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The use of cloud resources and services in distance learning of students in the context of restrictions caused by the pandemic

O uso de recursos e serviços da nuvem no ensino à distância de alunos no contexto de restrições causadas pela pandemia

El uso de recursos y servicios en la nube en la educación a distancia de estudiantes en el contexto de las restricciones causadas por la pandemia


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Abstract: The purpose of the study is to test the effectiveness of using the e-environment based on G Suit for Education in organizing distance learning for future social workers in the context of a pandemic. The study uses a set of methods: diagnostic (observation, interviews, questionnaires, testing) – to determine the effectiveness of using cloud resources and services in teaching students; pedagogical experiment for experimental verification of the effectiveness of using cloud resources and services in teaching students in the process of forming professional and communicative readiness of future social workers; methods of mathematical statistics for quantitative and qualitative processing of research results. Cloud resources and services allow activating knowledge, help to find and design new ideas, and help to develop independent decision-making skills. The conclusions of the work can be the basis for the development of an e-environment based on G Suit for Education. Materials and conclusions of the research can be used in the practice of teaching the humanities at university. The scientific novelty of the research is that the study identifies specific cloud services for implementing project activities when teaching students remotely. The stages of project implementation in the e-environment based on G Suit for Education are presented.

Keywords: Electronic learning, Virtual learning, Social workers, Experimental methods, University students.

Resumo: O objetivo do estudo é testar a eficácia do uso do e-ambiente baseado no G Suit for Education na organização de ensino à distância para futuros assistentes sociais no contexto de uma pandemia. O estudo usa um conjunto de métodos: diagnóstico (observação, entrevistas, questionários, testes) - para determinar a eficácia do uso de recursos e serviços da nuvem no ensino de alunos; experimento pedagógico para verificação experimental da eficácia do uso de recursos e serviços da nuvem no ensino de alunos no processo de formação da prontidão profissional e comunicativa dos futuros assistentes sociais; métodos de estatística matemática para processamento quantitativo e qualitativo de resultados de pesquisa. Os recursos e serviços da nuvem permitem ativar o conhecimento, ajudar a encontrar e projetar novas ideias e ajudar a desenvolver habilidades de tomada de decisão independente. As conclusões do trabalho podem servir de base para o desenvolvimento de um e-ambiente baseado no G Suit for Education. Os materiais e as conclusões da pesquisa podem ser utilizados na prática do ensino das ciências humanas na universidade. A novidade científica da pesquisa é que o estudo identifica serviços em nuvem específicos para a implementação de atividades de projeto no ensino de alunos à distância. São apresentadas as etapas de implantação do projeto no e-ambiente com base no G Suit for Education.

Palavras-chave: Aprendizagem eletrônica, Aprendizagem virtual, Assistentes sociais, Métodos experimentais, Estudantes universitários.

Resumen: El propósito del estudio es probar la efectividad del uso del entorno electrónico basado en G Suit for Education en la organización del aprendizaje a distancia para futuros trabajadores sociales en el contexto de una pandemia. El estudio utiliza un conjunto de métodos: diagnóstico (observación, entrevistas, cuestionarios, pruebas) - para determinar la efectividad del uso de recursos y servicios en la nube para enseñar a los estudiantes; experimento pedagógico para la verificación experimental de la efectividad del uso de recursos y servicios en la nube para enseñar a los estudiantes en el proceso de formación de la preparación profesional y comunicativa de los futuros trabajadores sociales; métodos de estadística matemática para el procesamiento cuantitativo y cualitativo de los resultados de la investigación. Los recursos y servicios en la nube permiten activar el conocimiento, ayudar a encontrar y diseñar nuevas ideas y ayudar a desarrollar habilidades de toma de decisiones independientes. Las conclusiones del trabajo pueden ser la base para el desarrollo de un entorno electrónico basado en G Suit for Education. Los materiales y las conclusiones de la investigación se pueden utilizar en la práctica de la enseñanza de humanidades en la universidad. La novedad científica de la investigación es que el estudio identifica servicios en la nube específicos para implementar actividades del proyecto cuando se enseña a los estudiantes de forma remota. Se presentan las etapas de implementación del proyecto en el entorno electrónico basado en G Suit for Education.

Palabras clave: Aprendizaje electrónico, Aprendizaje virtual, Trabajadores sociales, Métodos experimentales, Estudiantes universitarios.

INTRODUCTION

A new economy based on the development of the creative industry, new information technologies, and business processes that ensure Russia's leadership and competitiveness is replacing the raw material economy. Education is a key factor in ensuring economic growth, so the new economy puts forward new requirements for training future specialists and realizing their intellectual potential, which entails the need to introduce innovative information and communication technologies (ICT) into the educational process (Krivova et al.: 2020; Golubeva et al.: 2020).

