CLOUD TECHNOLOGIES IMPLEMENTATION IN SECONDARY EDUCATION

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Abstract. The current article is about the implementation of cloud technologies in secondary education in Bulgaria. An overview of the development and nature of cloud technologies is made. Practical experience is gained from the deployment of cloud technologies in a particular Bulgarian school. The use of cloud technologies facilitating the work of the school administration and increasing pupils' interest in the learning process, as well as their activity in the school, is shown.

Keywords: cloud technologies; innovative technologies; secondary education; school administration; learning process

1. Introduction

The rapid development of Information and Communication Technologies (ICT) and their widespread application in practice requires the absorption of new knowledge, skills and competencies for work in an information environment. It is considered that for a successful business development, young people need to learn and successfully use and develop new digital technologies. In modern economies, the deployment of the so-called "cloud" technology is one of the signs of integrating digital technology into business. In order to prepare young people for the use of cloud technologies, they need to be implemented in schools. The use of cloud technologies in education can lead to the following positive results:

- allows the learning process to run wherever there is Internet and a device for access to information and learning resources;
- facilitates teamwork for students, teachers and employees;
- enables online collaboration regardless of the team members' location;
- provides for the rapid and secure exchange of information and documents;
- reduces the use of paper in the performance of administrative processes;
- each participant is electronically identified with his/her profile in a specific process;

– the information is protected according to the requirements of the General Data Protection Regulation (European Union Regulation).

In the first section of this article, "Cloud Technologies", we look at the emergence and nature of these technologies. In the second section - "Implementation of cloud technologies in schools", the implementing of cloud technologies in schools so far is regarded. The last section describes the implementation of cloud technologies in a specific Bulgarian school - achievements, problems and solutions.

2. Cloud Technologies

Cloud technologies are a relatively new information service. In April 2001, in a New York Times article by John Markoff, the expression "cloud of computers" appeared. The article commented on the Microsoft.NET platform and the negative position of the software engineer David Weiner, using the cloud concept in the same way that it is used today: "For Microsoft, the idea behind. Net is software programs that do not reside on any one computer but instead exist in the "cloud" of computers that make up the Internet… Since last summer, Mr. Gates has been working to transform his company through systems like the recently announced Hailstorm project, which aims to move most of a computer user's personal information – from daily calendar to banking information – from the desktop PC and into the network cloud, where a user could have access to it from a variety of devices and locations"[1].

It is believed that the term "cloud computing" has been introduced by Eric Schmidt from Google on August 9, 2006, at a search engine conference where he explains a possible approach to software as a service (SaaS). Referring to it in the context of Google becomes a prerequisite for the association of platform and infrastructure as a service (PaaS / IaaS) with the way Google Inc. manage their computing centers and infrastructure.

Today, cloud computing is considered to be the fifth public utility used, after the use of electricity, gas, water and phone.

Cloud technologies allow the use of shared resources, software and information. The term refers to both software applications provided in the form of Internet services and access to the hardware and system resources of a data center that offers these services. Cloud technologies provide the following benefits to those working with them:

1. ***Flexibility and Competitiveness*** – Cloud-based services are user-friendly for growing or changing data traffic needs. With increasing needs, it is easy to increase cloud space by relying on remote servers. Likewise, space can be reduced. This flexibility, as well as the access to high-tech technologies, gives companies using cloud services a major competitive advantage.

2. ***Data storage and retrieval*** – data storage and recovery is a primary task for consumers. The largest users set funds aside for this, but small users with

insufficient resources are turning to cloud-based storage and recovery solutions that save time and reduce long-term investment.
3. ***Lack of Capital Expenses*** – Cloud services reduce high hardware costs and cloud service providers take care of software updates.
4. ***Enhancing Team Efficiency and Document Control*** – Cloud-based processes and sharing applications help teams to update the information in real time and have a full view of collaborative work.
5. ***Working through random devices from any location and at any desired time*** – cloud services can work anywhere as long as there is an Internet connection.
6. ***Security*** – Data is not stored on a device that may be damaged or lost, but on remote servers that have built-in information protection and data protection as required by the European Union Regulation.
7. ***Environmentalism*** - paper usage is reduced and only the amount of energy needed by the user at a given time is used.

