

# THE BLENDED LEARNING TECHNIQUES IN TECHNICAL HIGHER EDUCATION

## МЕТОДЫ СМЕШАННОГО ОБУЧЕНИЯ В ВЫСШЕМ ТЕХНИЧЕСКОМ ОБРАЗОВАНИИ

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**Abstract:** Nowadays systems can optimize the presentation of the course's content, suggesting next steps in subjects studying, dynamical planning of individual lectures with lecturers for students with special needs, and even create timetables of school buses accordingly to the time of courses running. We argue that massive open online courses created in Ukrainian by leading specialists in their fields and their implementation to the educational process can give students an opportunity to get up-to-date knowledge, a chance to study regardless of their financial state or an opportunity to enrol to the leading universities.

**KEYWORDS:** BLENDED LEARNING, DIGITAL LITERACY, LIFELONG LEARNING, MASSIVE OPEN ONLINE COURSE, ONLINE-LEARNING

### 1. Introduction

Modern trends in the world's educational process and the market's demand of technical specialists dictate new requirements to the personnel's quality and need to introduce the latest technologies into the educational process [1, 2]. Technical specialists are those who have needed to be clearly responsive to transient changes in the educational environment, knows how to assess trends and innovations, and choose the right ways to respond to the new challenges. The technical education is rapidly changing and those who are starting to obtain knowledge this year will be challenged with new technology not at the finish line of their bachelor's program but at the end of the first year of study and every year to come. The educational technologies for training such specialists should be constantly updated, be at the time and help the future professionals to find themselves in the post-industrial world controlled by information technology of a new age of society's development - artificial intelligence, based on the use of neural networks, virtual reality, online technology of different directions and style, new electronic devices, internet of things' development, space technologies, etc.

In 2008 Dave Cormier introduced the term MOOCs (Massive Open Online Courses). Such courses are available online for a wide audience and are designed for all interested users with Internet access regardless of age, sex, nationality, country of origin, social standards, etc. [2, 3]. In 2012 the world's top three modern online education platforms were launched simultaneously: Coursera (founded by Stanford University professors), Udacity (founded by Stanford University professors, developed due to courses of Georgia Institute of Technology) and edX (Harvard University and the Massachusetts Institute of Technology collaboration project). In Ukraine, the first attempt to create massive open online courses was made in 2013 in the Taras Shevchenko National University of Kyiv, where the UniversityOnline was created, but the project was not in high demand. In the spring of 2014, the EdEra project, launched in the form of online courses to help scholars to prepare for an external independent evaluation, started. The first successful platform for massive open online courses in Ukraine was founded in October 2014. The Prometheus platform today has over 750,000 active users, and this figure is constantly increasing. All courses offered by the platform are taught in Ukrainian and most of them are developed by leading Ukrainian lecturers [4, 5]. This massive open online courses' platform has introduced the project to implement blended learning techniques into Ukrainian educational process.

### 2. Preconditions and means for resolving the problem

This innovation process in education leads to rapid online learning development and its implementation into the offline educational process. In 2016-2019 in Ukraine was successfully implemented a pilot project combining the massive open online courses and classic university education in the blended format.

This study's main aim is to determine relevant models in blended learning techniques in technical specialists' training by implementing these techniques in the educational process of several departments at National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute".

In the experiment's pilot version that was conducted on throughout the academic year 2016-2017, 320 students from 4 departments at National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" had participated. It was joint efforts by four lecturers who were in constant contact with MOOC platform representatives for obtaining operational data on student performance and with colleagues from other higher education institutions to exchange experiences and contribute corrected in the implementation process in real time. The online courses were used as in full (all lectures, practical tasks, additional materials, and certificate as part of the final assessment of the student), and partially (certain topics used in full, a part only fragmentary without student certificate and scoring in the final assessment).

