FEATURES OF ENSURING INFORMATION SECURITY WHEN USING CLOUD TECHNOLOGIES IN EDUCATIONAL INSTITUTIONS

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Annotation: The use of cloud technologies in the activity of an educational organization provides certain advantages and creates new opportunities both for inclusion in the educational process and for forming a management system for the educational organization with new opportunities. However, a number of security issues arise, the solution of which may affect the use of cloud technologies. Particular attention is paid to promising technologies and services that can be used both in the management of the educational organization and in the process of training.

Keywords: cloud technologies in education, education management, information security, infosphere, blockchain technologies

1. INTRODUCTION

Cloud technologies play an important role in the development of public organization management, as well as the quality of education, ensuring the achievement of the necessary level of educational process [11]. Thus, organized training using cloud technologies offers a number of advantages, including: providing cheap infrastructure, flexibility and scalability, the possibility of joint-local work, ease of use. In addition, cloud technologies allow users to store important information with extensive access to it. Services and applications implemented on the basis of cloud technologies allow users to store and gain access to their local data located in the remote data-center, use both personal computers and mobile devices [20]. In educational organizations, cloud technologies provide all participants in the learning process, including students, teachers, parents, school staff, administrators and even additional staff, access to educational technologies [4, 10].

Educational services implemented on the basis of cloud technologies have five main areas: the ability to work independently, universal access, pooling of resources, the possibility of rapid change, the use of internal statistics on the use of cloud services [1]. Let us consider the features of the selected areas from the point of view of ensuring the security of the data used in the learning process.

2. TECHNOLOGICAL SOLUTION

2.1 Cloud technologies

Independent work with cloud services is based on automation tools. Users in educational organizations need to perform various functions and operations. At the same time, it is necessary to provide a certain freedom of action for the choice and use of cloud services or resources from the whole variety of cloud technologies. As a rule, the user of cloud services configures and manages all resources to which has access, or requests this access through the web interface from the administrator of the educational environment to use the necessary technologies. Such a list can be very extensive: from the self-reset or change the password to your account (without the need to contact the teacher or administrative employee) to access to training materials or management reports, including online.

Extensive access is based on the fact that cloud technologies should be widely available on the basis of the use of any device with different operating systems (laptops, tablets, mobile phones, etc) and on every side (both from the network of the educational organization, and from home, library, etc.). Extensive access is based on the use of standard mechanisms and data transfer protocols. Connecting this level of access to different categories of users of an educational organization requires that educational cloud technologies be adapted to the requirements of these users.

The pooling of resources is based on the fact that one set of resources is used to serve a number of users. This multi-user model is based on virtualization technologies, in which resources are dynamically assigned and re-used according to user demand. The multi-user environment is characterized by the fact that the user does not know where his data is currently located or stored.

The ability to change resources quickly is based on security policies and is implemented by the rights you set. For example, pre-provisioned services are scaled based on policies and requirements for users or their devices. For example, you can prevent access to educational organization resources from devices that do not have anti-virus software installed and updated. These changes have no impact on applications hosted in the cloud, and do not require constant human intervention to correct such changes. Various stakeholders in an educational organization, such as students, teachers, administrative staff, and others, can access and use educational resources as needed, and computing and multimedia capacities are allocated based on access and security policies automatically, at any time.

The use of internal statistics and reporting allows to organize a system of control and accounting of the use of educational cloud technologies [14]. It usually includes various counters, including resources used in the educational process, and forms of collection of performance reports. Reports on the use of educational cloud technologies or resources provide transparency, both for the user and for the head of the educational organization, the organization providing access to cloud technologies, as well as provide additional indicators necessary for decision-making in the management of the educational process. At the same time, the use of educational cloud technologies is more cost-effective than the local software and hardware infrastructure.

There are three main groups of main cloud technologies that a user can get in an educational organization: software as a service (hereinafter SaaS), platform as a service (hereinafter PaaS) and infrastructure as a service (hereinafter IaaS) [20]. These groups use each other, which means that it is necessary to consider all groups in the formation of the security system, even if only one is currently used.

In the SaaS model (business application usage model in the Internet services format), users can access the applications they have published at any time. Currently, SaaS is considered to be the most widely demanded type of cloud technologies in the field of education. Yandex disk and Google, Twitter, VKontakte, Dropbox, YouTube and OneDrive, Office 365 Suite of applications are the most striking examples of SaaS. Microsoft and Google provide some services based on SaaS fashion, specifically designed for education and educational institutions [17].

In the PaaS model (a cloud environment that can be used to develop, test, run, and manage applications), the technology provider provides developers with the development tools to build or configure their application or service in the cloud, regardless of the platform to run. A well-known example of PaaS is the Google App Engine, where the developer can install and configure the application using Python.