Cloud technologies allow people to access any information from anywhere in the world. All information is available online, and when data or communication is to be made, it can be done through the Cloud. According to many studies, the use of cloud technologies has been constantly growing. The adoption of open source software, spatial analysis tools and so on in the community of geospatial objects is constantly increasing, and this is due to the improved infrastructure caused by the Cloud. The number of users of cloud technologies in the industry has increased and is expected to continue to increase steadily in the future. This is a really big transition, so the business community has to focus its resources on the adoption of new digital technologies.

3. Implementation of cloud technologies in schools
According to the Digital Economy and Society Index (DESI) for 2018, the report for Bulgaria states: "Compared to last year, Bulgaria made progress in connectivity and the availability of digital services. In particular digital public services improved, resulting in an increased number of e-government users. Bulgaria's main challenges relate to the very low level of digital skills among its citizens – also among young people – and the low integration of digital technologies by businesses. In particular, the low level of digital skills combined with shortages of ICT specialists and underinvestment in digital infrastructures may be among the reasons why the digitization process in Bulgaria is slow both in the public and private sector"[2].

Businesses can engage in more intensive digital integration by employing staff trained to use the technology. Absorption of cloud technologies is one of the signs of the digital technologies integration in economy - an indicator by which Bulgar-

ia (along with Romania, Poland, Hungary) lags behind other European countries. Leading in digital integration among European countries are Denmark, Finland, Ireland and Sweden[3]. These countries also belong to the group most actively introducing cloud technologies into their education systems.

Only seven European countries have introduced cloud-based platforms in their secondary education systems, with Belgium, the Netherlands, Luxembourg, the UK and Portugal leading. There is no country in central and eastern Europe that has a cloud platform in education.

According to the Strategy for Effective Implementation of Information and Communication Technologies in Education and Science of the Republic of Bulgaria (2014 – 2020) "The implementation of cloud technologies in the education and science system will allow mobility, accessibility and up-to-date education and scientific resources to be ensured. The cloud environment will allow uninterrupted use of permanently updated computer infrastructures, software tools and services. The funds for construction and maintenance of local infrastructure will substantially decrease, the technology will allow scientists, educators, students and their parents to participate in the educational process via personal computing devices"[4].

The Center for Creative Training is an organization that is pioneering the implementation of cloud platforms in education in Bulgaria and is the only partner of Google and Microsoft for education at national level. It is a non-governmental organization set up in 2008 to make a qualitative change in education and training. The Center carries out a number of activities related to lifelong learning, and actively works in the field of formal and non-formal education. The aim is to improve the educational environment in Bulgaria by developing key competences, unlocking the potential of both learners and training specialists, and successfully raising competitive staff in the professional and social spheres of their lives. The Center also works actively on introducing a holistic approach to general education that addresses the physical, mental and social aspects of the student's overall personality. The Center for Creative Training offers teacher trainings that show alternative and interactive methods of applying technologies both in and outside the classroom. The Center's experts develop complete classroom technology solutions based on the "Creative Classroom" model. The Center experts' opinion is based on the team's experience gained from the visit of over 1000 schools in Bulgaria, the practical assistance in the introduction of technologies in the classroom in the model of the Creative Classroom in schools in the country, and the regular visits at the world's largest exhibition of educational technologies, BETT Show in London, England, where the latest technological innovations are presented. The organization also has experience in deploying measures that contribute to the implementation of the National Lifelong Learning Strategy, the ICT Strategy and the development of key competences under the "Lifelong Learning" Program and ET2020. At the reference date of this article, according to the Center for Creative Training, cloud

platforms have been activated in more than 300 Bulgarian schools, with about 5 to 10% of the staff employed being trained in cloud technologies. In a few of these schools, however, cloud technologies are being used to their full potential or good administrative and pedagogical cloud practices have been developed. This is due to both the insufficient number of trained cloud specialists and the limited support for the systematic introduction of cloud technologies in school practice.

In the Strategy for Effective Implementation of Information and Communication Technologies in the Education and Science of the Republic of Bulgaria (2014 – 2020), cloud technologies are defined as one of the sustainable global trends in the development of the informatics tools. ''They are based on centralized storage and processing of information, flexible resources management mechanisms and their remoteness from the user. The main advantages of cloud technologies are the efficient use of technical means and information resources, reduction of resources for development and operation of systems, the possibility of providing a high level of protection, etc.''[4] Therefore the MES (Ministry of Education and Science) provides a unified information environment and modernization of the educational and scientific infrastructure.Cloud technologies require fast Internet access and connectivity.Due to the need of building a high-speed supportive optical network for the education and science, providing a transport environment for access to Bulgarian and international electronic resources, as well as wireless networks (Wi-Fi type and other), MES implements a program for development of wireless networks for the needs of state and municipal schools.

