THE USE OF CLOUD COMPUTING TECHNOLOGIES IN TEACHERS' EDUCATION AND TRAINING

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Abstract

In this paper, the use of cloud computing technologies in teachers' education and training is studied. Cloud technologies have spread to numerous sectors in the past few years, education being one of them. STEM training methodologies are also being used more and more. The possible advantages and disadvantages of using cloud-based application in education are given. Furthermore, a survey amongst the active students (class of 2017) of the Greek teachers' training program EPPAIK was conducted, documenting their strongly positive opinion on the use of cloud computing technologies and STEM training in education. They also confirm the lack of adequate training and information on cloud technologies and STEM training during their bachelor studies and other training programs. However, the EPPAIK training program seems to meet both their requirements. Finally, the survey documents the students' positive stance and intention to use cloud computing technologies and STEM training methodologies in their teaching.

Key words: *cloud computing, teacher, education, training, teaching, STEM training*

1 INTRODUCTION

Technology and its products are evolving rapidly, becoming more and more accessible. Education is one of the sectors affected by this, particularly since the launch and evolution of cloud-based services. In the forthcoming years, anyone will be able to access education, using any kind of device, while being anywhere in the world (Militsopoulos, 2016). Hence, those involved in the education sector must address a set of challenges, namely the ongoing global economic and political turmoil, the fast evolution of education-applicable technologies, the commercialization of ICT and the emerging of the new, "digital" and heavily dependent on technology generations (IBM, 2012). The cloud-based applications and the use of STEM teaching methodologies seem to successfully address these challenges for the time being, making the training of teachers in using such technologies and technologies more critical than ever (Akritidou, 2014). In the second part of this paper, the advantages and disadvantages of using cloud computing in education and the use of STEM training are presented, in the third and fourth part the methodology and the results of the survey are given, respectively, whereas in the fifth part the conclusions are described.

2 CLOUD COMPUTING AND STEM IN EDUCATION

It seems that more and more educational institutions will depend on information technology for their operation. In the near future, most of their operations will rely on cloud-based services (IBM, 2012). Users will be able to access and control their educational needs via internet (Yadav, 2014). The advantages of using cloud computing technologies in education are: (**1a**) *personalized learning*: since every student can choose to learn whatever lies in his interests at his own pace; (**1b**) *minimized cost*: the extensive use of cloud services can minimize the needs for specialized infrastructure, software and hardware; (**1c**) *accessibility*: the courses are

available by anyone, at any time, via any kind of device; (**1d**) *environmental awareness*: the aforementioned can minimize the needs for infrastructure, hence minimizing the environmental output of the education sector as a whole; (**1e**) *user friendliness*: the interfaces are simple, easy to use and do not demand extensive IT knowledge for the most part; (**1f**) *group learning*: students can form or be part of online groups, fora and project teams concerning their fields of interest; (**1g**) *smart classes*: since the learning and teaching procedures get personalized, most of the class operations become student-centric, personal, hence smarter; (**1h**) *personalized evaluation*: any participant can evaluate his own work, his students' or teachers' performance or even the administrative parts of the course; (**1i**) *job creation*: it is believed that the increased accessibility will increase the job creation rate in education; (**1j**) *smart administration*: every administrative operation can be done using cloud-based technologies, making administration more effective and manageable; (**1k**) *statistics and analytics*: teachers, students and institutions can access and process a wide range of data and statistics in order to extract useful reports (IBM, 2012, Yadav, 2014 and US Department of Education, 2017).

On the other hand, the use of cloud computing technologies in education may have some disadvantages. These are: (**2a**) *limited user controls*: users need to have access to their own, private data via any device, anytime. Protecting these data from intruders requires a lot of effort from the service providers' part; (**2b**) *misunderstandings of end-user agreements*: these agreements tend to clear the providers of any responsibility in case of data infringement. Users are also obliged to accept any term posed by the provider in order to use a service, without being able to negotiate on any of the terms; (**2c**) *uncertain provider chain*: End users usually think the provided service originates from the same provider. They cannot be sure though, as a cloud service provider can outsource parts of its own operations to other, less liable ones; (**2d**) *lack of interpersonal interaction*: users will not be in need of interacting with other users in person. This could lead to lack of social skills (3M, 2015 and Donert et al., 2015).

