

Cloud-based e-learning

Kosta Andreev Garov¹, Lambri Yovkov Yovkov¹, Liliyana Ivanova Rusenova¹

¹*Plovdiv University "Paisii Hilendarski", 24 Tsar Asen, 4000 Plovdiv, Bulgaria*

Abstract – Learning (and self-learning) is one of the most important activities in human professional and personal life. Over the past several years, there has been a very strong tendency to emphasize the electronic form of education. The aim is the students to have access to learning materials anytime, anywhere and through various types of electronic devices connected to Internet (desktop computers, laptops, smartphones, phablets, tablets, etc.). With the increasingly strong use of cloud technologies, many solutions have been provided for flexible planning and implementation of e-learning. The necessary knowledge is given in a modern, cheap and easily accessible way.

This article overviews the concept and the services provided by cloud technologies. An example is presented for the use of cloud computing during the students' education at the Plovdiv University "Paisii Hilendarski" within the "Web programming" course realized on the base of WordPress and using the cloud platform CloudAccess.

Keywords – cloud infrastructure, cloud platform, cloud technologies, software as a service (SaaS)

DOI: 10.18421/TEM72-07

<https://dx.doi.org/10.18421/TEM72-07>

Corresponding author: Kosta Andreev Garov,
Plovdiv University "Paisii Hilendarski", 24 Tsar Asen, 4000 Plovdiv, Bulgaria

Email: kosgar@uni-plovdiv.bg

Received: 03 February 2018.

Accepted: 15 March 2018.

Published: 25 May 2018.

 © 2018 Kosta Andreev Garov, Lambri Yovkov Yovkov, Liliyana Ivanova Rusenova; published by UIKTEN. This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 License.

The article is published with Open Access at www.temjournal.com

1. Introduction

The concept of lifelong learning, and the development of social and communicative skills are imposed in government structures and in a large part of the business sector. The widespread proliferation of computers, mobile devices and internet technologies has led to the need for e-training and self-learning methodology in an electronic version.

The role of e-Learning is constantly increasing, because it offers more accessible, cheaper, and better-quality training. It can illustrate complex processes and phenomena through the use of multimedia products and services. It may individualize the learning process to a great extent, according to the learner's individual characteristics in order to acquire new knowledge at a convenient time and place for the learner, at his / her own pace of learning. To do this, the learner needs access to the internet and a suitable electronic device.

The mentioned advantages of e-learning are also used in the training of the business staff. In most universities there is a tendency to combine e-learning and traditional education for students in different fields and majors. There are some shortcomings of conventional traditional education, which could be overcome by the widespread use of e-learning courses.

Some of the disadvantages of traditional education compared to e-learning are the need for a centralized and appropriate place of training. In some cases, it is necessary to have a costly IT infrastructure. The need for learners to be present at a specific place at a particular time for teaching classes leads to financial and time losses for the learners. All these shortcomings could be avoided by means of e-learning, which also includes cloud training.

2. Cloud computing - nature and characteristics

In the past few years, a large number of leading IT companies have invested substantial amounts in the development of the so-called cloud services. This is

one of the most promising and fast-growing trends in the IT industry at the moment. Some of these companies are Google, Amazon, Microsoft, IBM, Oracle, SAP and others. There is a wide variety of cloud platforms. Some of them are Google App Engine [1], Amazon AWS [2], Microsoft Azure [3], Oracle Cloud [4], IBM Cloud [5], OpenStack [6], OpenShift [7], etc. The purpose of using them is the so-called outsourcing of services, i.e. reducing the cost of the particular service and saving significant cash, tangible and human resources to customers who use them.

Cloud infrastructure consists of hardware and software components such as servers, storage, networks and virtualization software that are needed to support cloud computing requirements [8].

There are several different cloud services, but the most common and used are the following three: IaaS, PaaS and SaaS.

One of the cloud services is the Infrastructure as a Service (IaaS). IaaS offers virtualized computing resources over the Internet. These resources include hardware, software, servers, data storages, and other infrastructure components provided to the customer on a subscription basis [9].

