Cloud Computing as a Means of ICT-Competence Formation of Future Teachers of Physical and Mathematical Science

Shevchuk Mikhail V.
Moscow State Regional University (MRSU)
Moscow, Russian Federation

Shevchenko Victoria G.*
Moscow State Regional University (MRSU)
Moscow, Russian Federation

Gran Tatiana N.
Moscow State Regional University (MRSU)
Moscow, Russian Federation

Abstract-The article substantiates a justification of the urgency of the formation problem of ICT competence of future teachers of physical and mathematical science in the conditions of education system and the development of network technologies modernization. The article reviews the special competences in the field of cloud computing, highlighted in the ICT-competence structure of a teacher of physical and mathematical science, as one of the most important components of a modern teacher's ICT competence. The overview of various software classes that are implemented as cloud services and can be an alternative to desktop software is provided.

Keywords-cloud computing, cloud services, teaching methods, information technology

I. INTRODUCTION

Nowadays, the teacher's knowledge and skills should actually cover all areas of information and communication technology. The teacher should be able to carry out the retrospective analysis of technologies that have not been used in educational and other areas of education for a long time, in order to have an idea of technology trends and have the opportunity to enlighten students about it.

At the same time, the teacher must possess the most modern and developing information technologies in order to give students the most complete picture of the world of modern computer technology and innovative technologies. One of the actively developing modern information technologies areas are virtualization technologies and cloud technologies [4]. The essence of cloud computing is to use remote computing resources through a web browser interface, which is accessed when there is an Internet connection, regardless of the remoteness of users [3].

The usage of cloud computing and virtualization systems in the learning process, as well as the building a methodical training system that is based on it, are an effective tool for the competence formation in the field of cloud computing.

The main directions of ICT - competence formation in the field of cloud computing:

- The mastering and systematization of knowledge in the field of cloud computing.

- The training in network services selection based on cloud computing in order to introduce them into the educational process.

- The mastering the skills of working with cloud services.

- The training in the development of methodological support for organization and maintenance of educational activities based on cloud computing.

- The development of design and research skills using network services with the usage of cloud - based network services in the development of e-learning materials.

- The development of professionally significant personal qualities and communication skills in network interaction with usage of network services based on cloud computing.

- The competence in the field of ICT will allow the future specialist to be competitive in the labor market, be ready for continuous professional growth and professional mobility in accordance with the needs of the modern education system.

Formed competence in the field of ICT will allow the future specialist to be competitive in the labour market, be ready for constant professional growth and professional mobility according to the needs of the modern education system.

The development of ICT competence of future teachers will be carried out more efficiently if:

- To reveal the possibilities of network services based on cloud computing for the ICT competence formation of future teachers of a physical and mathematical science.

- To develop and use criteria that allow effectively select the cloud services for studying (the possibility of multi-tenancy and self-service during registration; subscription mechanism, control functions, settings and management of applications and service users; the support for unique identifiers and authentication of service users; a certain level of customization for each student).

- To implement information and technological conditions, such as the usage of cloud computing (cloud services and platforms for development) in the development of studying materials, the selection of the most functionally appropriate cloud services depending on the form of organization of training activities, the use of organizational and technical measures and methods of information security during the work with cloud services, etc.

- To fulfill the requirements of safe use of cloud services for their use in educational activities of students and teachers (compliance with the rules of conduct and communication on the Internet; the usage of only secure Internet connections for access to cloud services; use of authorization, including a two-level authorization system during work with cloud services; the usage of complex passwords for access to services; use of services, especially data storage services that support encryption of not only personal data, but also stored information; selecting only known cloud service providers, etc.).

II. CLOUD COMPUTING IN EDUCATION

During the experiment, cloud-based services were selected: office applications based on cloud computing (for co-creation, editing and use on the Internet text documents, spreadsheets, and presentations); graphics editors (for collaborative creation, editing and use of graphic images); database management system (for joint creation, editing and use of databases); services for programming (joint design, development and testing programs); virtual remote desktops (to locate individual virtual work space); development platform; cloud-based antivirus and security software [5].

These services can be considered as an alternative to traditional software or an supplement to it, which extends the usual functionality with its additional communication capabilities and universal, independent access via the Internet to an organized individual virtual workplace. Furthermore, cloud services have unique network functionality that is not typical for traditional software of personal computers, familiarity with which will allow future teachers to form ideas about the popular functions of modern information and communication technologies.

Cloud computing has a wide range of didactic opportunities that contribute to the achievement of planned educational results, contribute to the formation of cognitive needs, the formation of analytical skills, a motivation increase of students, the functions of transfer and reproduction of social experience with use of the provided facilities, contributing to the universalization of graduates (the ability to master new facilities of activity, interdisciplinary knowledge, skills to change quickly), the creation of conditions implementing new types of educational activities, allowing to stimulate cognitive activity of students, research and project skills, development of General intellectual skills [2].

