institutions, freeing them from the equipment (updates, support) and security. Now, students cannot be limited only by traditional educational means, the system requires new educational technologies, methods and forms. Any activity, including SIW, can be arranged with the support of cloud technologies, you just need to have the appropriate competencies, desires and time. Cloud technologies make possible to penetrate the student's mind to a greater extent with their interactivity, multimedia, virtuality, etc. The SIW effectiveness can be achieved only when there is a student's motivation. To reach it, the teacher must think carefully about the process organizing students' independence. It should not be forgotten that students need to be independent (self-developed, self-improved, self-educated), to work on improving their personality and on their professional growth. To do this, the teacher must select a toolkit in the organizational process that encourages the self-development implementation, the timely completion of assigned tasks, the use of creativity to achieve the goal.

During the study, performed within the framework of T.H. Shevchenko National University "Chernihiv Collegium" and Rivne State Humanitarian University the students' independent work has been organized for the EG students by means of the Google Apps for Education cloud technologies and web services in the following order: 1) A learning environment (website), which contains important educational material and the base software necessary for performing independent tasks, has been created; 2) Students have been combined into groups (2-3 people) to solve the tasks; 3) A common journal table (Google Sheets) has been created for students to fill in data on assignments; 4) A personal folder has been created for each student to store the SIW results with the provision of editing access rights (to the student and the teacher-curator-tutor); 5) A protection of tasks has been organized by students in the university auditorium. The independent work organized in the CG has taken place according to the traditional methods.

The EG students have freely used all the proposed materials. During the allotted time, students have completed tasks, the results of which have been stored in a folder and filled in a common grade record book. The instructor-supervisor had an access to each student's folder and checked the results every day by posting grades in the e-grade record book of academic groups being placed on the site. Thanks to the cloud services, students have had the opportunity to consult more with the teacher; "not to be attached" to the place; to have some interactivity, high-quality software, and the teacher easily assessed the results of the tasks performed. Upon the training completion, a survey of all the respondents was conducted. It has established how students are familiar with services.

After analyzing the data, we can say that the use of cloud technologies is at a low level. Only

60 percent of students know or have got to know about cloud technologies before. These are students of senior courses, where some of them got acquainted with them only during the SIW organization. The notion "cloud technologies" [30] is understand by students as a technology that stores data remotely. Unfortunately, students do not know about the colossal possibilities of cloud technologies (web services). The survey results are shown in (figure 1).

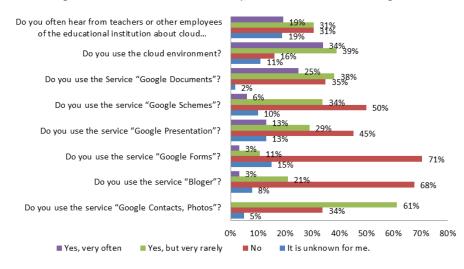


Figure 1: EG Students' Survey Results.

To begin with, it has been established whether the respondents are familiar with such a notion as "cloud technologies". As a result of the survey, 16 percent of respondents do not know this notion. Respondents mostly believe that these are technologies that help to store data remotely. This suggests that more than half have known or heard from others about these technologies. After analyzing the results, it should be noted that not all the students have information about the capabilities of the Google Docs service, and this is 30 percent. It has been found that on an average 13 percent of respondents are unaware of Google Sheets, Presentations, Forms and their capabilities. To find out how students see the usefulness of cloud services for educational purposes and whether they want to know about their capabilities in the future, following questions have been prepared: "Would you like to learn more about the practical value of using services: Google Docs, Presentations, Forms, Spreadsheets, Calendars, Photos, Cards?" to which the students answered: "yes" - 85 percent, and 15 percent of the suspected. Moreover, some students prefer to get more familiar with the work of individual services, such as: Word Learner, OneDrive cloud storage, Google Drive, Google Sheets, Google Contacts, Google Docs, Bloger, Google Photos, Demo Animate, Wikimapia, Glogster, Eliademy, Educaplay.

To complete the experiment, students have been asked to carry out tasks, prepared through the web services (Learning Apps, Master Test, WordArt (Tagul), OnlineTestPad, Glogster, etc.) every other day. After the experiment, the students answered the question: "Did you like doing tasks thanks to web services?" 95 percent of students responded "yes". The survey has revealed cloud environments, which are known to students. Respondents have had the option to choose multiple cloud environments. The results are presented in (figure 2).

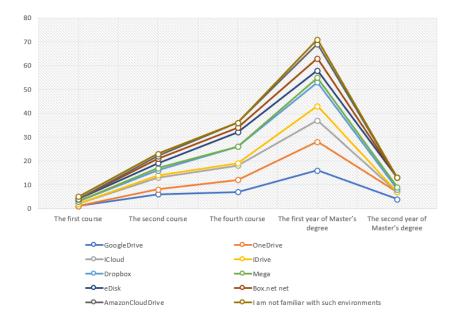


Figure 2: Cloud Environments Known to EG students.