Key IT trends affecting education in the 21st century include blended learning, real-time mobile learning, open mass online courses (OMOC), cloud computing (technology), etc. (Siemens: 2013). It is assumed that taking into account the above trends, the features of new educational technologies will be as follows (Galizina et al.: 2020; Skripak et al.: 2020):

- 1) mobile devices will become a platform for choosing a workspace for learning (collaboration in content creation);
- 2) the variety of support means will increase;
- 3) learning management systems (LMS) will evolve to support informal and social learning components;
- 4) games and simulations will become an integral part of the learning space;
- 5) the emergence of new tools for authoring, based on the creation of a "collective mind" using cloud and 3D technologies (Romero, Ventura: 2013; Pivec: 2007).

The rapid improvement and spread of cloud technologies today is one of the key trends that will have a significant impact on the global development in the coming years of not only the IT industry but also business, finance, public administration, medicine, as well as education and many other areas of human life.

Cloud technologies are a paradigm that involves remote data processing and storage. "Cloud" refers to a data center, server, or network where data and programs are stored, provided as services, and connected to users via the Internet (Buyya et al.: 2009). That is, cloud technologies allow for the delivery of hosting (services for providing resources for placing information on the server) from the cloud via the Internet.

L. Luo (2010) identified the differences between Web 2.0 and cloud computing; if in the first case, it is a certain type of software, in the second case, it is a method of storing data and providing software, hardware, and so on to the end-user, which will allow transferring the LMS to external providers.

The use of cloud computing requires the interface of information and telecommunications systems, as a result of which their resources become interdependent. According to researchers (Vouk: 2009; Greengard: 2010), the use of cloud technologies in any field of activity allows:

- 1) significantly reducing capital expenditures (cost reduction) for building data centers, purchasing server, and network equipment, hardware and software solutions, etc.;
- 2) providing the ability to extremely quickly change the configuration of the corporate IT infrastructure depending on current needs, consuming (and buying) exactly as many resources as is needed at the current moment, providing elasticity. At the same time, there are no problems with reliability: software updates and compatibility of different operating systems;
- 3) providing the possibility of virtualization: if there is a mobile terminal device and access to the Internet, the user, regardless of location, always has easy access to the virtual computer, corporate networks, databases;

4) constantly expanding the range of services offered by manufacturers and providers of cloud solutions.

In terms of hardware, three aspects of cloud computing are new (Armbrust et al.: 2010):

1. The illusion of endless computing resources available on demand;
2. The ability to increase hardware resources only when their demand increases;
3. The ability to pay for the use of computing resources for short periods when necessary (for example, calculations for an hour or storage for a day).

Cloud environments are designed to meet specific technical and business needs: they allow combining an acceptable level of security and privacy with minimizing costs. This flexibility of the cloud architecture, which is one of its main advantages, is also the most common reason for criticism because this configuration causes an additional level of risk: critical services are provided by a third-party organization on the terms of IT outsourcing.

However, in the context of the advanced development of ICT and the next recession in the global economy, cloud computing technology, which allows organizations and other entities to abandon significant costs for their own IT infrastructure in favor of obtaining all the necessary IT resources online, is considered as a promising choice and an optimal investment in future (Voas, Zhang: 2009).

World experience shows that cloud-based educational services can be used in the higher school system. For example, the modernization of education with the help of cloud computing is carried out in China, introducing various educational cloud projects (Zhang et al.: 2010).

The recommendations for the effective use of cloud computing in universities note that educational institutions are beginning to use cloud services to store the main data set and open electronic educational resources. There is also a gradual transfer of LMS to external providers, such as Blackboard and Moodle (Bouyer, Arasteh: 2014; Sultan: 2010).

Cloud computing has become a traditional computer science over the past few years. For example, students earn a bachelor's degree in applied science in networking at the Robert Morris University, Illinois. The San Jose State University and the University of Notre Dame offer a software engineering degree with a focus on cloud technology and virtualization (Stein et al.: 2013; Spring: 2008). As more enterprises and institutions move to the cloud, educational programs using cloud computing will likely become the global norm (Truong, Dustdar: 2011).

Since cloud computing has caused a qualitative leap in business, this could not but affect the field of education: today, the use of cloud technologies in education is at the peak of popularity. The use of cloud technologies in teaching is the next evolutionary step in making the educational process adaptive, flexible, open, and mobile.

The purpose of the study is to test the effectiveness of using the e-environment based on G Suit for Education in organizing distance learning for future social workers in the context of a pandemic.

Research hypothesis: the use of innovative learning tools in the form of cloud resources and services in the process of distance learning will help to improve the professional and communicative readiness (PCR) of future social workers.

Based on the results of the study, it can be concluded that the goal set in the study was achieved.

LITERATURE REVIEW

Numerous scholars have devoted their research to the problem of using cloud computing technologies in education (Kaur, Singh: 2015; Ganesh et al.: 2012; Okai et al.: 2014). The saturation of the educational process with modern ICT tools, in particular, cloud services, determines a close relationship between individual trends in the development of information technology and methodological training systems due to the impact on their technological subsystems (Al-Zoube et al.: 2010). Carrying out a significant impact on teaching techniques, cloud technologies also affect other components of the technological subsystem of the methodological system, in particular, the methods and forms of organizing training.

N. Sclater (2010) believes that the experience of using cloud-based learning tools is the basis for a "revision" of the methodological system of training – increasing the share of the group and active forms of educational activity of students, activating their independence in obtaining knowledge and mastering skills, and technological integration of classroom and extracurricular work using mixed learning.