Another positive fact is that a community of ''cloud'' teachers is being established in Bulgaria and they share experience with each other, as well as with interested colleagues. There are schools where cloud technologies are actively used to manage administrative processes, teaching and training. These schools are willing to share their good practices.

Cloud technologies allow the teacher and students to connect in a variety of ways, exchange ideas, information, various files - text, graphics, videos, and more. Creating groups and digital classrooms makes it easier to organize the teacher's communication with all-class students or with different teams. The applications include a word processor, a spreadsheet program, presentations, a site application, and others that work online without computer installation. A positive aspect is the ability to edit a shared file from different users. The calendar allows planning of activities to be made available and allows the common plans timetables to be monitored. The deployment of cloud technologies increases teachers and students' digital competences.

4. Implementation of cloud technologies in a particular Bulgarian school

In the article certain achievements, problems and solutions will be presented for the implementation of cloud technologies at the Professional School of Food

Technologies (PSFT)in Plovdiv. The cloud platform used is G Suite - Google for Education.

In November 2017, the implementation of cloud technologies in PSFT Plovdiv began. Over the course of a few months, 16 teachers (including a principal and two vice principals) have been trained to work with cloud technologies under 4 major programs approved by the Ministry of Education and Science:

1) Cloud School: Introduction – 16 teachers;
2) Cloud School: Communication and Organization – 16 teachers;
3) Cloud School: Creating Content – 16 teachers;
4) Cloud School: Administration and Management – 2 teachers;

The training organization is the Center for Creative Training and the training was conducted with the cooperation of the Municipality of Plovdiv.

With the support of the Center for Creative Training, one of these teachers is also a Certified Google Trainer.

There are two aspects to the implementation of cloud technologies in a school - the use for administrative purposes and the use in the learning process itself.

First, let us look at cloud technologies in managing administrative processes.

By the end of 2017, the G Suite for Education is activated and set up in PSFT Plovdiv. By the end of January 2018, a new Wi-Fi network was established in the school. Domain administrators include one vice principal, a Certified Google Trainer, and two other school teachers. They created professional profiles for all PSFT teachers and staff. The official e-mail address of the school has been changed to improve the security of information exchange. Rules and regulations have been created for working in the PSFT domain.

By April 2018, all teachers who have not been through the Center's training, as well as some of the school's employees, passed an inside "Cloud School" qualification course and were prepared to work with the G Suite tools. The training was conducted by the Certified Google Educator.

Class tutors receive sub-organization administrators' rights and make school profiles for students in their classes. The domain administrators create groups for each class, as well as ones that meet the needs of specific subjects. A PSFT team drive has been created, in which teachers and employees can share information of any kind – text documents, presentations, spreadsheets, pictures, videos and more. This is done through a strict organization of folders – for example, there are sub-folders such as "Scholarships", "Sanctions", "Lists", "Absences", "Traffic Safety", "State Matriculation Exams", etc. in the "Class Tutors" folder, with relevant documents in them, as well as separate documents, such as a spreadsheet for automatically calculating average students' marks and absences at the end of the school year. The "Health and Safety at Work" folder contains instructions for students, teachers, employees, outside visitors; plans; programs; presentations for disaster

and accident prevention training, etc. There are also folders "Personal Data Protection", "Annotations of majors", "Competitions", "Olympiads", "Laws and Regulations", "Methodological Unions", "Documents for pupils with special educational needs" and many others. The PSFT team drive actually contains all the information exchanged in the school, including school regulations, plans, schedules and other documents. These are available to any teacher or employee at any given moment from anywhere - it's enough to have an Internet connection and an access device (phone, tablet, laptop or computer). This way the work of the administration is considerably alleviated and the use of paper abruptly decreases, respectively, so does the consumables' costs. It is no longer necessary for committees to physically gather in one place to create plans, schedules, or other documents, or to forward files in countless versions – all can work on their tasks together, even if they are miles away, while at the same time, see the changes made by colleagues in real time. The weekly task plan has been available to everyone since the previous week and no longer needs to be read in the teacher's room. Pedagogical councils are considerably shorter, as the rules, plans, reports, schedules discussed are pre-uploaded in the "Documents for Upcoming Pedagogical Councils" folder, and everyone has the opportunity to know the content before the meeting itself. All polls and surveys are made quickly and easily by using Google Forms. If there is a need for an emergency meeting, it is enough a vice principal to create an event in the electronic calendar and send an invitation to the teachers' group – all of them are ready to respond to the invitation received in real time, even if this happens on Sunday afternoon, and the meeting can be scheduled for the 25-minute recess on Monday morning. This is because even the personal smartphones of teachers and employees can be set up to receive messages on their professional profiles.