Another cloud service is the Platform as a service (PaaS). PaaS provides a platform for developing, running, and managing Web applications without building and maintaining the necessary infrastructure [10].

The third cloud service is the Software as a service (SaaS). SaaS means providing licensed software on a subscription basis [11].

IaaS, PaaS and SaaS form a single structure in which IaaS is the base layer, PaaS is the intermediate layer, and SaaS is the top layer. Figure 1 shows the scheme of this structure and some of the service providers.

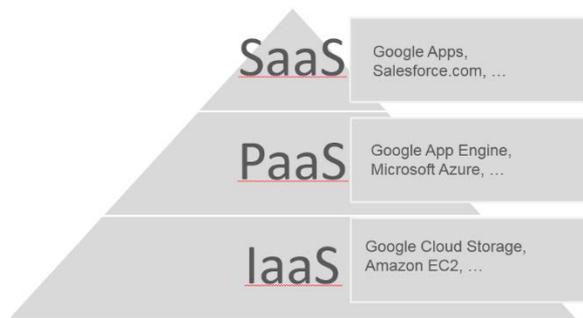


Figure 1. Common structure of IaaS, PaaS and SaaS

Figure 2 presents a general cloud service scheme.



Figure 2. Common cloud service scheme

Depending on the access to the cloud services, they are divided into three types: public, private, and hybrid. Public clouds provide access to all potential customers. Private clouds are only available to a limited number of customers. Typically, private clouds are used in the presence of particularly sensitive and confidential information and data. Hybrid clouds are a mixture of public and private clouds, and some of their services are public, and some of them are private, depending on what the cloud is targeting and its customers. For them, not critical information and data can be placed in a public cloud, but confidential information is available to private cloud services. There is no fundamental difference between public, private and hybrid clouds, it is only on the level of access to them.

The access to Cloud Services can be done with any electronic devices that have access to the Internet. These devices can be desktops, laptops, tablets, phablets, smartphones, etc. Figure 3 shows a common scheme for accessing cloud services from any class of devices.

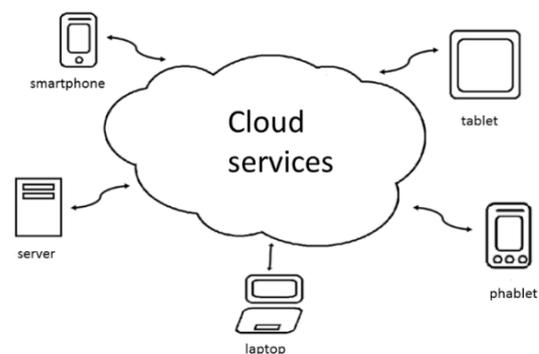


Figure 3. Common Cloud Service Access Scheme (see [12], p.276)

Some of the services are paid and the others are completely free. Even paid cloud services are relatively inexpensive because their users do not need expensive hardware and software (multiple computers, licensed software, and several Internet providers to deliver a reliable connection to the global network).

Cloud Services allow fast, easy, and relatively cheap scalability of applications. Scalability of the application means that it can use more hardware resources if needed. This is at the expense of hiring more and more resources from the service provider. It is much easier, faster and cheaper than buying expensive hardware. There is no need to rent or purchase large areas to deploy the hardware, build shelters for special servers and other sensitive hardware. There is no need to pay for numerous and expensive software licenses, install sophisticated software, monitor timely software upgrades and hardware upgrades, hire expensive and highly qualified IT specialists that would be required for the proper operation and maintenance of available hardware and software. The problem of recruiting some qualified IT executives is not a small one, because the whole IT industry lacks them. There is also no need to worry about backing up and storing data, and eventually recovering them from hardware failure or software failure. The service provider takes care of duplicating the required hardware and software and ensures access to the service at all times. In most cases, this happens in 99% of the time, and sometimes even in 99.9%, which naturally affects the price of the service itself.