According to researchers (Alamri, Qureshi: 2015; Elamir et al.: 2013), the introduction of cloud-based learning tools in education, in particular in higher education institutions, will provide the following additional opportunities:

- potential cost savings: moving to cloud usually means moving away from the CAPEX model (tangible assets that depreciate) to the OPEX model (pay-for-use);
- collaboration: includes a wide range of communication tools, ideal for conducting online classes or providing peer-to-peer support or training;
- backup: an important function of cloud computing is to automatically save content, eliminating the loss or deletion of any valuable material;
- accessibility: any data that is stored in the cloud can be easily accessed from any device, including mobile devices such as phones or tablets;
- storage: the cloud allows users to store almost all types of content and data, including music, documents, e-books, apps, photos, and more;
- flexibility: rapid change of program requirements for today's and tomorrow's teachers and students;
- no need for personal experience: network managers can save a significant amount of time by reducing routine, operational tasks.

Cost savings, according to researchers (Khedr, Idrees: 2017; Tomasz, Bajdor: 2015), enable universities to spend money on IT assets and

infrastructure, encouraging students and teachers to follow the principle of "bring your own device" (BYOD), since each device (phone, tablet, laptop) to access corporate data and systems can be connected to the network via cloud technologies. Thus, everyone can quickly get access to the network of the educational institution and the necessary educational material.

Experts (Odeh et al.: 2017; Ozdamlia, Bicen: 2014) believe that the mass adoption of mobile devices in the past few years is a trend that is developing in parallel with cloud computing. While business is moving towards BYOD, educational institutions are also looking for ways to capitalize on increased mobility. R.G. Lennon (2012) believes that BYOD has the following advantages: student engagement; availability of resources; and simplification of teaching and learning processes.

Leading cloud providers have recognized the importance of adjusting their computing services specifically for the needs of educational institutions. They contain specialized software packages at low prices so that more establishments can afford to use these technologies (Sabi et al.: 2016).

V.H. Pardeshia (2014) reviews criteria and indicators for selecting cloud-based learning support systems, in particular for programming basics, and provides recommendations for selecting such systems, namely:

- design (reliability; availability; security; adaptability; ease of use and administration; free of charge),
- technological (providing access with access rights differentiation, cloud data storage, integration with other cloud-oriented services, the ability to upload various types of files),
- communication (user registration, communication between registered users, creating groups, creating forums, chats),
- information and didactic (structuredness, calendar, assessment of students' academic achievements, file exchange, testing and survey, organization of group and individual forms of work; analytics at a certain rate).

Numerous studies are devoted to the application of specific educational-oriented cloud services. Thus, a model of an e-environment based on Microsoft SharePoint was developed in (Guasch et al.: 2010) and a method of using Office 365 cloud services in an e-environment for organizing group project work of students was presented. J. Ravitz and J. Blazeovski (2014) present the experience of using Microsoft Office 365 collaboration services so that students can combine social learning with academic learning. Researchers focus on attracting students to designing portals based on SharePoint.

T. M. Morales et al. (2013) consider the concept of collaborative content sharing with feedback using Microsoft SharePoint so that the tutor can develop students' understanding of the role of collaboration. The work (Koch et al.: 2016) considers the organization of group project work of future information technology specialists using the example of Microsoft and Google cloud services.

The experience of integrating Google Apps cloud services into the information and educational space of higher education institutions is highlighted in the research (Scheid et al.: 2012; Al-Emran, Malik: 2016; Owayid, Uden: 2014; Teo, Noyes: 2014; Robertson: 2013). An important feature of Google services, according to researchers, is that the company guarantees technical support 24 hours a day, 7 days a week, as well as uptime (operating mode) of the system at the level of 99.9% (Klein et al.: 2012).

A comparison of centralized learning platforms and cloud services in the course of students' coursework is considered by S. Bonham (2011). The author describes the personal perception and reaction of students to the use of the Google platform in general, as well as comparisons with previous experience in using LMS.

According to D. R. Herrick (2009), one of the most well-known platforms used in the educational process is G Suite for Education, which is cloud technology, the use of which is designed to increase the effectiveness of communication and collaboration between students and teachers. The advantages of using Google Apps for Education are discussed as modern approaches to organizing the educational process, and the services are considered as tools for supporting flexible environments for organizing collaborative learning (Barlow, Lane: 2007). M. Wood (2011) offers the experience of using Google Apps for e-support of university students' learning.

The integration of Google educational resources and services into the educational environment of the university is considered in the study (Lee, Song: 2013), and the didactic aspects of using G Suite cloud services in the educational process are presented in the work (Cheon et al.: 2012).

J. G. Appling (2012) analyzed the possibilities and advantages of using Suite G cloud services (Google Apps) in the educational process. It is proved that the information space of educational institutions should be a dynamic education, an important aspect of the functioning of which should be the use of cloud services.

At the same time, according to E. Pechenkina (2017), the integration of Google Apps not only contributes to a qualitatively new level of education but also provides a permanent process of forming ICT competencies of all participants in the educational process.

