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THE USE OF MOOCs FOR TRAINING OF THE FUTURE COMPUTER SCIENCE TEACHERS IN UKRAINE

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Abstract: *The article is examines the global trends in MOOCs development, problems and perspectives of implementation and using of MOOCs in Ukraine. Some experience of MOOCS introduction to face-to-face learning is analyzed. The article is includes the analysis of authors' experience concerning the MOOCs recommended for supporting of training of the future computer science teachers in Ukraine. The authors offer the way of MOOCs introduction for supporting face-to-face learning in three stages: a) pre-university preparing of students; b) additions to the traditional courses with MOOCs training elements; c) advanced training and retraining of specialists. The authors' experience of using MOOC in these three stages are described and discussed. Finally, the problems that appeared and solutions which could be beneficial formulated.*

Keywords: MOOCs, Training Teachers, Future Computer Science Teachers, Integration of MOOCs and Traditional Learning.

INTRODUCTION

Massive Open Online Courses (MOOCs) have brought about the real educational revolution. The MOOC is an educational model that brings online learning content to any person willing to participate. An increasing number of MOOCs is offered by higher education institutions and companies, and many authors have pointed at the important role of open online courses for lifelong learning.

According to the statistics of the year 2010, every sixth American student of the full-time education has used an online course to any extent. Now amount of MOOCs users is increased. Video lectures of different schools began to appear on the Internet in the late 1990s. Massive open online courses also provide interactive communication opportunity for students and teachers. Also they make possible online exams.

According to the data collected by MOOC aggregator "Class Central" (www.class-central.com, accessed on 25 July 2016), the total number of students who signed up for at least one online course has crossed 35 million in 2015 – up from an estimated 16-18 million in 2014.

Approximately 1,800 new courses were announced in 2015. As a result, the total number of courses announced since the inception of MOOCs has increased to 4,200 (Shah, 2015).

MOOCs attract a lot of students, but only a minority of the students succeeds in completing these courses (Reich, 2014). A typical example is an edX course (MIT and Harvard). Only 7,157 students (from 154,763 students registered on electric circuits) have received the certificate (Breslow et al, 2013).

As Reich noted and taking into account the completion rates, no more than 25% of students really intend to finish online courses. This number is lower comparing with such a number related to the traditional face-to-face university courses (Reich, 2014). This is raising the question about combination of the traditional learning and MOOCs.

An increasing number of researchers and teachers have participated in integrating MOOCs into the traditional learning to support face-to-face learning (Bruff, Fisher, McEwen, & Smith, 2013; Caulfield, Collier, &Halawa, 2013; Firmin, Schiorring, Whitmer, Willet, Collins, & Sujitparapitaya, 2014; Holotescu, Grosseck, Cretu, & Naaji, 2014).

This research presents our investigation of the ways of introducing MOOCs to the traditional learning in order to train future computer science teachers in Ukraine. The similar pedagogical approach has been considered by Holotescu et al. (2014). They have examined a combination of face-to-face and online activities and the integration of synchronous and asynchronous learning tools for providing an optimal possibility for the arrangement of effective learning processes.

The issues of integrating MOOCs into the traditional learning have been also considered by Israel (2015) in her study *"Effectiveness of Integrating MOOCs in Traditional Classrooms for Undergraduate Student"*.

According to this research, authors can conclude that the combination of the traditional learning and MOOCs exposes students to high quality materials created with the best educational technologies. This creates opportunities for students to collaborate in the global learning community and expand their experience. It is much more than only using of the university learning materials.

Research goal. This paper reviews the results of the recently completed study concerning introduction MOOCs to the traditional learning for training of future computer science teachers in Ukraine. It attempts to address the following questions:

- analysis of global trends in MOOCs development;
- analysis of problems and perspectives of using MOOCs in Ukraine;
- analysis of some experience of using MOOC in higher educational institutions (HEI) of the Netherlands and France;
- consideration of ways of introducing MOOCs to the traditional learning while the process of training of future computer science teachers in the Dragomanov National Pedagogical University.

Hypothesis: taking into account quick development of educational technologies, authors believe that update of the methodological approaches to the training of future computer science teachers by introducing MOOCs to the learning process will increase the level of training and efficiency of education in general.

