POSSIBILITIES AND APPLICATIONS OF CLOUD COMPUTING IN THE EDUCATIONAL PROCESS

Mariyana Nikolova[1], Petya Byalmarkova[2]

[1] Mariyana I. Nikolova,
St. Cyril and St. Methodius University of Veliko Turnovo
Veliko Turnovo 5000, Bulgaria
Email: mnikolova_vt@abv.bg

[2] Petya Y. Byalmarkova,
St. Cyril and St. Methodius University of Veliko Turnovo
Veliko Turnovo 5000, Bulgaria
Email: petia_iord@abv.bg

ABSTRACT — This document presents the main opportunities and challenges based on structural principles and potential capabilities of the cloud, as applied to the world of education. The purpose of this document is to show how a recent technological development could lighten, in some regards, the burdens of equipment, management and new teaching methods.

Keywords: Cloud computing, education, e-services, flexible learning environment, resources

1. INTRODUCTION

New methods and tools have always been accepted by the education at different rates. By starting using computers in classrooms all educational institutions try to meet the society demands.

The applicability of Cloud Computing in education is related to the nature of technologies offered and provides a flexible learning environment and accessible resources. Such an environment corresponds to the needs and objectives of "modern learning" and allows adequate learning scenarios appropriate for joint learning and quick access to new technologies and resources.

This article explores cloud technologies as a flexible and technological learning environment. The emphasis is laid on the application and services offered by Cloud Computing, student motivation and changing profile of learners and trainers. The three main areas where cloud technologies could be applied are sharing resources, collaborative work and communication environment.

The aim is to analyze the role, possibilities and applying cloud technologies in the educational structures summarized in a structural model and to present the reality in Bulgaria at different levels, as part of a survey of 226 participants.

2. EXPOSITION

2.1. Cloud Computing as a model for accessing e-services and resources

Cloud Computing is another stage in the Web-based development services that uses the Internet and central remote servers to support data and applications. This is a new paradigm that provides virtualized resources (computing power, applications, business services and on-demand services) as an Internet service.

Cloud definition

According to the official US National Institute of Standards and Technology (NIST), Cloud Computing is a model that provides ubiquitous and user-friendly access to common configurable computing resources (networks, servers, database, applications and services) that can be quickly secured. The NIST definition identifies five important features of Cloud technologies:

- ✓ self-service when this is needed;

- ✓ permanent network access;

- ✓ pooling and sharing resources;

- ✓ immediate access and flexibility - "variable elasticity";

- ✓ price changing depending on the consumption (pay-per-use), and e.g. evaluating the services used.

Cloud structure

Regardless the model (public, private or hybrid cloud), the structure of the cloud can be divided into three main layers [Sultan, 2010], [Pyramid research, 2015] in a pyramidal pattern (Figure 1):

➡ *Software as a service (SaaS)*. SaaS is any cloud-based application or service (Facebook, Google Drive, Airbnb, or Uber). This is the layer facing end-users and provides the desired functionality: social and media communication, access to documents, shared information, reservations, etc. This model offers a limited set of functionalities and has no control over the computing resources. Software applications are available as Internet services.

➡ *Platform as a service (PaaS)*. PaaS is a basic level of Application Programming Interfaces (APIs) that allows developers, researchers and scientists to configure the resources needed for their work to be used within the limits set by the platform.