All these benefits of Cloud Services can be used when one pays for them. When we do not need such great hardware resources, we just do not use them. This would be quite a problem if the hardware was owned by the developers concerned, because even if there is no need for the hardware and it is not used, the occupied physical space remains busy, the need for its maintenance, updating and payment of the respective licenses for the respective software remains, and the need for the relevant IT specialists, too. All of the reasons listed here show how fast, easy and relatively inexpensive Cloud Services can be used with their suppliers. These services are particularly suited to relatively small teams of developers and companies that do not have any large budgets for the development and maintenance of an application. The savings in this way could be used for more useful purposes, such as improving the design and architecture of the application itself, which would improve the quality of the service provided.

Figure 4 presents a part of the benefits of cloud services.



Figure 4. Benefits of Cloud Services

3. Education in cloud

The cloud features listed here and their broad and easy accessibility via the Internet enable them to be used for a variety of educational purposes. As mentioned above, their use requires a device that can connect to the Internet. Google App Engine [1], Amazon AWS [2], etc. are widely used for educational purposes. These services can include wikis, blogs, e-mail, etc.

Through these cloud features, a fast, efficient, and easy way to access the necessary educational services is provided, through which the pupils and students acquire up-to-date knowledge and skills needed for the 21st century. It is also possible to share educational resources and services between the different educational institutions.

For the implementation of e-learning, a significant investment is needed in the required hardware and licensed software, in the subsequent installation and maintenance of the infrastructure. It is necessary to train the team that will use it. Cloud technologies provide hardware, software, and structure maintenance at a relatively low cost, sometimes it is free when it comes to educational institutions or educational purposes.

4. Cloud platform implementation for educational purposes

Two groups of 15 freshmen students each doing the "Introduction to web programming" course in 2015-2016 academic year participated in a cloud-based e-learning training.

The requirements for choosing a specific cloud platform, so the students could work with it, were: the possibility of free registration for using the functionality of the system, a lightweight process of publishing materials in different file formats, as well as the possibilities for commenting, adding and updating previously published units, and no limit on the number of registered users in the system.

After a discussion with the students, which cloud platform would be the most appropriate for them, taking into account the requirements we defined here above, the choice was made between three cloud services aimed at supporting custom applications - OpenShift [7], Heroku [13], and CloudAccess.net [14]. By analyzing the opportunities for free use of cloud structures, the platform that stood out as the most suitable for our educational purposes was CloudAccess.net. The final choice of the CloudAccess.net platform was also due to its ease of use, flexibility, intuitive design and navigation in user panels. Last but not least, the online version of the Wordpress blog system [15], which was chosen by the students as a development environment, was maintained in this platform.

In Figures 5-17, the process of registration, administration and publishing in CloudAccess.net is presented in a step-by-step manner.

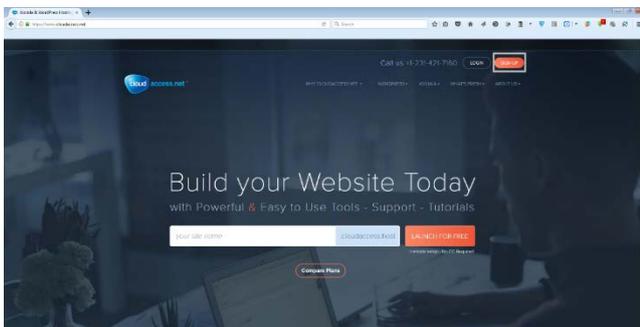


Figure 5. Main Screen of CloudAccess.net

At this step, the CloudAccess.net sign-up process started by means of clicking on the “sign up” button (see Figure 5).

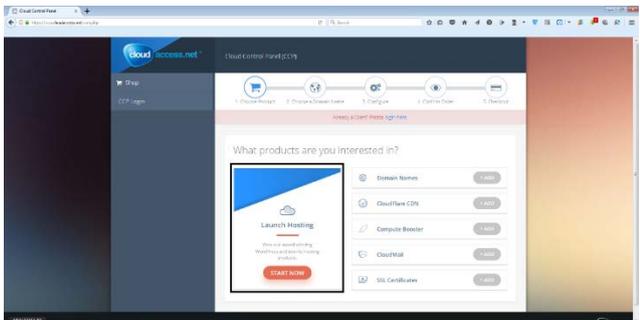


Figure 6. Creation of a new account (step 1)

At this step of working with CloudAccess.net, hosting was launched by means of clicking on the “Start now” button (see Figure 6).