STEM is an acronym deriving from the words Science, Technology, Engineering, and Mathematics and it refers to an approach where technology and engineering are introduced to the teaching procedures of mathematics and physics. This approach aims to create citizens who will be socially and environmentally conscious, up-to-date on the challenges humanity faces as a whole, able to think analytically and critically, and able to innovate (Gonzalez and Kuenzi, 2012). STEM training refers to a set of teaching techniques, including student-centricity, problem solving, inquiry-based learning and project assignment (US Department of Education, 2017). It is gaining more and more significance in the EU and the US, since most of the economic models and predictions suggest that the vast majority of the jobs to be created in the next 20 years will require some sort of STEM training (Wassem, 2012 and Akritidou, 2014). Cloud-based technologies and STEM training are two of the major factors expected to deeply affect education in the next few years from a technological point of view (Akritidou, 2014). The education of in-service or future teachers in using cloud-based technologies and STEM training techniques is therefore of great significance. In the following parts, an effort to document the existing knowledge, experience and opinion of in-service and future teachers, on the use of cloud-based technologies and STEM training techniques in their classes, is made.

3   METHODS USED

The methological tool to conduct the survey was a properly configured anonymous questionnaire, aimed at students of EPPAIK. EPPAIK is a one-year program offered by the School of Pedagogical and Technological Education (ASPETE) to in-service and future teachers. It leads to a "*Certificate of Pedagogical and Teaching Competence*" which is necessary for any diploma holder in Greece who wishes to teach in primary or secondary education (YPETH, 2016). The survey was conducted from April 23, 2017 to April 25, 2017 by using a digital questionnaire (digitally distributed). The research took place in a population of a hundred and eight (108) persons who had to answer to 30 questions. The collected data analysis was made using the SPSS software.

4   SURVEY RESULTS

Amongst 108 participants, 47.2% were men and 52.8% were women. The majority were between 31 – 35 years old (30,6%) and the rest were 26 – 30 years old (25%), 36 – 40 years old (19,4%) και 41 – 45 years old (13,9%). 30.6% held a bachelor degree, 58.3% held a master degree and 8.3% held a Ph.D. 33.3% were engineers, while the humanities and social sciences, technological sciences and natural sciences graduates were 16.7% each. 9.3% originated from the health sciences and 7.3% from the economy/business sciences, respectively. 22.2% were in-service teachers and 41.7% has attended extra teachers' training in the past, other than EPPAIK.

In the first axis of the survey, nearly 86% of the participants stated that they were a lot or very familiar with using internet. The participants were also asked if they were familiar with the terms "cloud computing" (55.60% positive, 22.20% negative, 22.20% never heard of it) and "STEM training" (47.20% positive, 44.40% negative, 8.30% never heard of it). In the second axis of the survey, a description of the term "cloud computing" was given, accompanied by examples of cloud-based applications. The participants stated they did use such an application at the time being (97.2%) and were asked to mention such a cloud-based application. The vast majority answered "*online email*", "*Dropbox*", "*Google Apps*", "*Moodle*" and "*eClass*". Afterwards, a series of possible advantages and disadvantages of the use of cloud-based applications in education were stated; the participants had to rate each feature on the 1-5 rating scale, 1 meaning "I totally disagree" and 5 meaning "I totally agree". The results are given in figure 1, using the median and standard deviation values (fig.1). They seem to agree with all the features, mostly with "*personalized learning*" and "*accessibility*" advantages on the one hand, and the "*uncertain provider chain*" and "*lack of interpersonal interaction*" disadvantages on the other hand. The participants were also asked to rate the extent to which they were taught how to use cloud-based applications in their future classes while being undergraduates, studying in EPPAIK and studying in other teachers' training programs. They had to answer on the 1-5 rating scale, 1 meaning "Not at all" and 5 meaning "Extensively". The results are given in figure 2, using the median and standard deviation values (fig.2). They do confirm the lack of adequate training and information on cloud during their bachelor studies and other training programs. However, the EPPAIK training program seems to meet their requirements. Finally, 65.70% states their former experience in using cloud-based applications was "Very Positive" or "Positive", a stunning 97.20% wish every teacher should get educated in using cloud technologies in their classes and 88.90% would use cloud-based applications in their teaching.