➡ *Infrastructure as a service (IaaS)*. Hardware resources are provided as customer services, while allowing institutions to employ these resources. IaaS is the lowest level of cloud services. This layer can work with the hardware provided by service providers. The level provides the most capabilities (load balancing, backup, versioning and infrastructure restoration) but requires a significant set of skills for proper use and development.
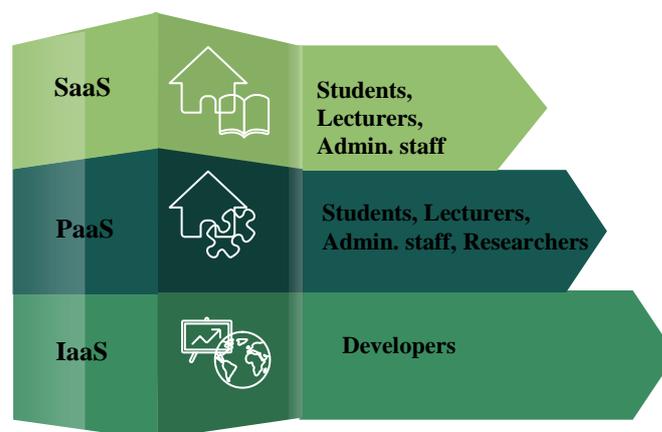

Figure 1 Cloud pyramidal pattern

176

2.2. Applying cloud technologies in learning

The applicability of Cloud Computing in education today is related to the nature of technology offered and provides (Figure 2): *flexible learning environment; accessible resources; effectiveness.*

The benefits of Cloud technologies for education can be assessed in several ways:

✓ Fast acquisition, provision and introduction of new IT solutions;

✓ Better and more efficient use of IT equipment;

✓ Focusing on specific activities;

✓ Stimulating and supporting research;

✓ Sharing learning resources and activities combined with collaborative work among all participants in the learning process.
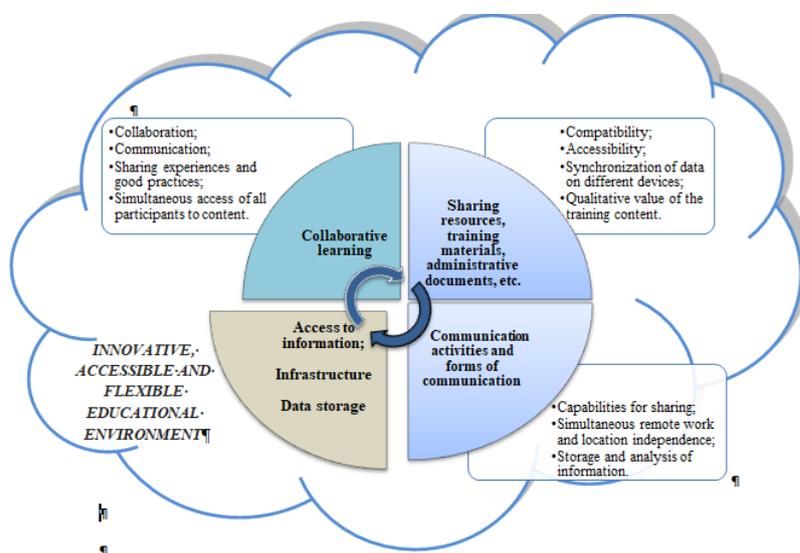

Figure 2 Applying cloud technologies in education

Flexible learning environment

Cloud technologies are imposed in the educational structure by offering a flexible learning environment rich in opportunities, resources and tools in three main areas [White Paper, IBM]: *sharing resources; collaboration; communication.*

This learning environment offers an individual approach and maximum match of specific needs.

Centralized cloud infrastructures allow faster access to technological changes such as virtualization, component modularity, etc. that promote flexibility, including the speed of use of services and resources. This stimulates and supports teamwork, development and research. The main features of this process are:

✓ *smooth adaptation to ICT resources* (servers, databases, computing power, application administration, content), thanks to the flexibility of the infrastructure and easy access to resources for specific needs. Using cloud-based IT, newer versions of applications or software application platforms can be easily spread;

✓ *flexibility in the provision of learning content* - customized training that meets the specific needs of each learner. Students have access to all available content as well as find the information and tools they are looking for and which are relevant and close to the relevant learning stage;

✓ *flexibility in terms of the number of necessary pieces of equipment* - cloud architecture can potentially support any type of client hardware and application (depending on the service provider);

✓ *possibility of self-service* by trainees, teachers and educational institutions;

✓ *flexibility of learning* - providing easy access to courses and content at any time, in any place; learning opportunities outside the school and university, as well as outside the school and academic calendar (holidays, continuing education, post-graduate qualifications).