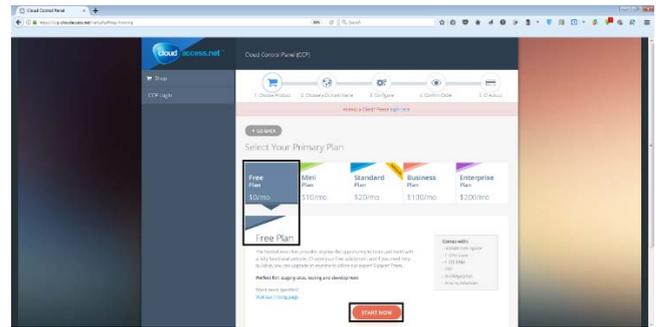


Figure 7. Creation of a new account (step 2)

Then, a free plan of the service was chosen among several plans of the product (see Figure 7).

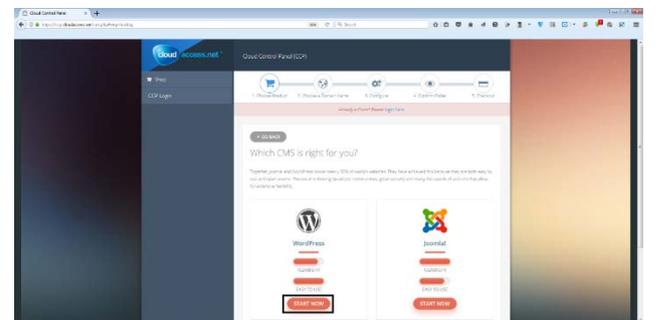


Figure 8. Creation of a new account (step 3)

Here, there was a choice between Wordpress CMS [15] and Joomla CMS [16] (see Figure 8). The students chose Wordpress because they were familiar with this product.

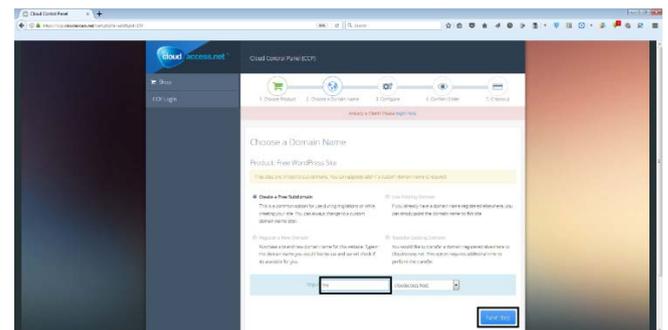


Figure 9. Creation of a new account (step 4)

Next, a free subdomain for the educational site was chosen between four different options (see Figure 9).

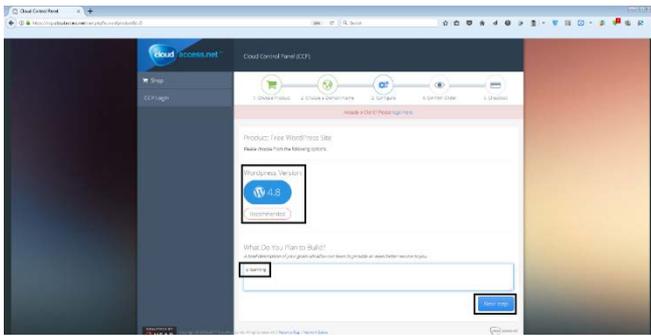


Figure 10. Creation of a new account (step 5)

The purposes of use of CloudAccess.net (i.e., e-learning) were specified in brief (see Figure 10).