Since today a competitive specialist, regardless of profession, must have both professional and personal skills, when designing their training activities, they must be taken into account as the expected results (learning goals). Studies (Shek et al.: 2017; Zarzycka: 2017; Cornalli: 2018) have shown that only 15% of career success is due to the level of professional skills, while the remaining 85% are soft skills.

Given that the use of soft skills is possible only if it is possible to use different behaviors, understand personal and common interests holistically, prioritize and make choices, the use of the project method in the study of social disciplines is considered promising in teaching cloud computing (which is a separate subject of this article, but is not a limitation in general).

METHODS

When performing the tasks, a set of modern methods of psychological and pedagogical research was used:

- theoretical-analysis of scientific and educational literature to determine the current state of the problem of using cloud resources and services in distance learning;
- empirical-diagnostic (observation, interviews, questionnaires, testing) to determine the effectiveness of using cloud resources and services when teaching students in distance learning mode;
- pedagogical experiment for experimental verification of the effectiveness of using cloud resources and services in teaching students in the distance learning mode in the process of forming PCR of future social workers;
- methods of mathematical statistics for quantitative and qualitative processing of research results.

The purpose of the experiment was to test the effectiveness of using the e-environment based on G Suit for Education in organizing distance learning in the context of a pandemic of future social workers.

It was necessary to consistently perform several tasks to solve this goal:

1. to develop criteria and indicators of PCR of future social workers;
2. to form an experimental and control group of future social workers participating in the pilot study;
3. to perform diagnostics of respondents at the ascertaining stage of the experiment to confirm the homogeneity of the selected groups;
4. to create an e-environment for organizing distance learning based on G Suit for Education, justify the method of training using the created environment and test its effectiveness as a means of improving the PCR of future social workers at the stage of the formative experiment.

Taking into account the hypothesis of the research, we present a set of criteria and indicators of PCR of future social workers and the corresponding diagnostic tools in Table 1.

Table 1
Criteria and indicators of professional and communicative preparedness of future social workers

Criteria	Indicators	Diagnostic tools
Value-motivational	professional and humanistic orientation presence of valuable professional motives motivation for success	Original questionnaires, adapted methodology "Motivation for studying at a university" by T. Ilyina, "Diagnostics of personality for motivation for success" by T. Ehlers
Content-procedural	system of knowledge and skills in the studied disciplines a set of knowledge about the content and components of professional and communicative training professional and communication skills	Diagnostic control questions, results of examination sessions in the relevant disciplines, test tasks, reports on practices
Assessment and behavioral	presence of communicative qualities ability to empathize manifestation of tolerance	Test of communication skills by V. Ryakozhskiy, "Diagnostics of the level of empathy" by M. Yurupov, test by V. Boyko "Diagnostics of communicative tolerance"

The study was conducted with 2nd-year students during distance learning in the context of a pandemic. To identify the levels of PCR of future social workers, two groups of respondents were selected: EG (experimental group) – 103 students and CG (control group) – 105 students. At the same time, EG students, in contrast to CG students, were

engaged in group project work using G Suit for Education cloud services in the course of distance learning.

The reliability of diagnostic results at the ascertaining and forming stages of the experiment was carried out by conducting a statistical analysis of the obtained diagnostic data. The reliability of matches or differences in the number of points scored by students of EG and CG was determined by the criterion of uniformity χ^2 .

Upon completion of the formative stage of the experiment, a questionnaire consisting of 10 questions was developed to reveal the attitude of students from the EG to work using cloud resources and services by the method of projects and reflection of the acquisition of professional and communication skills. The survey was conducted in the classroom.

Based on the results of distance learning, EG students were asked to evaluate the quality of using G Suit for Education tools to perform proposed tasks in comparison with previous experience of using LMS Moodle in the study of individual disciplines.

Further, in the process of designing and creating an e-environment based on G Suit for Education, we analyzed all the services that enable students to form an environment for effective teamwork.

RESULTS

The general characteristic of the levels of PCR of future social workers (according to three criteria) at the ascertaining stage of the study is presented in Table 2.

Table 2
General characteristics of the PCR levels of future social workers at the ascertaining stage of the study

Groups	Levels	Criteria							
		Value-motivational		Content-procedural		Assessment and behavioral		Arithmetic mean	
		Number of students	%	Number of students	%	Number of students	%	Number of students	%
EG =103	High	37	35.6	9	8.5	34	32.7	27	25.7
	Average	44	43	48	46.6	33	31.9	42	40.4
	Low	22	21.4	46	44.9	36	35.4	34	33.9
CG=105	High	35	33.7	8	7.6	32	30.8	25	24
	Average	44	41.9	45	43.2	32	30.5	40	38
	Low	26	24.4	52	49.2	41	38.7	40	38

Comparing the χ^2_{emp} with the critical value, we see that the characteristics of EG and CG coincide with the significance level of 0.05 due to the fact that the resulting value of $\chi^2_{emp} = 0.59 < \chi^2_{crit} = 5.99$. The case when $\chi^2_{emp} < \chi^2_{crit}$ it confirms the correctness of our hypothesis – the control and experimental samples are identical; the result $\chi^2_{emp} > \chi^2_{crit}$

crit will mean that the distribution of students in the CG and the EG is statistically different.