Available resources

�« *Access to information.* Users use non-install applications and access personal educational and administrative information from any computer that is connected to the Internet. The main advantage of this service is access to e-materials and learning resources in accordance with the needs and independence of the site and the possible access devices for a certain available infrastructure.

➤ *Data storage.* Certain disk space is used to store data [Kenova]. Teamwork and collaboration opportunities are provided, and specific and user-friendly information can be accessed at any time and from anywhere. Cloud storage providers are responsible for maintaining the availability and accessibility of data as well as for working in secure environments. Any data format can be stored in the online repository, and cloud users can access their own files from different devices.

Best places for data storage within the cloud for 2018 according to [TechRadar] are: Dropbox; Google Drive; Mega; OneDrive; Box; NextCloud; SpiderOak; Idrive; pCloud. Their characteristics can be summarized as follows:

✓ Shared access to resources, files and tools to add interactivity;

✓ User-friendly interface;

✓ Good synchronization with different categories of users;

✓ A suitable environment for collaborative (simultaneous) work on files;

✓ Existence of file recovery functionality;

✓ Data transfer in encrypted stream - at the input and output;

✓ Basic business features, including collaboration;

✓ Maintaining a plurality of applications (Apps);

✓ Offering innovative products (complete Office package) and cloud data repository with additional functionality (Chrome Webstore).

Effectiveness

The location and accessibility of IT resources provided by cloud technologies promotes the dynamic exchange of information and events (seminars, conferences, workshops, etc.) between lecturers, trainees, administration, governing bodies and other structures. The opportunities available provide numerous methods and techniques leading to more productive and effective learning (increasing the level of understanding and achievement within a specific stage of

education, increasing the chances of success, obtaining more up-to-date information on events, activities and opportunities for quick performance, etc.).

Sharing equipment leads to synchronization of resources, avoiding the incompatibility problems or difficult integration between different tools and systems (even within the same institution).

Sharing quality learning content eliminates and avoids inequality in education and promises fair access to educational and learning resources.

These opportunities are part of the solution to overcoming the digital divide and promote new ways of accessible education.

The effectiveness of implementation and use of cloud technologies in education can be summarized in the following aspects:

➥ *Convenience and improved accessibility.* Information and resources can be accessed from anywhere and with every device by users, while at the same time there is convenience and ease of use. The only requirement is the device to have Internet access. The user is not required to pay for a software licence or to upgrade data.

➥ *Access to resources.* Students can use new technologies and have access to good practices. Educational institutions use and provide databases such as electronic resources, publish or view current documents, analyses, reports, presentations, reports and documents of a different nature.

➥ *Cost savings.* By pooling or sharing resources, the cost of installing IT infrastructure is reduced.

The Cloud saves [White Paper, IBM]:

✓ the costs of virtualization for the equipment, which reduces the number of required systems;

✓ the costs of providing software licenses, servers' physical security, etc.

✓ the size and complexity of the equipment and software which is to be installed;

✓ service-based charging based on actual use of resources (pay-per-use only);

✓ saving human resources (the necessary technical staff for managing the internal network and the technological infrastructure).

3. LECTURER'S NEW PROFILE

Acquiring new skills and knowledge in the context of modern sources (Internet vs. Board) implies a new relation information - knowledge that is now easier to access or can be used differently. There is a difference between individual teaching and the functioning of flexible learning communities, because the virtual work differently, depending on the area of learning and the people involved [White Paper, IBM]. This means students can be in the same classroom but work in virtual networks that are very different from each other.