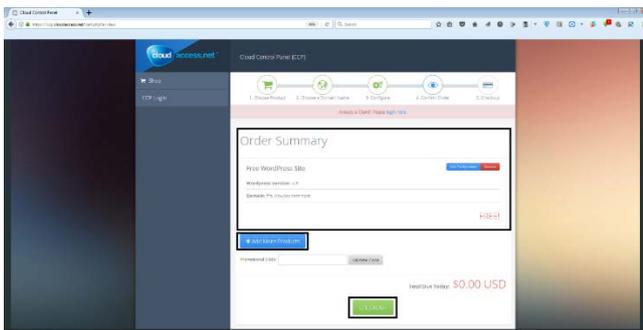


Figure 11. Creation of a new account (step 6)

At the next step, we may see what kind of services we could use. If we click on “Add More Products” (see Figure 11), we would be redirected to step 1 of Creation of a new account (that is shown in Figure 6) in order to make our choice between several options: Domain Names, CloudFlare CDN, Compute Booster, CloudMail and SSL Certificates. If we need, we could use them. Any additional products were not chosen for the educational purposes of cloud e-learning by the participating students. The option “Checkout” was chosen (see Figure 11).

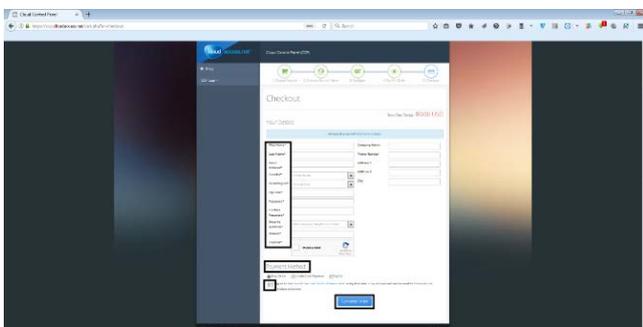


Figure 12. Creation of a new account (step 7)

Then, we created a new account inserting First Name, Last Name, Email Address, Country, State/Region, Zip Code, Password, Confirm Password, Security question, and Answer. We had to

use Captcha. In Payment Method, we chose Free Order. We checked CloudAccess.net Terms of Service. And finally we clicked the “Complete Order” button (see Figure 12).

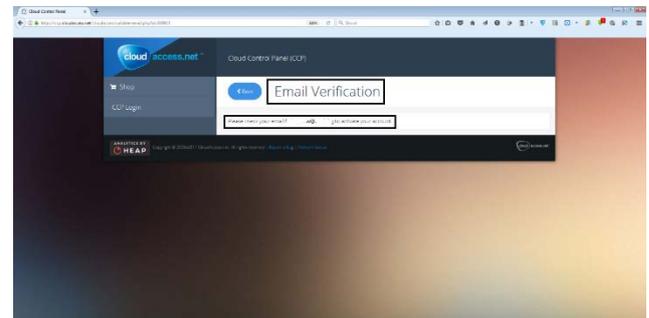


Figure 13. Creation of a new account (step 8)

At this step, a verification message was sent (see Figure 13) at the email address provided during registration.

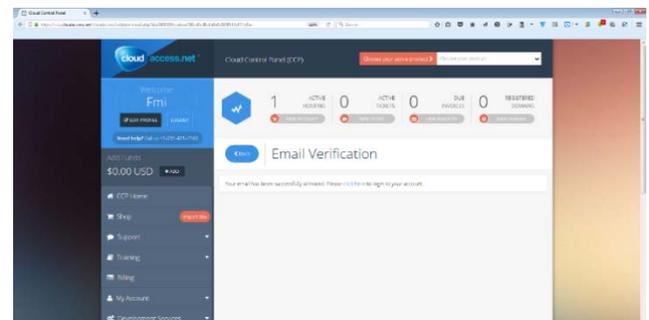


Figure 14. Creation of a new account (step 9)

This was the final step of CloudAccess.net account creation. After email verification, we already had an active CloudAccess.net account (see Figure 14). Now we could login in our CloudAccess.net account (see Figure 15).