In the IaaS model (computing infrastructure (servers, data warehouses, networks, operating systems), which is provided to users for deployment and launch of their own software solutions) represents access to computing resources that can be remotely controlled (processors, storage space, virtual networks, etc.) in the data center and used to run their own operating systems and applications. The great advantage of using IaaS is that It offers an on-demand data center without the need to buy or install new expensive equipment. Microsoft Azure and Amazon Elastic Compute Cloud are the most common examples of IaaS.

2.2. Information security

Data security concerns are primarily related to three main requirements: privacy, integrity, and availability. Privacy is defined as a set of rules that prevent unauthorized access to confidential information, while integrity is a way of protecting data from unauthorized modification of data and confirm that data is retrieved without any accidental or intentional distortion, and is reliable, and compliance with accessibility requirements allows authorized users to securely access data, especially those outside the educational organization.

In order to understand and successfully address the issues of data security, spread in the "cloud" and quickly assess the problems of their security in educational organizations, it is necessary to consider various aspects of the use of cloud technologies, possible threats, risks in information attacks [8].

The security of the communication environment that connects the user to the cloud infrastructure is an important area of protection. Ensuring the security of such an environment prevents the loss of confidential information during its transfer [3].

The biggest security problems are related to the data network, as all operations using cloud technologies are completely dependent on it, and all users use their data in remote access mode.

The security of the cloud infrastructure entails issues related to the operation of the physical equipment used as the basis for the cloud infrastructure, as well as virtualization tools used for the operation of cloud resources.

One of the security tasks of a virtual environment is to protect a virtual machine, because when multiple virtual machines are located on the same computer, you cannot put a hardware protection device, such as a firewall between them. Another problem is in a dynamic environment where virtual machines are created, deleted or moved to another location automatically, which makes it very difficult to monitor movements and determine a security breach.

We can make some recommendations for secure use of cloud technologies.

1. Cloud technologies give a lot of advantages, but from administrators and from administrative staff requires an understanding of the principles of cloud technologies and following the recommendations and standards of information security, as well as knowledge and implementation of laws and regulations on the handling of personal data.
2. Networks and environments for information transfer in an educational organization must be ready for cloud technologies. This means that network equipment, such as routers and firewalls, must be set up so that access to the cloud is the most secure and achieves the expected results from the use of cloud technologies. In addition, you need to consider the use of network isolation (for example, based on VPN, VLAN, etc.).
3. The it administrator must control and manage the cloud services when signing a contract with the technology provider.
4. It is recommended that a contract be concluded with a third party to conduct regular inspections to monitor the performance and compliance of the service provider with agreed terms. It audit will allow to identify security problems in time, and not only when using cloud technologies.
5. The application of the threat assessment strategy is an urgent need. Depending on the processed information — it can also be a requirement for implementation of the laws on the protection of personal data.
6. Sometimes, stakeholders were simply not aware of specific threats to the cloud infrastructure. This requires finding a way to detect threats and avoid them before they occur. These measures should be taken specifically to address potential internal threats.
7. Data and applications in the cloud environment should be classified based on their values according to their importance and sensitivity to modification and access. Not all data stored in the cloud needs to be securely encrypted or protected. We should not forget that security always affects the performance of the system and its efficiency.
8. Backup and restore schemes must be run regularly to prevent data loss. At the same time, they must also be reliably protected.

9. Proper authentication, authorization and access to security tools must be regularly monitored.
10. Encryption and key management protocols during data transfer (including backups) must be continuously updated.

2.3. Perspective processing technique

Particular attention should be paid to the competence and skills possessed by the administration of the educational organization and teachers in the use of cloud services. These will include the General level of personal computer skills, specialized software, understanding of distributed systems, skills of working together in a single infosphere, readiness to adopt new tools and change the speed of work, management literacy, team building, public relations, etc. When the administration of an educational organization comes to understand that almost everything is changing, like any person, they have a fear of something not to do. The most common and dangerous fears are shown in figure 1.