All information has a higher level of protection, as it is exchanged in the school domain and is unavailable to external organizations, even those who support the email service.

Difficulties that arise with the implementation of cloud technologies in the administrative processes of a school are related to both the available hardware and human factor.

Once a comprehensive Wi-Fi network has been built and all teachers, employees and students have access to the Internet, it remains the question of providing devices to use the resources of the school domain. This is easy for teachers in computer cabinets, but is not so feasible in Bulgarian Language and Literature classes, Mathematics or Chemistry, in classrooms with no computers or tablets for everyone. This problem is only partly solved, with the use of personal electronic devices – phones, tablets, laptops – by both teachers and students.

The second and most significant difficulty is some of the staff' inertia. The final switch from personal emails to professional ones only takes place after a decision has been made to send each email with official content, received from a personal

address, to the school's Spam folder. Some teachers and employees are currently in difficulty with the technical devices for accessing the resources of the school domain. Nevertheless, the percentage of teachers and employees using the PSFT team drive regularly increases. In September 2018, the school's Google Certified Educator passed another exam and became a Certified Google Trainer, one of the two in the Plovdiv district.In December 2018, 9 more teachers are certified as Google Educator Level 1. The Level 2 exam is yet to be held.

With the introduction of an electronic gradebook in the PSFT, the need to include pupils' parents in the school's domain was dropped. The necessary communication with them is done through the available electronic gradebook.

Let us now look at how cloud technologies are used in the learning process.

Google's tools are most often and most easily used in computer rooms, in Information Technology classes. Students format texts and documents, make spreadsheet calculations, create charts, presentations, sites, PDFs and integrated documents.They also do online tests, create projects, present homework. Their work is often organized in digital classrooms. Of course, they apply these skills in other subjects such as English, History and Civilization, Mathematics, etc.With Internet access, pupils can use the Google for Education tools in each class. They search, analyze and systematize information from the Internet on a given topic, check the authenticity of the sources. They write reports, work in teams on different projects, create presentations for different subjects.They do online tests and respond to surveys. All this is done in a cloud environment, using Google tools.

There are also some difficulties in applying cloud technologies to the learning process.One of them is the insufficient self-preparation of part of the teachers for working in a cloud environment. In order for a class period to be successful in the Cloud, it must be carefully and thoroughly prepared, using the appropriate digital tools. Some teachers still prefer classical teaching methods and are worried about using new technologies. Also, part of the curriculum has its own specificity that requires particular methods. However, cloud technologies are entering more and more classes, and more and more subjects.

The main difficulty is the insufficient availability of a hardware. There are still students without access to class resources due to lack of devices.They can use the available school equipment after school hours, but this makes their preparation difficult.On the other hand, many students prefer their own electronic devices and work through them, even with the availability of school equipment in given classes. This shows their growing skills to work with cloud technologies. New technologies are no longer an attraction or an exception, but natural tools for classwork.Homework can be created and sent to the teacher while the student is traveling by bus to home, the study for a report can be done while the student goes to a sports training session, etc. The accessibility of cloud technologies increases the employment of students with the learning process.

5. Conclusion

Cloud technologies are already a fact in Bulgarian schools. They help in managing administrative processes and teamwork, make communication more convenient, and the exchange of information – more secure. Accessibility of shared resources provides the opportunity for better and faster work, while reducing consumable costs. Cloud technologies provide a flexible learning environment, rich in opportunities, resources and tools, corresponding to the needs of students and learning objectives. Pupils raise their competencies and develop logical and critical thinking. They communicate more easily, learn to work with a great deal of information, extract the most important part of it and use it in the required context. The thorough use of cloud technologies enhances students' information culture, e-skills, and prepares them for the implementation of innovative technologies in real life. Cloud technology facilitates collaboration, information sharing and online civil society engagement, resulting in a digitally competent citizen of the world.

NOTES

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