1. RESEARCH METHODS

Authors have used the following research methods and tools for our investigation (during 2014-2016):

- questionnaire;
- survey and interview of the future computer science teachers;
- observation;
- documents and content analysis;
- research trip and visiting partner universities;
- meeting, conference, seminar, workshop, etc.;
- pedagogical experiment;
- analysis of research papers.

100 students of the Faculty of Informatics took part in this research. The Dragomanov National Pedagogical University in Kyiv and more than 100 students from partner universities (University of Montpellier 2 (France); University of Groningen (the Netherlands)) were involved in this process.

The questionnaire was created during this project which purposed to gain data on the students' opinions and attitudes towards online learning, blended learning, MOOCs and combination of the traditional learning and MOOCs.

2. ANALYSIS OF GLOBAL TRENDS IN MOOCs DEVELOPMENT

Massive Open Online Courses (MOOC or MOOCs) are free training courses with public access via the Internet. This is one of the newest forms of the distance learning, which is actively developing in the global education. Such sites are designed for students of different levels of prior training (both for beginners and experienced professionals), (Kaplan & Haenlein, 2016).

Now owing to MOOCs, any disciplines (mathematics, medicine, art, business, psychology, etc.) are available for those who wish to study. MOOCs includes tens of areas and thousands of courses.

The world's best universities (Stanford, Harvard, MIT, Berkeley, Brown, Columbia University, University of London, École Polytechnique Fédérale de Lausanne, University of Edinburgh, Oxford, Cambridge, and many others) participate in the process of creating and implementing of MOOCs. Distance education initiatives are supported by large corporations and charitable organizations (Google, Microsoft, Bill and Melinda Gates Foundation, and others).

The idea of online learning is also realized on the platforms developed by universities. Major educational institutions such as Yale, Carnegie Mellon University, Berkeley, Duke University, Massachusetts Institute of Technology (MIT) create their own video tutorials that duplicate traditional off-line lectures. Fully identical courses can be counted as academic hours of the program course at the university.

MOOSs platforms can be used not only for educational programs but also for advanced training.

The growth of MOOCs is shown in Fig. 1:

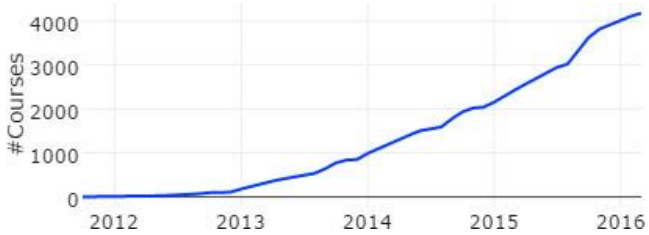

Figure 1. Growth of MOOCs

Source: Data retrieved from MOOC aggregator "Class Central" (https://www.class-central.com/report/moocs-2015-stats, accessed on 25 July 2016)

According to statistics from MOOC aggregator "Class Central" (https://plot.ly/alpha/workspace/?fid=dhawalhs:88), total number of MOOCs was 4180 courses in March 2016 (accessed on 25 July 2016).

The most popular MOOCs providers are Coursera, edX, Udacity, KhanAcademy, CanvasNetwork, FutureLearn, FUN, MyEducationKey, Udemy, and MIT OpenCourseware.

The distribution by MOOCs providers is shown in Fig. 2:

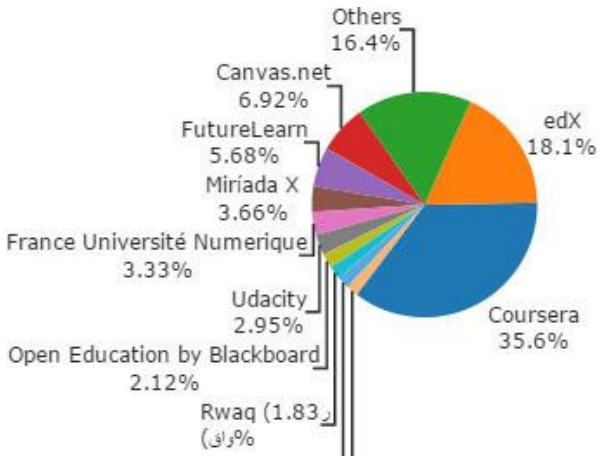

Figure 2.Course Distribution by Providers in 2015

Source: Data retrieved from MOOC aggregator "Class Central" (https://www.class-central.com/report/moocs-2015-stats, accessed on 25 July 2016)

Coursera is the largest online course provider in the world (MOOC or otherwise). Generally, it had 17 million students in 2015 (Shah, 2015).