Therefore, the results of the calculations showed that there is no statistically significant difference in CG and EG, so they can be used for the next stage of the study – a formative experiment.

The obtained generalized results of the levels of PCR of future social workers (for clarity) are presented in the form of a diagram (Fig. 1).

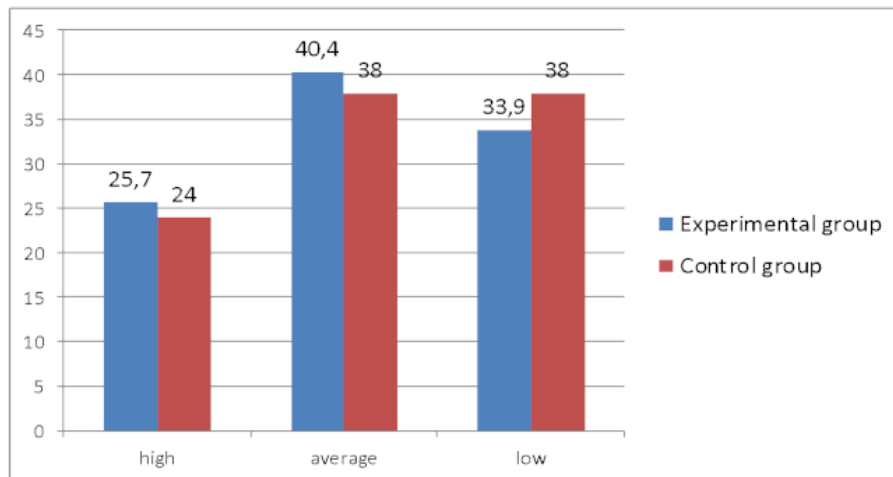


Figure 1

Levels of PCR of future social workers (based on the results of the ascertaining experiment)

As can be seen from the diagram, the results obtained at the ascertaining stage of the study indicate, firstly, the insufficient educational work of the university to form the PCR of future social workers and, secondly (which logically follows from the first conclusion), the correctness of the hypothetical assumption about the need and feasibility of introducing innovative learning tools in the form of cloud resources and services to increase the levels of PCR.

After carrying out the formative stage of the experiment, to determine the dynamics of changes in terms of the indicators of the three PCR criteria, a final cut was carried out using the same research methods as at the stage of the ascertaining stage of the experimental work.

The determination of the PCR levels of future social workers according to the value-motivational criterion (at the final stage of the study) is presented in Table 3.

Table 3
Determination of the PCR levels of future social workers according to the value-motivational criterion (at the final stage of the study)

Groups	Levels	Indicators							
		professional and humanistic orientation		presence of valuable professional motives		motivation for success		arithmetic mean	
		Number of students	%	Number of students	%	Number of students	%	Number of students	%
EG =103	High	43	41.7	42	40.8	51	49.5	45	43.7
	Average	49	47.6	48	46.6	40	38.8	46	44.7
	Low	11	10.7	13	12.6	12	11.7	12	11.6
CG=105	High	39	37.1	37	35.2	38	36.2	38	36.2
	Average	49	46.7	47	44.8	49	46.7	48	45.7
	Low	17	16.2	21	20	18	17.1	19	18.1

Thus, according to the results of the final stage of the research, a high level of PCR according to the value-motivational criterion was revealed in 43.7% of future social workers from the EG and 36.2% in the CG; the average level according to this criterion was observed in 44.7% of respondents from the EG and 45.7% from the CG; a low level was determined in 11.6% of future social workers from the EG and 18.1% of the CG. Note that the value-motivational criterion has not received significant development in the CG compared to the EG.

The results of the diagnostics of the content-procedural criterion at the final stage of the study are presented in Table 4.

Table 4
The results of diagnostics of the PCR levels of future social workers according to the content-procedural criterion at the final stage

Groups	Levels	Indicators							
		system of knowledge and skills in the studied disciplines		set of knowledge of the content of professional and communicative training		professional and communication skills		arithmetic mean	
		Number of students	%	Number of students	%	Number of students	%	Number of students	%
EG =103	High	38	36.9	20	19.4	17	16.5	25	24.3
	Average	48	46.6	51	49.5	47	45.6	49	47.6
	Low	17	16.5	32	31.1	39	37.9	29	28.1
CG=105	High	24	22.8	15	14.3	6	5.7	15	14.3
	Average	56	53.4	49	46.7	38	36.2	48	45.7
	Low	25	23.8	41	39	61	58.1	42	40

According to the content-procedural criterion of the PCR, the qualitative analysis of the results showed that the students from the EG, in comparison with the results of the ascertaining stage, have a better knowledge of the taught disciplines and professional skills of implementing the acquired knowledge, the number of correct answers about the essence of professional and communicative training and its components significantly increased.

We obtained the following results based on the assessment and behavioral criteria of future social workers' PCR (Table 5).