For the introduction of MOOC in the educational process the lecturers independently evaluated courses materials, made it into the discipline's work plan and the curriculum, created topics for problem-oriented lectures and practical exercises. After each online part that students had to go through on their own, testing in an auditorium was necessarily carried out to assess the learning and discussion lectures and tests passed on the platform. As a result of the introduction, the academic performance of first-year students compared to the previous first year increased by 13%, the performance of second-year students increased by 17%. The number of received certificates of successful completion was 62% of all students who studied disciplines in blended format [6].

These results give an opportunity to argue that blended learning implementation in technical higher education can be a revolutionary way to combine best world practices and to keep students in the loop of the new changes in the world through up-to-date online courses introduction to the educational process. Thus, we need to understand which blended learning techniques are better suited for the technical disciplines and how we can implement these techniques in Ukrainian educational process.

### 3. The solution of the examined problem

Blended learning involves the use of a popular teaching practices (lectures, classroom practical classes, seminars, workshops, etc.) in conjunction with a digital component - the use of information technology for automating the testing process, performing homework tasks, reviewing lecture material, etc. At the present stage, blended learning involves the transfer of the lecture material in its classical presentation of the information lecture in the online by creating a video library and placing it on the appropriate platform [1]. It allows to deepen the material, stimulates students for independent study and involves critical thinking, optimizes the teaching time. Part of the practical classes or their full cycle can

also be translated online and fully automated. The selection of a digital particle and process automation depends on the purpose and tasks and the teacher-developer and inclusion the level of preparation of students.

As it was argued in previous studies, according to online learning studies for the average mass open online course the normal successful completion rate is about 7-8% [7]. This indicates a rather low students' motivation to complete the course, even though they have already registered for the course of their own choice or at the request of the management/lecturer, that is, from the beginning they had a certain intention, desire or purpose to learn.

Obviously, the reasons for the motivation loss to attend courses can be directly related to the course's content (subjective teacher's dissatisfaction, dissatisfaction with the course materials, the level of complexity of tasks, etc.), the nature of the materials' presentation and the educational process structure, and personal changes of plans.

There are no possibilities to influence the personal reasons for the motivation loss to study, since they depend on external circumstances. However, dealing with other barriers, especially of a technical and organizational nature would be feasible when using the individual approach to material submission, the time spent doing tasks, the reminders of various types, and encouragement to pass tests. Avoiding a personal component is possible only if the student's expectations of the course, the sphere of his interests, certain personal characteristics before the subscription to a course are determined [8]. The same problem is an uprising in blended learning process: the motivation lack can dramatically increase drop out from studies and students' failures. The proposed techniques analysis included motivational aspects and different motivational techniques was also used during field studies in implementation of blended learning introduction second stage in 2019.

In modern blended learning practice, different models are used. The most popular for higher education institutions is a rotational model, a flex model, a la carte model and an enrich virtual model [9, 10].

In terms of rotational model, there are three types of interaction between the lecturer and the students [1, 9, 10]:

1. Stations' rotation deals with different stations within one classroom to watch a video, conduct practical assignments, discuss proposed materials, create own product, etc. The stations and the order of their use are chosen by the lecturer according to the course tasks or together with the students to determine the type of work that will be most convenient for all participants in the educational process.
2. The second option is rotation in laboratories provided that the subject is studied, which involves laboratory classes and the use of laboratory equipment. Students move in laboratories, both real and virtual.
3. The third version is a popular model of "flipped classes" used in high-school education both in Europe (for example, in Finland) and in the United States. All the lecture material and preparation for the class are transmitted online, and in the classroom, the students perform practical tasks and disassemble they mastered at home or in another environment with access to the Internet.

The Flex model is used within an open space that can be arranged so that up to 100 people are simultaneously trained in it. Each of them has access to all equipment hosted, can watch online video, can contact other students, and so on. In the use of such a model the lecturer turns completely into a mentor who explains incomprehensible moments, together with the student develops a "road map" for studying the discipline, and for each student, such a plan of training will be individual, and everyone needs an individual approach [1].

The a la carte model implies the presence of a lecturer or a full-time online classroom program - lectures and practical, laboratory classes, if necessary, the student can go online

completely, including checking his / her tasks using the online learning platform [10].