Coursera, ***edX***, and ***Udacity*** are usually known as the big three. ***FutureLearn*** had a breakout year in 2015. Now it has more students than ***Udacity***. ***FutureLearn*** is the UK-based MOOCs provider (the Open University, United Kingdom (UK)). This makes ***FutureLearn*** the third largest MOOC provider in the world. It grew over to 275% in 2015. Now this is rapidly approaching the three million user mark. Also this launched perhaps the world's largest single session of a MOOC: 440,000 students signed up for one

session of the *'Understanding IELTS: Techniques for English Language Tests course'*, which was taught by the British Council (Shah, 2015).

Since October 2014 (under the European Union support), the project related to uniting of the MOOC courses of various European universities on one platform EMMA (European Multiple MOOC Aggregator) has been launched. This platform includes the online courses from the European universities (http://europeanmoocs.eu). These courses are in different languages. Pilot program of the project has launched in eight countries (England, Belgium, Spain, Italy, the Netherlands, Portugal, France and Estonia).

Participation in the program are Twelve universities and companies (in these eight European countries) participate in the program. EMMA operates with the support and financing of "Framework Programme of the European Union's competitiveness and innovation". Also, EMMA is presented to the public as a 30-month pilot project that provides the access to MOOC courses in multiple languages with automatic transcription.

According to the information of the project website, EMMA operates in two basic modes: as an aggregator and hosting of the courses developed by the European universities, as well as a system that allows students to build their own way of learning with using MOOC units as building blocks.

Thus, the analysis of the global trends in the field of creating and using MOOCs by leading universities of the world confirms the relevance and necessity of introducing this technology in Ukraine.

3. ANALYSIS OF PROBLEMS AND PERSPECTIVES OF THE USE OF MOOCs IN UKRAINE

The first MOOCs in Ukraine were in 2013 at the Taras Shevchenko Kyiv National University ("University online" (http://online.knu.ua). The first of them was related to brand management. This gathered over 9,000 participants. In September 2014 the Ukrainian Project ***Prometheus*** for developing of MOOCs has been launched (http://prometheus.org.ua/courses/).

The project Prometheus is based on the basis of the platform edX.

Prometheus operates in two formats: MOOCs and blended learning. MOOCs consist of video lectures, and interactive tasks that help to solidify knowledge and a forum where students can ask the teacher different questions and communicate with each other. Blended learning involves the integration of online learning and, in particular, MOOCs, in the educational process of universities and schools.

The first experiments with blended learning were conducted by the Massachusetts Institute of Technology (MIT). They have demonstrated growth of educational results by 35% (Primachenko, 2015). The experiments related of the implementation of online course elements to the traditional learning. MOOCs can be partly replaced with the traditional lectures. Typical tasks are replaced with interactive tasks by using of the network technologies. Students' questions are discussed on forums, but teachers also conduct seminars which are impossible to conduct via the Internet. Final control of students is performed on the face-to-face basis.

Blended learning is essential educational breakthrough, the introduction of which is actively performed by leading Western scientists (Breslowetal., 2013; Bruffetal., 2013; Bucketal., 2013; Caulfieldetal., 2013; Dazaetal., 2013; Yuan & Powell, 2013; Holotescuetal., 2014; Firminetal., 2014; Reich, 2014; Israel, 2015). Start of the pilot project of blended learning with the use of ***Prometheus*** platform is planned in several Ukrainian universities in different cities of Ukraine in September 2016.