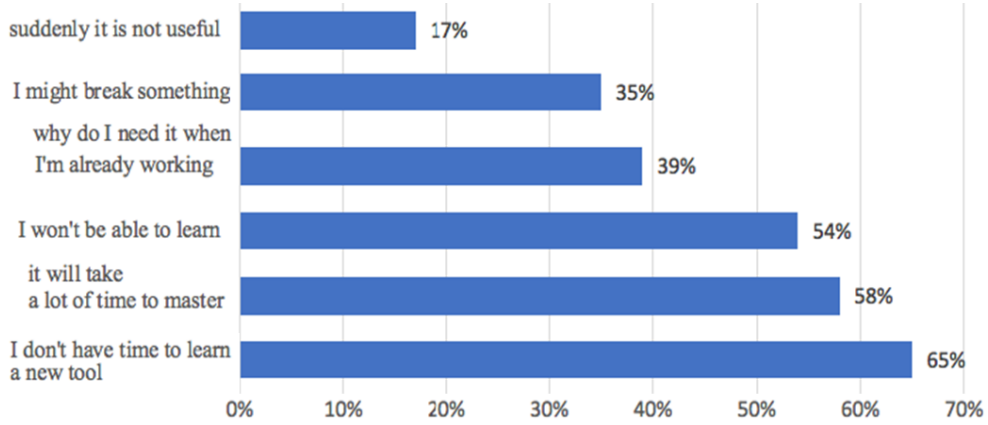

Figure 1. Fears during the development of cloud services

The data are obtained on the basis of a survey of undergraduates of the first and second year of study, who work directly in educational institutions of Moscow, and their teaching staff.

By statistics, the successful implementation of cloud services eventually leads to savings of 30% to 70% of working time, depending on the degree of formalization of portable processes. Savings consist of reducing the time of execution of ordinary processes, from reducing the time for reporting, from the optimization of human and material resources planning, from simplifying the functionality of the system and its accounting, from automating the implementation of pre-known actions, from automating alerts (which is extremely important given the increase in the number of participants in the educational process), from attracting additional funding by increasing the status of the educational organization.

Table 1 shows the calculation of time savings based on the annual number of certain typical tasks. For the number of tasks the average indicators on average educational organizations are taken.

Table 1. Calculation of time savings when using cloud services

		Time used (hour)		**Time used (hour at year)**		
	Task	**Without use**	**Tasks per year**	**Without use**	**With use**	**Economy**
1. Collaborative systems	Create a report	5	50	250	162,5	87,5
2. Helpdesk systems	Ticket for maintenanc e	1	220	220	66	154
3. Knowledgebase systems	Finding information to solve a difficult situation	3	189	567	283,5	283,5
4. To-do list systems	Work planning	10	120	1200	480	720
5. CRM systems	Search for contacts of employees of partner companies	0,5	240	120	36	84
6. Combo-systems	The preparation of the project for execution of works	8	120	960	672	288
7. Blockchain based systems	Inventory	20	5	100	50	50

Based on the presented data, we have that with the use of modern cloud services, the saving of working time reaches (on average) 1667 hours per year, since almost 70 days. Taking these indicators as average, we can assume that the real savings for a particular educational organization will be a diff of fifty percent of the obtained value and will be from 35 to 105 days. Even in the minimum version it is essential.

Technology will appear and change soon with high speed. You can try to resist this, but you can use the best practices of the leading educational organizations of the world, "ride" the technological wave and bring your educational organization to a new level [12].

Here is a list of modern and promising information technologies, the use of which (especially SaaS implementation) is able to bring the management of internal and

external processes, as well as information security of educational organization to a new level.

1.Collaboration systems – anything that allows multiple users to work on a single document at the same time, providing access to a single calendar, address book or service.

2.Helpdesk systems – application systems, operating with the "incident" entity and presenting any action within the educational organization allow to organize the accounting of all performed and planned actions, to keep records of employees, workload and employment, to make visual reports of their activities and to track performance indicators.

3.Knowledgebase systems – used to document and later use information about the processes and activities within an educational institution. The use of knowledge Bases allows you to accumulate the experience of employees to solve standard and non-standard situations, analyze it, provide access to it, introduce new employees to the course and use it as an electronic archive of all the main documents with the ability to search online.

4.To-do list systems - very easy to learn systems will allow to automate the formulation and accounting of tasks to employees of educational organization, increase the efficiency of their delivery, increase involvement in work processes and allow the Manager to always monitor the workload of employees (get cutoff on the number of tasks, their execution time, etc.)

5.CRM systems - Customer Relationship Management – allows to redefine the educational organization to interactions with parents and external contractors through an automated individual records of action on contract, an integration with the phone comes the ability to record telephone conversations to enhance the security level of the educational organization, and use built-in tools for standardization activities to paperwork and automate their accounting.

6.Combined-Systems - such systems combine several systems of the above, provide end-to-end operation with data, significantly increase the stability and security of the system as a whole.

7.Blockchain based Systems – the most promising from the point of view of information security direction for software in the field of education based on the use of linked list. The use of Blockchain technologies will take the security of educational organization's data to a new level.