This requires teachers to be able to: Manage students in the new "time space" that is being created; Target and apply different learning methods (including social networks, online, virtual environments, etc.); Act as "arbitrators" and counselors to avoid bad habits (e.g. filtering "wrong" knowledge gathered from the Internet or from "friends" on social networks); Stimulate modern teaching based on student co-operation and encouragement of their more active participation in classes, which is motivated by unlimited access to information.

179

The acquisition of knowledge, skills and competences is changing in the context of new technological environments and the nature of changing activities. This is also part of the Ministry of Education strategy for continuous qualification of pedagogical specialists.

The authors have set themselves the task to take part in the realization of the "mission" to raise teachers' competencies for the effective implementation of cloud technologies:

✓ The introduction of innovative practices leads to new opportunities for interaction – administration - teachers, teachers - teachers, teachers - students, students - students;

✓ Extending the possibilities for planning and monitoring the implementation of various activities, team- building and collaborative learning, various forms of testing and analysis of results, opportunities for changing the role of the teacher;

✓ Holding various meetings, seminars, working groups and addressing issues related to strengthening the positive aspects (trends) from the supervisory work of the Regional Inspectorate of Education;

✓ Implementation of didactic models for adapting the educational system to the digital generation.

Teachers should be able to master modern technological tools, including cloud technologies, to apply new approaches and techniques that provide flexible learning environment.

4. SURVEY RESULTS

Data from studies on application of cloud technologies in the Bulgarian educational environment direct the analysis to the cross-sectional situation in several distinct categories (Figure 3).

In *elementary school* (1st to 4th grade), cloud technologies are commonly used as convenient and fast ***teacher-parent*** contacts, where information on interesting activities and events in school is updated daily; ***teacher-teacher***, for sharing good practice, sharing and providing electronic learning materials; ***teachers - Regional Inspectorate of Education***, sharing important documents, legislation, current messages, conducting online seminars, conferences, discussions, etc.

In *5th to 12th grade*, besides the already mentioned applicability, there are some additional relations and participants: ***teacher-student***, for sharing electronic learning materials, homework, projects, online real-time communication, etc.; ***student-student*** exchange of e-materials, sharing resources and good practices, online seminars, discussions, etc.

With regard to the *higher education* institution, particular attention is paid to the ***training of pedagogical specialists*** and their skills to use and effectively apply the specific features and functionalities of e-learning environments and platforms and the cloud technologies and services tools.
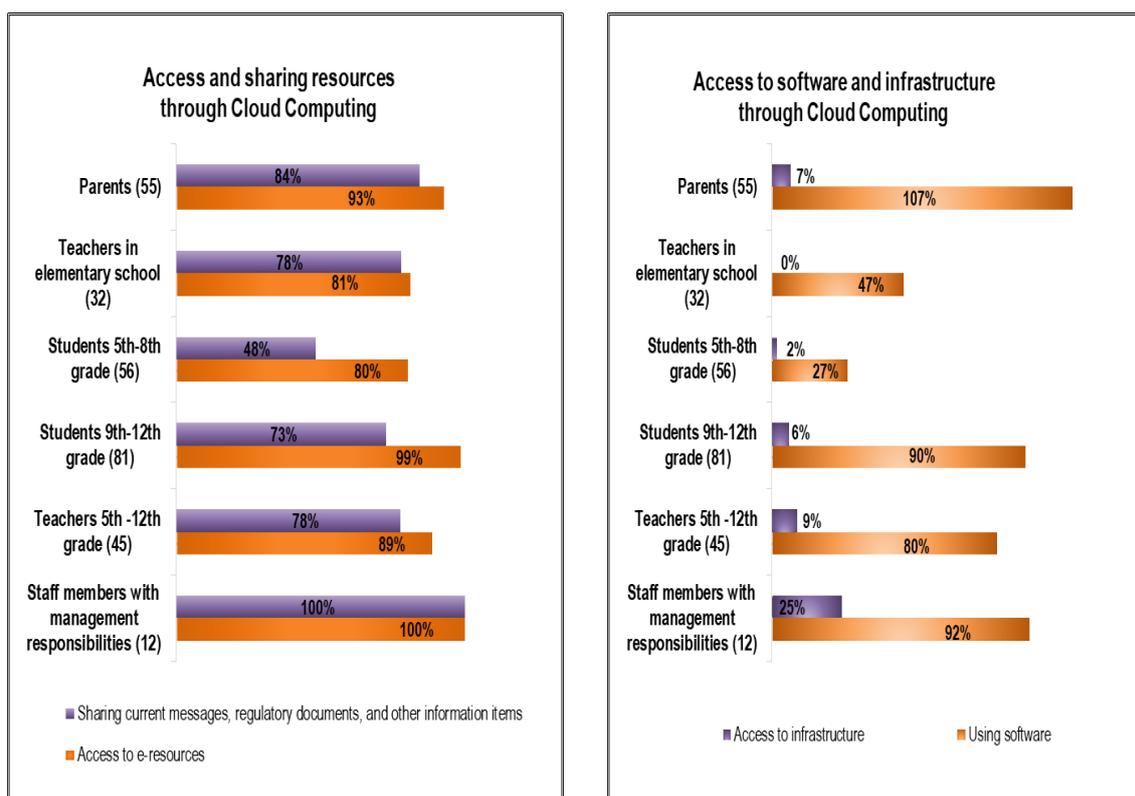
Figure 3 Cloud Computing at school