Advantage	Median	SD	Disadvantage	Median	SD
1a	**4.27**	1.100	2a	2.97	1.161
1b	3.81	0.944			
1c	**4.02**	0.640	2b	3.19	1.192
1d	3.56	1.086			
1e	3.50	1.062	2c	**4.03**	1.095
1f	3.42	1.293			
1g	3.14	1.200	2d	**3.47**	1.274
1h	3.73	0.762			
1i	3.28	1.140			
1j	3.56	1.160			
1k	3.98	0.952			

Fig.1 Agreement rates on advantages/disadvantages of cloud computing in education.

Level of studies	Median	SD
Bachelor degree	2.08	1.134
EPPAIK	3.61	1.107
Other teachers' training	2.44	1.207

Fig.2 Received cloud computing apps rate.

Technique	Median	SD
Problem solving	3.47	1.062
Inquiry-based learning	3.78	1.078
Project assignment	3.72	0.916
Individual activities - game teaching	3.50	1.230
Group activities – game teaching	3.69	1.121

Fig.3 Agreement rates on STEM training techniques.

Level of studies	Median	SD
Bachelor degree	1.81	0.807
EPPAIK	**3.22**	1.128
Other teachers' training	2.08	0.949

Fig.4 Received STEM training techniques rate.

In the last axis of the survey, a description of the term "STEM training" was given, accompanied by examples of STEM training techniques. 83.3% stated they agreed "A lot" or "Quite". Afterwards, a series of possible STEM training techniques were given; the participants had to rate each feature on the 1-5 rating scale, 1 meaning "I totally disagree" and 5 meaning "I totally agree". The results are given in figure 3, using the median and standard deviation values (fig.3). They seem to agree with all the features, mostly with "*inquiry-based learning*" and "*project assignment*". The participants were also asked to rate the extent to which they were taught how to use such techniques in their future classes while being undergraduates, studying in EPPAIK and studying in other teachers' training programs. They had to answer on the 1-5 rating scale, 1 meaning "Not at all" and 5 meaning "Extensively". The results are given in figure 4, using the median and standard deviation values (fig.4). The result is nearly identical to this documented for cloud computing; the EPPAIK training program seems to meet their requirements. 63.20% states their former experience in using cloud-based applications was "Very Positive" or "Positive", a stunning 97.20% wish every teacher should get educated in using cloud technologies in their classes and 91.70% would use cloud-based applications in their teaching. Finally, the participants were asked a series of questions on a possible combination of cloud computing technologies and STEM training techniques. 80% thought a combination is worthwhile, 86.10% wish every teacher should get educated in cloud-STEM combination and 83.30% would use such a combination in their teaching.

5 CONCLUSION

Cloud-based technologies will definitely play a significant role in the education sector in the near future. Students will be able to learn from everywhere and teachers to teach anywhere. The use of cloud computing technologies in education has both

advantages and disadvantages. More, the introduction of STEM training techniques is critical, given the expected changes in the workforce and human needs. In-service and prospective teachers in Greece may not receive adequate education and training in both of the aforementioned technologies and techniques, however the EPPAIK training program seems to meet both their requirements. The students attending the program share their strongly positive opinion on the use of cloud computing technologies and STEM training in education and they state the their intention to use cloud computing technologies and STEM training methodologies in their teaching.

Acknowledgement

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