Blokchain Technology distinguished by the fact that once trapped in her information cannot be deleted. Based on this approach, it is possible to use it in areas not than only financial affairs. Let us consider the examples in which the maximum security and reliability in the framework of the activities of the educational organization is required [13]:

- registration of incoming letters and documents;
- internal documents accounting;
- maintaining a portfolio of students;

- maintaining a portfolio of teachers;
- using the services of virtual phone system;
- registration of documents submitted for admission;
- maintenance of the electronic training log;
- the results of the state certification;
- accounting of graduates of educational organization;
- registration of users in the infosphere of the educational organization;
- carrying out and control of advertising companies of educational organization.

Let's demonstrate the statistical data obtained in the survey of masters of the first year of study before, during and after the study of disciplines related to the information space of the educational organization (Figure 2).

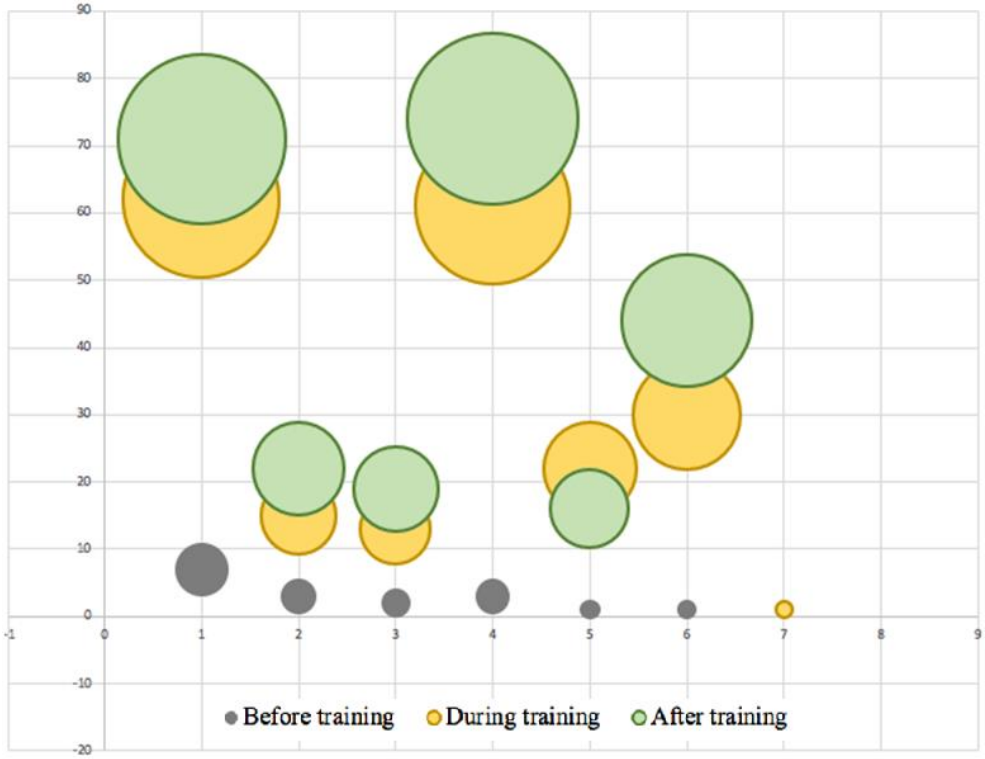

Figure 2. The use of cloud services before, during and after training specialized master's degree subjects

They clearly demonstrate the transition to the use of various cloud services in their professional work of employees of educational organizations. The most popular are the technologies under numbers 1 and 4 of the presented list, namely the system of joint work and the system To-Do list for the organization of own and collection activities. The next most popular are the combined-systems. An interesting situation has occurred with the systems number 5 and 7: their implementation and use is how difficult, which is

possible only in the presence of a highly qualified system administrator. Systems numbered 2 and 3 are not very popular due to the need for structured, volumetric and regular filling. Taking into account the volume of documents and reports currently available in educational institutions, such systems do not find a response from employees.

3. CONCLUSION

Cloud technologies represent an opportunity for educational organizations to use great advantages both in the educational process and in the management of an educational organization. When used collectively, they significantly increase the level of information security and increase the speed of embodiment of digital processes. The use of modern tools increases the speed of response of the educational organization, automates reporting and systematizes multi-pass processes. Documenting the activities of the administration creates conditions for its mobility and allows for a retrospective analysis to improve the quality of processes. However, educational organizations are still not without reason concerned about security issues. Risks in the use of cloud technologies can be a serious obstacle, which can interfere with the implementation of cloud technologies. With proper use, information in the cloud is usually much better protected than local information in an educational organization, but the use of such services and systems requires teachers and administrators to spend time on the development of new competencies. Over time, these costs are fully recouped by the efficiency and productivity of joint interaction.

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