The results shown in Figure 3 are represent aggregated data for the individual use of cloud services of different categories. No summary analysis has been carried out at the level of schools and type of towns, cities or villages, which is yet to be published as a separate material and is a task of future work for the team.

There is no universal platform in the Bulgarian education system. Each structure and institution (school, college, university) decides locally and autonomously what cloud systems to use, related to platform-related dependencies and features (PaaS) and software delivery (SaaS). The most commonly used for sharing resources are: Dropbox, Google Drive, OneDrive, pCloud platforms; Microsoft technologies and services - Office 365, Skype for Business as the main channel for communication and holding joint seminars, meetings and more.

The practical application of Office 365 in education (and in business as well) makes schools be a part of the cloud and thus the sharing and learning of content, administration and communication are based on advanced technology solutions.

5. CONCLUSION

Cloud technologies are imposed on the educational structure as a technology providing a flexible learning environment. Options and tools are available in three main areas: sharing resources, working together and communicating.

The "solid walls" of the classroom yield to technology, incl. cloud services and the Internet, making it possible to communicate with students at any time of the day; real-time dialogue to solve problems and tasks, advice and consultation from any point, conducting scientific experiments in a virtual lab without need to be all together, and so on. As a result, the learning

www.e-acadjournal.org

processes are personalized and individualized, a different environment that meets the learner's needs and educational objectives is provided. This environment allows learning approaches and scenarios which are complied to the leading paradigms such as social constructivism and collaborative learning.

The authors continue the research on applying cloud technologies in the Bulgarian school, with the final aim to complete a study with a representative sample for all levels of the educational system.

6. REFERENCES

Kenova, P. (2015). Cloud technologies, Sofia, https://fin.unibit.bg/images/pdf/bakalavri/Kovacheva_21_KNz.pdf.

Nabil Sultan (2010). Cloud computing for education: A new dawn?, International Journal of Information Management, (109–116).

White Paper (2012), IBM Global Technology Services, Applying the cloud in education, IBM Corporation, http://www-935.ibm.com/ services/be/en/cloud-computing/cloud_edu_en.pdf

TechRadar, Best cloud storage of 2018: Free, paid and business options, https://www.techradar.com/news/the-best-cloud-storage.

Pyramid research (2015). Etisalat UAE expands its IoT service offering, https://www.pyramidresearch.com/analyst-notes/pyramid-points/etisalat-uae-expands-its-iot-service-offering/