Table 5

The results of diagnostics of PCR levels of future social workers according to the assessment and behavioral criterion at the final stage

Groups	Levels	Indicators							
		presence of communicative qualities		ability to empathize		manifestation of tolerance		arithmetic mean	
		Number of students	%	Number of students	%	Number of students	%	Number of students	%
EG =103	High	62	60.2	30	29.1	21	20.4	38	36.9
	Average	33	32	48	46.6	39	37.9	40	38.9
	Low	8	7.8	25	24.3	43	41.7	25	24.2
CG=105	High	59	56.2	28	26.7	17	16.2	32	30.5
	Average	30	28.6	42	40	29	27.6	36	34.3
	Low	16	15.2	35	33.3	59	56.2	37	35.2

The data obtained at the final stage of the research give grounds to assert that there were positive changes in the levels of PCR for all criterion indicators in the EG of future social workers. Minor changes in the CG are evidence of insufficient purposeful educational work in the process of distance learning for future social workers.

A general characteristic of the levels of the PCR of future social workers at the final stage is presented in Table 6.

Table 6

General characteristics of the PCR levels of future social workers at the final stage

Groups	Levels	Criteria							
		Value-motivational		Content-procedural		Assessment and behavioral		Arithmetic mean	
		Number of students	%	Number of students	%	Number of students	%	Number of students	%
EG =103	High	45	43.7	25	24.3	38	36.9	36	35
	Average	46	44.7	49	47.6	40	38.9	51	49.5
	Low	12	11.6	29	28.1	25	24.2	16	15.5
CG=105	High	38	36.2	15	14.3	32	30.5	28	26.7
	Average	48	45.7	48	45.7	36	34.3	41	39
	Low	19	18.1	42	40	37	35.2	36	34.3

Compare the final results of the levels of research on the PCR of future social workers at the ascertaining and final stages (Table 7).

Table 7

Comparison of PCR levels of future social workers at the ascertaining and final stages

Levels	The ascertaining stage				The final stage			
	EG		CG		EG		CG	
	Number of students	%	Number of students	%	Number of students	%	Number of students	%
High	27	25.7	25	24	36	35	28	26.7
Average	42	40.4	40	38	51	49.5	41	39
Low	34	33.9	40	38	16	15.5	36	34.3

For clarity, the PCR levels of future social workers in the experimental and control groups are presented in the diagram (Fig. 2).

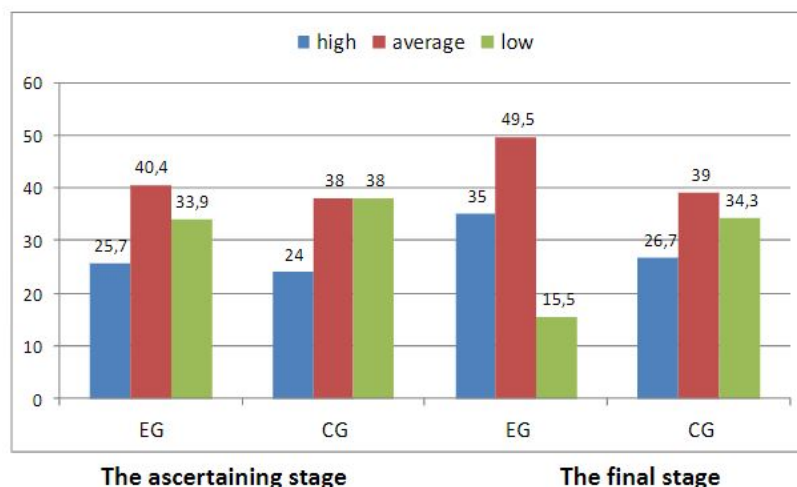


Figure 2

PCR levels of future social workers in the experimental and control groups

The reliability of the data of the forming stage of the experiment was calculated using the homogeneity criterion χ^2 . Comparing the empirical value of the x^2_{emp} criterion with its critical value, we conclude that the reliability of differences in the characteristics of CG and EG according to the statistical criterion is 95%, since the obtained value of $x^2_{\text{emp}} = 9.73$ is greater than the critical $x^2_{\text{crit}} = 5.99$.

DISCUSSION

As the results of mathematical processing have shown, the use of cloud resources and services in the process of distance learning helps to increase the professional and communicative preparedness of future social workers.

Analyzing the results of the subsequent survey, it is possible to conclude that such projects have practical significance for the majority of EG students (87.45%).

While working on the project, 48.18% of EG students acquired effective digital communication skills, 37.01% self-organization and leadership, and 14.81% time management.

Although students appreciate the use of the centralized Moodle platform as a support for formal learning in universities, they preferred to use G Suit For Education for organizing distance learning. This is especially true for such positions as time management and using personal content (on a 12-point quality rating scale – 10 to 1). Students consider G Suit For Education to be almost twice as good a medium for communication and collaboration.

Also, 77.78% of the surveyed students noted that it is the acquired knowledge and skills obtained as a result of working on a project using G

Suit For Education during distance learning that will be useful to them in their future profession.

Students identified Google+ as the most useful service for social workers, as a community for promoting social service ideas.