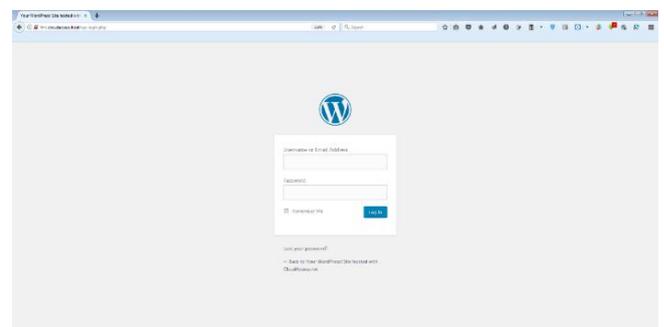


Figure 15. Entering our site with administrator rights

After login on web address on <http://fmi.cloudaccess.host/wp-login.php>, we were redirected to WordPress Administrator Panel on <http://fmi.cloudaccess.host/wp-admin/>.

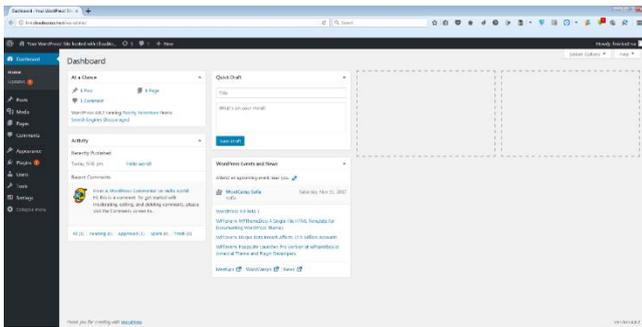


Figure 16. Screen for additional site's settings with WordPress

At this step, we had the full control of administration of our site and we could do further activities and maintenance of our site (see Figure 16). WordPress offers a wide range of settings through which we can fully control the site design and functionality. We created an e-learning course based on cloud technology located at: <http://fmi.cloudaccess.host/>.



Figure 17. Our WordPress Site

We had a fully functional WordPress web site (see Figure 17). We could access our site on <http://fmi.cloudaccess.host/>.

Figures 18 - 19 present a part of the created and published training materials for the "Web Programming" course.

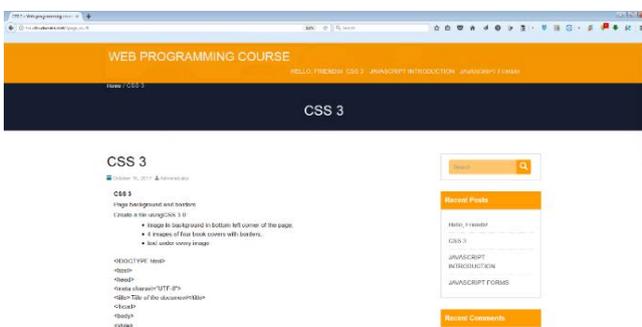


Figure 18. A part of the resources available for Web Programming course (1)



Figure 19. A part of the resources available for Web Programming course (2)

Once WordPress is installed, we can add some new training materials (these can be text, audio, or video files) to an existing course. Also, some of the materials may be removed or edited. Some new courses can also be added. There are practically no limitations on the number of courses or study materials in them, because we use cloud service and if there is a shortage of technical parameters, we could easily expand them.

5. Conclusion

The CloudAccess.net platform was presented. This article described how to register and use it. The main points for building e-learning content with software as a service (SAAS) and WordPress were indicated. Several units of learning realized on it were illustrated.

An option for delivery of electronic content for student education was found, explored and implemented as a service independent on a software platform, system security, hardware resources, and time span. WordPress provides the opportunities to publish and graphically format different materials (photos, tables, graphics, audio and video resources), the possibility for posting comments on any topic that facilitates the learning process.

The described approach in this cloud-based training can be used for work on some conceptual tasks, operational tasks, practical tasks, and assignments for course projects. The use of open-source resources can allow the students to develop further their own projects that may stimulate their creativity, and practicing their skills. Working in small groups when the peers cooperate and are involved in the assigned tasks is important in order to develop the students' skills.