Now Prometheus offers 230,000 students 35 free MOOCs from the best teachers of Ukranian and foreign universities, top-companies and organizations. As an example, it is possible to consider the world's best course dubbed in Ukrainian related to programming ***CS50 Introduction to Computer Science***: http://courses.prometheus.org.ua/courses/Prometheus/CS50/2016_T1/info. This course is taught by Professor David Malan of Harvard to university students of the university in the fall semester of 2014-2015 (academic year). The course was accessible on the ***edX*** platform during the year 2015. (cs50.harvard.edu or https://www.edx.org/course/introduction-computer-science-harvardx-cs50x).

At the beginning of Project ***Prometheus*** launch, its authors had doubt concerning the necessity of creation of the Ukrainian MOOCs, taking into account the presence of lots of foreign courses. However, national

platforms have certain advantages. They eliminate the language barrier and are based on the national specifics (Primachenko, 2015). In addition, there are areas for which it is advisable to develop the Ukrainian language courses such as “History of Ukraine”, “Geography of Ukraine”, and “Ukrainian language”.

Kyiv National University, Kyiv-Mohyla Academy, National Technical University of Ukraine “Kyiv Polytechnic Institute”, Dragomanov National Pedagogical University and “Microsoft” company can create their own MOOC courses and place them on the platform Prometheus.

So, now Ukraine has background for implementing MOOCs in the educational process of universities, colleges and schools to facilitate the access of Ukrainian students to high quality educational materials. In addition, each student will be able to study for free, listening to lectures of the best professors of leading universities.

Before the introduction of new educational technologies, it is necessary to find out all the pros and cons of the use.

The main advantages of MOOCs in the learning process are:

• accessibility (if you have access to the Internet);

• free-of-charge-basis;

• access to high quality educational materials (the ability to listen thematic lectures of the best specialists in the world);

• the opportunity to learn the experience of creating and using MOOCs in the educational process by the Ukrainian teachers on the basis of the foreign MOOCs;

• increase the rate of the growth of the knowledge.

The problems of implementation and use of MOOCs in Ukraine are:

• lack of state support in the implementation of such projects to create such public platforms of MOOCs as in France or China (Primachenko, 2015);

• limited hardware characteristics of the server, on which MEP platform is planned to install;

• lack of experimental studies to determine the sufficiency of control methods of learning for issuing specific Certificate of Completion;

• uncertainty concerning the quality of training materials for courses;

• lack of specialists to develop MOOCs;

•necessity of training of teachers and students for using MOOCs, especially for non-informatics specialties;

• time needed by teachers for the use of this technology;

• difference between personal experience of the student under conditions of full-time education and distance learning (students do not always have well-formed individual work skills and high motivation for educational activity);

• combination of a large volume of the total material for the discipline with a relatively small amount of material that can be placed in MOOC.

• a rather small number of MOOCs in the Ukrainian language;

• Ukrainian students need knowledge of the English language at the level required for the course.

The last problem relates to the fact that in most cases MOOSs training is conducted in English (MOOC has the American “origin”). The share of English language courses has slightly reduced from 80% in 2014 to 75% in 2015. But English still is the most popular language in which courses are offered (Shah, 2015).

Quite common courses are also in Spanish. Already established MOOSs are gradually translated into other languages (French, Chinese, Russian, Ukrainian, Turkish, German, etc.).

Now courses are currently being offered in 17 different languages. Course distribution by languages is shown in Fig. 3:

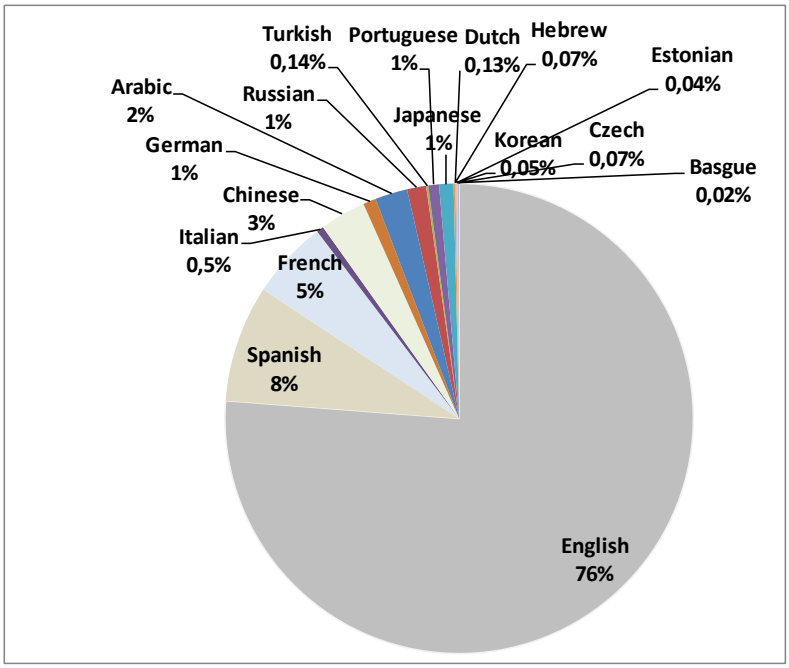

Figure 3. Course Distribution by Languages
Source: Own work based on data retrieved from MOOC aggregator "Class Central" (www.class-central.com/languages, accessed on 28 July 2016)

4. WAYS OF INTRODUCTION OF MOOCs TO SUPPORT OF COMPUTER SCIENCE TEACHERS TRAINING IN UKRAINE

Despite many drawbacks, authors believe that it is for the students to know about this educational technology. This issue is especially important for future computer science teachers. They should not only know about such existing projects and gain skills of work in these systems, but also know how to work with the MOOCs development technology. In future it will not only improve the qualification of future computer science teachers, but also it will contribute to using of the technology in their pedagogical activity own training future professionals for life but also the possibility of using this technology in their professional educational activity.

In this research authors propose such ways of using MOOCs in the Dragomanov National Pedagogical University for supporting face-to-face learning of the future computer science teachers as:

1. Pre-university preparing of students.
2. Additions to the traditional courses with MOOCs training elements.
3. Advanced training and retraining of specialists.

The article considers these trends in more detail with stating of specific examples of using MOOCs by the universities of Ukraine, the Netherlands and France.

4.1. PRE-UNIVERSITY PREPARING OF STUDENTS VIA MOOCs

Based on our own experience authors propose to use follows ways for pre-university preparing of students in Ukraine:

1. Recommended online courses for prospective students;
2. Pre-study courses;

3. Adapted courses of university professors for pupils to make them acquainted with the peculiarities of specialties and/or disciplines which pupils plan to study in future.

Online courses can be recommended for prospective students to pass training on propedeutics of certain field (e.g., Computer Science) planned to be studied by the students. Thus, while choosing courses teachers should take into account such factors as:

• insufficient knowledge and skills of students to study many MOOCs needed for understanding of the educational material;

• lack of motivation of pupils;

• low English level of Ukrainian students, because previously mentioned, today 76% of MOOCs are conducted in English (see Fig. 3).

In addition, MOOCs can be effectively used to prepare students for external evaluation (EIT, External Independent Testing). The results of EIT make possible the entry to universities in Ukraine. The Dragomanov National Pedagogical University conducts these courses in full-time and distance modes. However, the development of MOOCs to prepare for EIT will increase the effectiveness of training and motivation of students by the providing of opportunity to learn the appropriate material many times.

Such MOOCs are already starting to appear in Ukraine. Thus, the Ukrainian platform ***Prometheus*** can be used by applicants for free to take MOOCs for preparation to for the testing EIT of the Ukrainian language and literature, the English language, Mathematics, Physics, and Chemistry (in Ukrainian, see Table 1 below):

Table 1.

MOOCs recommended for pre-university preparing students in Ukraine

Name of MOOCs	Link of MOOCs
Preparation to EIT of the Ukrainian language and literature	http://courses.prometheus.org.ua/courses/OsvitaOnline/Ukr101/2015_T1/about
Preparation to EIT of Mathematics	http://courses.prometheus.org.ua/courses/Prometheus/101/2015_T1/about
Preparation of EIT of the English language	http://courses.prometheus.org.ua/courses/OsvitaOnline/Eng101/2015_T1/about
Preparation of EIT of Physics	http://courses.prometheus.org.ua/courses/Prometheus/102/2015_T1/about
Preparation of EIT of Chemistry	http://courses.prometheus.org.ua/courses/Prometheus/103/2015_T1/about

Source: Own work

In addition to the mentioned fields of training, preparing of prospective students can be made by creating adapted and simplified MOOCs. These MOOCs developed by the university professors for pupils to make them acquainted with the peculiarities of specialties and/or disciplines which pupils plan to study in future.