After reviewing the data, we can conclude that the most famous cloud technologies among students are: Google Drive, OneDrive, iCloud, Dropox. No wonder, as they are the market leaders and are very popular among users around the world. As for the effect of using cloud environments by students, unfortunately, the situation is different, this phenomenon is not common among students. According to the survey, students mainly use cloud environments like Google Drive – 69.4 percent; OneDrive – 22.6 percent; iCloud – 19.4 percent; do not use any – 24.2 percent; single use: e-Disk – 12.9 percent; Dropbox – 9.7 percent. Important for the study is the assessment proposed for students, namely: to evaluate the services. The results are presented graphically (figure 3).

Having considered the data obtained, we can say that unfortunately, cloud services are unfamiliar for 35 percent of students. Such services are new for them, but have long been used in the educational process in other countries. Students consider services herein below to be very useful among other cloud services: Google Drive – 73 percent; Google Docs – 63 percent; Google Sheets – 32percent. It is worth noting that on average 6percent of students consider cloud technologies useless for educational purposes, namely: Caurserra.org, Mindomo, Bloger. It can be explained by the fact that these services are less known to students than others as their capabilities are unknown for them. It is appropriate that services, mentioned herein, have more practical use among teachers to familiarize students with benefits of each service.

Thus, with the help of cloud technologies, students have become united. They have learned how to work within a team and it is a significant professional quality. Moreover, they have gained some experience in working with web services, and have increased the motivation for learning. 76 percent of students have coped with the tasks perfectly well, as a result, the final score has increased. According to students, it is more interesting to complete tasks (87 percent),

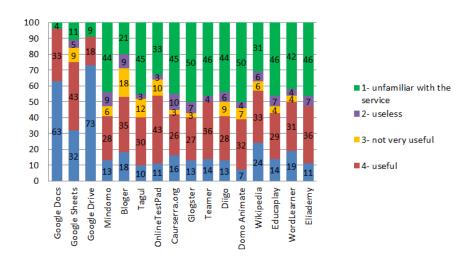


Figure 3: Cloud Services Evaluated by EG students in percent.

the ability to use materials anywhere, and anytime (100 percent), the assessment transparency (90 percent), the teacher's consultations, better established (95 percent). Summing up the survey results, one may state that the senior students' majority knows about cloud technologies, but does not know how to use them correctly on an individual basis. In general, the study points to enormous possibilities of cloud technologies in the SIW organization, providing great benefits to students and teachers; deprives educational institutions of the burden of software and hardware ongoing support; forms students' creativity, teamwork skills, development of creative abilities, information competence, and technological literacy. The main locus is the teachers' motivation to use modern tools for the educational process structuring, since most of them really use the powerful capabilities of cloud services. These technologies are valuable tools for a modern teacher and interesting means to solve problems for students.

Based on the findings, the following effective approaches to the use of cloud services in the organisation of independent work by students are proposed: 1) A personally oriented approach: the most important competencies are formed through the mentorship of the teacher, which serve as the foundation for the assimilation of knowledge, skills, and abilities that will be maintained throughout life. 2) An integrated approach: students use the cloud services provided by the teacher collaboratively; as a result, they develop teamwork skills and creative skills aimed at improving the assimilation of educational content in a playful manner. This approach solves two difficult problems: the purpose of learning and the means of learning. 3) A creative approach: this develops the ability to adapt to rapid changes in digital technologies and services and harmoniously affects students, providing an opportunity to express themselves and their abilities.

## 5. Conclusions

Through the author's approach to the organization of the learning environment by selecting cloud services, the student's independent work has been carried out, and it has helped students in fulfilling their tasks.

The possibility of using cloud technologies (services) in the organization of the SIW as effective, motivating, optimal tools with enormous capabilities has been tested. The knowledge gained by students during their independent work is much stronger, the data interpretation is better, as they are stored in the student's memory for a long time. As a result, cloud technologies have helped much, as they fit well into the educational process and have become good tools for ensuring an increase in the final grade of students.

According to the survey, the most popular cloud environments for students are Google Drive and OneDrive. Respondents set forth forcefully their choice by useful, interesting and free services, as a result – 69.4 percent of students actively use Google Drive in their activities. The teacher, organizing the educational process based on cloud services, does not lose his/ her qualification level, but remains an innovator, who develops, goes step by step with innovations, and is constantly updating his/ her knowledge. Therefore, according to the current requirements, it is very important to develop a creative approach to solving problems and creativity in future specialists, using the Internet not only as a source of information, but also as a powerful tool in the professional activities.

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