Thus, students positively evaluate the implementation of distance learning tasks in the format of group projects using the environment that is created for the project based on G Suit For Education. As a result, there is an increase in the level of motivation to learn, develop information and communication skills, and soft skills. In addition to ICT tools that are used to perform distance learning tasks, students actively use the e-environment based on G Suit For Education, which makes it possible to effectively communicate and collaborate. As can be seen from the survey of students and observation of the stages of task completion, the e-environment based on G Suit For Education is a more effective environment for conducting distance learning compared to others.

While designing and creating an e-environment based on G Suit for Education, all the services that enable students to form an environment for effective teamwork were analyzed. Students and teachers can collaborate through collaboration services: Drive, Documents, Tables, Presentations, and Keep.

Google services are effectively used in the educational process as additional resources to provide students with educational material and tools for performing various types of educational activities, in particular, for performing practical tasks and independent work, which can be built based on individual and group educational projects. The educational project is one of the most effective methods for the formation of professional competencies and skills of the 21st century among university students. Due to the use of training projects during educational practice, there is an opportunity to develop professional, self-educational, and communicative competencies as integrative formations (Ertmer, Ottenbreit-Leftwich: 2010; Sung et al.: 2016; Penuel et al.: 2007).

The basis of actions for implementing project technology in the framework of distance learning is presented in the form of the Google Classroom LMS system (Mouza: 2008; Inan, Lowther: 2010). Students use the following resources for critical evaluation and processing of distance learning materials:

- (1) Information (course visiting card);
- (2) Test (determining the level of incoming students' knowledge and evaluating intermediate performance results, feedback);
- (3) Hyperlinks (visualization, instructions, additional information, etc);
- (4) Themes (list of blocks for project execution);
- (5) Tasks (list of tasks per week, the practice of practical skills, experimental work);
- (6) Comment (discussion, the definition of current needs).

The task of distance learning consisted of several subject areas and was aimed at the formation of professional competencies and soft skills. Each group of four students received the following task: analyze current trends

in the field of social work (Analytics in MS Excel tables and charts), create a poster on the theme "Portrait of a modern social worker" (using services for creating infographics), organize personal learning trajectory (mental map), career maps in social work, an overview of tools for the work of a modern social worker (interactive presentation) and a promo video about a social worker.

Setting the problem task was preceded by familiarizing students with the academic disciplines that are provided by the working curriculum, determining the professional and personal skills of students that are in demand in the modern labor market. The proposal in the context of this work is a created site where documents and resources are posted, which include the selection of online courses, professional blogs, forums for each discipline, providing formal and informal education of a student of a future social worker, identifying tools for optimizing the work of a social work specialist, building a career map of a social worker, for further professional self-determination, presentation of the proposal, a web resource for discussion and evaluation of results. The study groups worked on the project in a designed e-environment based on the Google Classroom service, which integrated all the necessary services for group project work.

Google Classroom is a tool that connects Google Docs, Google Drive, and Gmail which allows creating and organizing assignments, assessing, commenting, and organizing effective communication with students in real-time (Bhat et al.: 2018; Rahmad et al.: 2019). The Main element of Google Classroom is **Groups**.

Due to the **Hangouts** communication service, students and teachers have the opportunity to conduct online conversations in real-time from a computer or mobile device. Team members can show their screens, watch, and work on everything together. Google Hangouts allows streaming live on Google+, YouTube, and the site (Lindh et al.: 2016; González-Martínez et al.: 2015).

Drive cloud storage allows students to find the information they need, work with documents together, and organize folders and files. Due to the **Documents**, **Tables**, and **Presentations** services, students can complete general group tasks. The service also allows students to add web applications, extensions, and themes to their own Google account (Ercan: 2010; Sultan: 2010).

The **Drawing** service allows quickly building various charts and diagrams. **Mindomo** is a network-based service for creating and storing concept maps. **PowToon** service is an online application for creating animated video presentations, which provides several options for animating text on slides: writing text by hand, the sequential appearance of letters, as well as simple options for animating text. The service provides an extensive library of animated images: models in vector graphics and many infographic elements. The service allows exporting the created multimedia presentation to YouTube (Gleaves et al.: 2007; Li et al.: 2013).

The task of group project work of students includes a lot of information, it is the **Keep** service that helps students save thoughts, plans, notes, and reminders. **Google calendar** allows creating different calendars for groups and sharing them with all users. A wide range of shared access management tools helps to ensure security and privacy. Google Calendar is integrated into Gmail and is compatible with other popular calendar apps. The app allows transferring a specific calendar or event to another person to manage. Students can use the mobile app or sync with the built-in calendar on mobile devices.

Google site allows students to create and edit web pages, even if they are not familiar with HTML and web design. One can build sites from scratch or using ready-made templates, upload content such as photos and videos, and provide flexible access control at the level of not only the site but also individual pages (Ozcelik, Acarturk: 2011).

Google+ is a social service that provides an opportunity to unite participants of the educational process in one social network for online communication. Students can share their experience and knowledge in Google+, post updates on topics that are interesting to the team, and spread new ideas (Wang, Wu: 2011).

