Implementation and Evaluation of Flipped Classroom as IoT Element into Learning Process of Computer Network Education

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ABSTRACT

Students nowadays are hard to be motivated to study lessons with traditional teaching methods. Computers, smartphones, tablets and other smart devices disturb students’ attentions. Nevertheless, those smart devices can be used as auxiliary tools of modern teaching methods. In this article, the authors review two popular modern teaching methods: flipped classroom and gamification. Next, they implement flipped classrooms as an element of IoT (Internet of Things) into learning process of computer networks course, by using Cisco networking academy tools, instead of traditional learning. The survey provided to students shows good feedback from students. The authors report the impact of flipped classroom implementation with data obtained from two parallel sections (one flipped classroom and the other traditional classroom). The results show that the flipped classroom approach is better than the traditional classroom approach with a difference of approximately 20% increase in the average of attendance, lab work, quizzes, midterm exams and final exam.

KEYWORDS

Computer Network Education, Flipped Classroom, Gamification, IoT Element, Learning Process, Smart Devices, Teaching Methods, Traditional Learning

INTRODUCTION

Society has dramatically changed in the last decade. Computers, smartphones, tablets, and other smart devices are all around students. Traditional teaching methods, based on listening to lecturers and taking notes, are mostly not interested to many students nowadays. To motivate them and give desire to learn the subject we can use new methods of teaching that satisfy new requirements and interests. A lot of new methods of teaching have been developed due to society change (Frederickson et al., 2012; Freeman et al., 2007; Maksimovic, 2017; Zhamanov, 2012). New technologies allow teachers use fresh approaches to educate students.

Nonetheless, not all schools and universities have switched to educate students with the help of new technologies. We may still observe that in universities lessons are provided with old methodology without implementing technological solutions (Akinogle and Tandogan, 2006). With the help of technology, we may build environment in which students and instructors can improve their results and achieve more successes. One alternative to the traditional teaching approach is to implement flipped classroom (Baker, 2012; Hwang and Soman, 2013) and gamification (Gamified UK). Using...
Internet of Things (IoT) elements into learning process of computer education may be a very promising approach (Hern and Serrano, 2016; Intelligence, 2016).

IoT – the current phase of internet evolution – connects things, people, data and processes. IoT *things* are physical devices (objects) that are connected to the Internet and able to interact with multiple servers and clients to provide different types of service and statistics periodically and/or on demand. Smart scale is a good example which shows how IoT can impact on human health (Graziano, 2016). IoT people are represented as wearable devices. Today most people connect socially through web-accessible devices. As the IoT evolves, we will connect in new and valuable ways. Wearable devices and clothing are already changing the way that we connect to the global network (Statt, 2017). IoT data is information generated by people, sensors and things. The data, when combined with analytics, delivers actionable information to people and machines. Better decisions are made and better results are achieved. By using data, it is possible to analyze situation from different perspectives and enhance process (Marr, 2015). IoT processes occur between all other pillars in the IoT. With the correct processes, connections become more valuable. These connections provide the right information, delivered to the right person, at the right time and in the most relevant way.

Researchers have tried to apply IoT to education. Maksimovic (2017) describes the model of IoT in education and compares the model with traditional education approach. Online content, online community platform, smart portfolio systems, advanced data analytics, and gamification with virtualization are the parts of IoT education model. The author expects that this model will play the huge role in the transformation of educational process. Here, the author also explained how IoT in education will impact on environment till year 2030 (GeSi, 2015). Those impacts will be available due to turning off personal computers in laboratories and using only own devices of students with the help of concept BYOD (Bring Your Own Device), and electronic materials and quiz/test submissions will reduce paper printing. Abhimanyu Roy (2016) made research on how IoT based innovations can help for education of poor people in big cities. Roy found that one of the main problems for the urban poor is that they spend much money to buy printed learning materials. The situation can be improved by providing students with digital information on demand. Marti Widya Sari (2017) made research on smart campus development using IoT technologies. Marti designed a smart campus that consists of smart education (eLearning, virtual classroom helps students to gain information anywhere, anytime with the help of internet connection), smart parking (system provides information about vacant parking places), and smart room (room reservation system). Maqbool Ali (2017) made research on IoT-based Flip Learning Platform for medical education (IoTFLiP), where IoT infrastructure is exploited to support flipped case-based learning. The research describes the model of IoTFLiP and shows pros and cons of the model.

The above-mentioned papers show different models of IoT and flipped classrooms in education process. Upon the best knowledge of authors, this IoT process is not implemented yet into learning process in Kazakhstan. In this article, we implemented a flipped classroom and gamification teaching techniques in learning process in Suleyman Demirel University in Kazakhstan. Here, computer network courses are integrated with Cisco Networking Academy (netacad.com).

The remainder of this article is organized as follows: First, we review two teaching methods, flipped classroom and gamification. Then, we present our implementation of flipped classroom and gamification, Next, we show implementation result and evaluation. Finally, we make conclusion and mentions on future work of this research.

**FLIPPED CLASSROOM AND GAMIFICATION**

**What is Flipped Classroom?**

A flipped classroom is a new approach that is not implemented yet into learning process in Kazakhstan upon the best knowledge of authors. Flipped classroom is a model in which homework and lectures
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www.igi-global.com/chapter/learning-industry/11846?camid=4v1a

Instructional Design, Web 2.0 Style
Bruce C. Howard (2010). *ICTs for Modern Educational and Instructional Advancement: New Approaches to Teaching* (pp. 355-402).
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