According to the modern directions of the modernization of the education system the development of modern technologies, it is reasonable to form students ' special competences that allow them to use successfully cloud computing in the professional activities of the future teacher.

This approach solves such problems as:

- Mastering the theoretical educational material in the field of cloud computing.

- An introduction to various cloud-based network services.

- Acquisition of skills to work with these services.

- The proper use of knowledge and skills in education.

- The planning and preparation of network services based on cloud computing for their use in the organization of the learning process.

- The development of methodological support for the use of network services based on cloud technologies in the organization and maintenance of educational activities.

Special competence of the future teacher, the formation of which should be given special attention:

- The ability to select network services based on cloud computing in accordance with the educational objectives..

- The ability to use cloud computing for the organization and implementation of the educational process at various levels in educational organizations.

- The ability to use cloud computing to carry out education in the framework of distance learning.

- The ability to analyze the security of network services based on cloud computing, taking into account the requirements of information security for education.

The development of cloud computing is a relevant solution for many educational problems. The use of cloud computing makes it possible to create an innovative educational environment of the University due to the realisation of new cooperations between all participants of educational relations, which contributes to the formation of multipurpose, general pedagogical and professional competences, providing training for graduates to solve pedagogical, design, methodological and research problems. Formed special competences in the field of cloud computing allow the future teacher of physical and mathematical science to find a more effective way to solve professional problems arising in the real educational process.

One of the directions of using cloud computing in the process of subject and methodological training, contributing to the formation of preparedness for professional activity, is the design and organization of project activities of students.

Project activity is an important component of the training of a competent, creative teacher with deep subject knowledge and a high level of professional readiness [1].

Educational and methodical projects should be of a research nature.

They could be run both individually and collectively.

These projects have a high educational potential, and formed professional competence of graduates, including ICT competence, can be considered as an educational result of their systematic research activities at the University.

During the implementation of these projects, students can form new methods of using cloud computing in the educational process, that will contribute to the better formation of special competence in the field of cloud computing.

The organization of project activity with the help of cloud services contributes to the creation of information educational environment of the University, which motivates students to independently produce and process information, as well as to share this information, quickly and freely navigate in the information space that surrounds them.

The educational and methodical projects carried out with the use of cloud technologies have a great innovative potential: "Designing a system of tasks", "Construction of control and measuring materials for the assessment of educational achievements of students", "designing an innovative lesson", "Designing an elective course of the physical and mathematical cycle", "Designing a technological map of the lesson", "Mathematics in the world of professions" and others. Great interest among students is the work on the project "Design of educational crossword puzzles" using the cloud service "crossword Factory». The work on the project "Design of educational crossword puzzles" using the cloud service "crossword Factory" is of great interest to students.

Project activity based on cloud services helps the development of cognitive independence of the student, his personality, provides the individuality of the student in the educational process, promotes the activation of his cognitive activity. Project activities based on cloud services can be considered as a tool that will improve the quality of the educational process.

Self-education is a significant part of the professional activity of the teacher. It is an important condition for improving professional skills. One of the means of forming the ability to self-education is the independent activity of students.

Within each discipline it is necessary to develop tasks for the organization of this activity and to think over means of its control.

The effective means to successfully organize and control this type of activity of students are network services based on cloud computing, the use of which is possible at all stages of mastering the training material.

The educational results of independent activity of students using this technology can be presented in the following form: laboratory work, technological maps, abstracts, essays, programs, reports, educational projects.

During the student's independent activity the cognitive independence is formed, creative thinking and self-control are developed, which help them to make their own decisions and act in the difficult conditions of modern life.

An interesting instrument that stimulates the innovative activity of the student using cloud computing is the creation of student's methodical portfolio.

It includes a variety of materials that he developed in the field of teaching methods (teaching projects, abstracts, abstracts, summaries of the best lessons learned during the practice, the development of activities for extracurricular activities on the subject). The portfolio allows to estimate the level of student's readiness to professional activity, including to carrying out innovative activity.

III. SUMMARY

Information technologies based on cloud computing have a great potential in the field of education development. With the use of cloud technologies facilities, it is possible to effectively organize and optimally support the information educational environment of the educational institution with the least time and financial resources, which will allow the released resources to be directed to improving the organizational efficiency of education. Due to the rapid introduction of cloud computing in the field of education, reducing the cost of the temporary Fund and optimization of administrative resources of educational organizations will be provided in the preparation and submission of regular reporting information on the stages and effectiveness of its management activities, as well as on the current education of teachers and students, which will allow all interested participants to have an accessible opportunity for interactive participation in the activities of the educational organization.

The use of network services based on cloud computing allows to increase the efficiency of training, to form special competencies, to identify the interests and abilities of students, to work with various information sources, Internet resources, to conduct research independently, to form skills of collective activity.

The use of cloud technologies provides opportunities for active involvement of students in the educational process and their immersion in the information and educational environment of the University, creates conditions for student's creative activity and the growth of their initiative in the future practical teaching activities.

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