The technology of completing the project tasks provided for activities according to certain stages, as a result of which professional, communication, interpersonal, leadership, teamwork, and time management skills were developed. There were 5 stages of project execution, namely: task statement (1), tools analysis (2), environment design (3), project design (4), publication and presentation (5). Table 8 shows the stages of project implementation and the respective tools that are appropriate for each of them.

Table 8
Stages of project implementation in the cloud environment

10. Stage	Project stage	Tools	Development of competences
1. Task statement	defining the project goals and objectives	Chatroom	- communication - professional
2. Tools analysis	- familiarization with Google services - familiarity with the functionality of the services - defining the necessary services to perform project tasks	Google services	- information-communication - self-education - analytical
3. Environment design	- planning the structure, content, and design of the main documents - search for the optimal way to achieve the project goal (analysis of data sources) - building an algorithm for work and interaction - defining deadlines and forms for submitting results	Google Drive, Sheets, Documents, Tables, Presentations	- information-communication - cultural - analytical
4. Project implementation	- building a model of the environment for the work of a modern social worker - building a portfolio of a modern social worker - development of the project portfolio - creation of a community social worker	Presentations, ProForma, Mindomo	- professional - cultural - communicative - information-communication - self-education
5. Presentation of results	- registration of research results - publication of the results obtained - presentation of work results	Google + Community, Wikians, Presentations, ProForma, YouTube, Periscope	- information-communication - professional - cultural

At the stage of the task statement, students are introduced to the subject, purpose, methods, and means for achieving the goal; they are determined with the sources of information and in what form the result of joint project activities will be presented. The teacher introduces the idea of the project and helps to define the tasks.

At the stage of tools analysis, students have the opportunity to divide themselves into groups, distribute tasks among team members, and decide on tools and services for completing the task. The teacher offers ideas

and suggestions. As a result, the students decided on the tools of the cloud service G Suit for Education, the functionality of which can be used to work on the project. In particular, the Calendar service was used for planning stages of task completion.

At the design stage of the environment, personal environment for performing group project work is designed, the necessary applications for working on the project are added. Students plan the structure of the main documents, determine the timing of the project stages and forms for submitting results. The teacher helps in determining the necessary services for the project and advises when building an algorithm for work and interaction.

During the project implementation stage, students work on tasks according to the distributed roles and schedule in the calendar: design a model of the environment for a social worker, build a portrait of a modern social worker, create scribing presentations, create and fill the community. The teacher monitors the process and provides advice. All processes are performed in the created Classroom-based environment, where the necessary tools are combined. The teacher conducts online discussions with students using the Hangouts service. The drive is used for working with documents and monitoring students' independent work on project tasks.

The presentation of the project takes place in the classroom in the form of a speech, a scribing presentation. Students published their project portfolios on the created site, filling pages with various content, using images, documents, surveys, videos, and other features. Students also created a Google+ community where they announced current trends in marketing. Students had the opportunity to accumulate knowledge and receive feedback from community members in the community.

CONCLUSION

Today, educational institutions recognize cloud computing as useful for simplifying the management and administration of the educational process. By using various cloud computing models, receiving infrastructure, platform, or software services, educational institutions can reduce costs and improve the efficiency of the learning process, as well as store, process, and analyze data. This is beneficial for universities, since getting constant access to various collaboration environments and important applications require minimal investment in hardware and licensed cloud software.

Cloud technologies, in particular G Suit for Education, have an impact on group forms of distance learning, as they facilitate collaboration and expand communication opportunities. The use of cloud technologies encourages innovative solutions in the teaching methodology, the use of the project method, coaching, technology of the inverted class, and mixed learning.

The functionality of the cloud environment, which includes services for planning activities, establishing communication and collaboration,

resources for non-formal education, tools for assessment and reflection, affects the effectiveness of the educational process, the development of professional and personal skills. Thus, cloud technologies influence the methodological system of training as a whole by influencing the means, methods, and forms of the training organization.

The use of e-environment based on Google services for distance learning has made it possible to improve the quality of training of future social workers. The application of the project method made it possible to use integrative tasks that combine knowledge and skills from various academic disciplines and involve the synthesis of new knowledge and skills among students as a result of the project. Educationally oriented cloud resources and services allow activating knowledge, help to search for and design new ideas, stimulate creative thinking, and promote the development of independent decision-making skills.

LIMITATION AND FURTHER RESEARCH

The main advantages of G Suit for Education are the openness of services and the ability to effectively use them in professional activities. In addition to the development of professional competencies, the implementation of the project using the e-environment based on G Suit For Education makes it possible to effectively form future specialists' personal competencies that ensure high competitiveness of future specialists in the labor market, the development of creative, communicative and research potential, the formation of a strong-willed character, education of active initiative, responsibility, hard work, perseverance in achieving goals, and diplomacy.

The obtained data indicate that the proposed e-environment is an effective tool for the development of the PCR of students. Also, the introduction of project activities in distance learning greatly contributes to increasing the motivation of the educational activity itself.

Thus, the results of the study confirmed the hypothesis that the use of innovative learning tools in the form of cloud resources and services in the process of distance learning will contribute to improving the PCR of future social workers.

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