E-learning, being flexible, interactive, practical and analytical, may encourage the students to take greater responsibilities for their learning outcomes [18]. Their commitment to the educational goals may be augmented.

The new methods may increase the level of creativity and adaptability to changes. E-learning as a modern educational method can contribute to revealing the students' creative potential. The use of cloud computing services intends to increase all the participants' commitment. An open portal can integrate curriculum data of the academic staff with the results from the students' work on some tasks. The students' involvement in the choice of the cloud-based open-source platform for e-learning can contribute to their satisfaction from the learning process. The students have not been asked to self-assess their satisfaction, knowledge and skills after this training, because it has been found that Bulgarian students' self-esteem is not related to the students' academic success [17].

The teaching approach in this paper has been based on e-learning, open resources, and co-operation between the students and the academic staff that can stimulate the students' creativity and academic motivation.

Acknowledgements

The authors express their appreciation for the scientific project FP17-FMI-008 "Innovative software tools and technologies with applications in research in mathematics, informatics and pedagogy of training" at the Scientific Research Fund of Plovdiv University "Paisii Hilendarski" for the partial financing of the present work.

References

- [1]. Google Cloud Platform. Google App Engine: Platform as a Service, Retrieved from: <https://cloud.google.com/appengine/docs>, (accessed 30 November 2017).
- [2]. Amazon Web Services, Retrieved from: <https://aws.amazon.com>, (accessed 30 November 2017).
- [3]. Microsoft Azure, Retrieved from: <https://azure.microsoft.com/en-us/>, (accessed 30 November 2017).
- [4]. Oracle Cloud, Retrieved from: <https://cloud.oracle.com/home>, (accessed 30 November 2017).
- [5]. IBM Cloud, Retrieved from: <http://www.ibm.com/cloud-computing>, (accessed 30 November 2017).
- [6]. Openstack. Open source software for creating private and public clouds, Retrieved from: <https://www.openstack.org>, (accessed 30 November 2017).
- [7]. Openshift. Develop, Host, and Scale Your Apps in the Cloud, Retrieved from: <https://www.openshift.com>, (accessed 30 November 2017).
- [8]. Cloud infrastructure definition, Retrieved from: <http://searchcloudcomputing.techtarget.com/definition/cloud-infrastructure>, (accessed 30 November 2017).
- [9]. Infrastructure as a Service (IaaS) definition, Retrieved from <http://searchcloudcomputing.techtarget.com/definition/Infrastructure-as-a-Service-IaaS>, (accessed 30 November 2017).
- [10]. Microsoft Azure. What is PaaS?, Retrieved from: <https://azure.microsoft.com/en-us/overview/what-is-paas>, (accessed 30 November 2017).
- [11]. Salesforce. SaaS: Software as a Service. Power your business with the best of the Web, Retrieved from: <https://www.salesforce.com/saas>, (accessed 30 November 2017).
- [12]. Garov, K., Angelov, A., & Yovkov, L. (2015). A project-based approach: The formation of computing skills through multidisciplinary interconnections and the incorporation of electronic devices. *Mathematics and Informatics*, 58(3), 272-278.
- [13]. Heroku, Retrieved from: <https://www.heroku.com>, (accessed 30 November 2017).
- [14]. Cloudaccess.net. Build your website today, Retrieved from <https://www.cloudaccess.net>, (accessed 30 November 2017).
- [15]. Wordpress.org. Meet WordPress, Retrieved from: <https://www.wordpress.org>, (accessed 30 November 2017).
- [16]. Joomla! The flexible platform empowering website creators, Retrieved from: <https://www.joomla.org>, (accessed 30 November 2017).
- [17]. Papazova, E., Stoyanova, S., & Bulut, S. (2017). Dimensions of Global Self-esteem in Bulgarian and Turkish Students: Comparative Analysis. *Türk Psikoloji Dergisi (Turkish Journal of Psychology)*, 32(78), 1-15.
- [18]. Ong, C. H. (2014). Goal orientation of adult students towards learning strategies: The Malaysian context. *Psychological Thought*, 7(2), 156-167.