Today's enrich virtual model is available only in the world's leading institutions of higher education, which began to introduce blended learning technologies in the mid-2000s. (MIT, Harvard, Yale, etc.) [10]. If this model is used, each of the courses available in a higher education institution has two options: online and offline. Students can choose courses to take in a classical format in class and maybe additionally or even as the main ones, to take courses that they pass online on the higher education institution platform.

#### 4. Results

The realities of modern Ukrainian higher education for technical specialists do not allow to use all the proposed blended learning types. Thus, we argue that the most useful model for blended learning introduction for technical specialists is the rotation model. The study's results have shown that students get better results with blended learning [1, 6, 9] and the stations' rotation gets the highest demand from lecturers. The stations' rotation is best suited for IT specialists' training. During the same class, they can watch and discuss video lecturers, create programs or obtain practical skills to create them, make joint projects, share, etc. The rotation in laboratories creates space to obtain knowledge in natural science (chemistry, biology, physics, etc.) where the laboratory equipment in high demand. Thus, we plan to implement the pilot project for blended learning in natural science in the following years. The "flipped classes" is commonly used for students of the humanities.

The Flex model is now not used in Ukrainian higher education for technical specialists, but we argue it can be in high demand for mechanical engineering, robotics, space engineering with big open space rooms to create and to share with partners. We proposed to make such open space in Ukrainian higher educational institutions as a future project.

A la carte model can be introduced for theoretic knowledge obtaining. Among the examples, it is worthwhile students studying problematic issues that do not have a clear or consistent answer and require the student to analyze critically his own. After proper reflection and discussion in the audience, an exchange of views with other students and a teacher, one can reach a meaningful inference and determine the position on the controversial statement.

The enrich virtual model was never used in higher educational institutions in Ukraine. The realities of modern Ukrainian education do not allow full use. With the development of educational technologies and the increase in the number of online courses and materials for blended learning, such a model can gain active use both in technical and humanitarian higher education in Ukraine.

#### 5. Conclusions

The blended learning is in high demand among technical professionals all over the world but was implemented in Ukrainian educational process only in 2016 with the pilot project for IT specialists. The enriched blended learning techniques analysis revealed that this way to study and obtain knowledge can be and must be used to training technical specialist but only those who are studying IT but engineers of all kinds, chemists, biologists, electronic specialist, space specialists, etc.

The study has shown that the most suited blended learning model for technical higher education is the rotation model, and the station rotation can be introduced into the educational process without further due. During the pilot implementation period at National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute students of the same year and the same program took the same course in traditional and blended way. Those who took the course in blended got completion better results (up to 15% in different subject groups) than those who took it in a traditional format.

Among the disadvantages it is worth noting:

- dependence on technical equipment;
- digital literacy problems;
- lack of group work;

- the motivation for self-study and mastering of material.

Digital literacy today is one of the components of not only successful learning, but also the implementation of yourself as a specialist in the future. We propose to introduce a self-passed course on digital literacy to overcome this difficulty,

Lack of proper hardware is one of the most important problems in the blended learning implementation since it depends to a large extent on the availability of a permanent and stable connection to the Internet and the necessary equipment to access the network. In large cities, regional centers of Ukraine, the possibility of using technical equipment is almost always available, but in small towns and villages, it is not always possible to overcome technical problems.

The lack of group lecture work can be overcome by further material's discussion during the problem-oriented lectures. However, the motivation for self-study still stays problematic. But individual ways to enhance motivation will improve the learning process quality and increase the overall success rate. Subsequent studies of various testing techniques for online course listeners will allow to identify key criteria for use, suggest ways to implement and automate the testing process, bypassing the individualization factors, as recent studies propose [8].

We propose to carry out large-scale experiment of blended learning implementation with massive open online courses created in Ukrainian by leading specialists in their fields and their implementation to the educational process to bring up-to-date knowledge, a chance to study regardless of financial state or an opportunity to enroll to the leading universities.

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