Authors have some experience in supervising MOOC "***Web Class Computing Science***" (in English) for preparing pre-university students at the University of Groningen (the Netherlands). It was short four weeks MOOC during March 2015 (screenshot of the course is in Fig. 4).

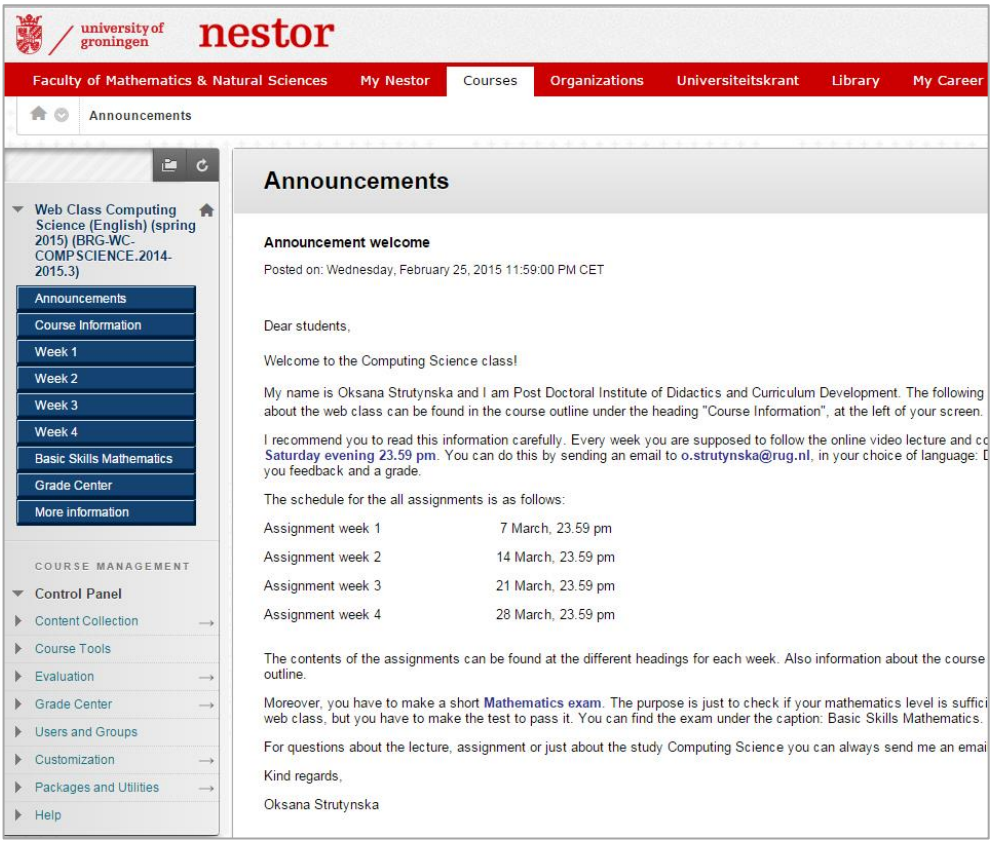

Figure 4. Announcement page of the MOOC "*Web Class Computing Science*"
Source: Own work

During this period authors had the following activities as supervising and evaluation assignments, and providing feedback; determining the use of ICT for preparing pre-university students (including digital learning environments, ICT applications, and innovative working methods).

28 students were registered for the MOOC course "***Web Class Computing Science***". 11 of them (39%) have fully passed the course, and only 5 (from the previously mentioned 11) have received certificates of successful completion of the course (18%).

These MOOCs are conducted in the University of Groningen twice a year (usually in November and March) and include more than 30 courses. Survey of participants (after the courses completion) show positive attitude of students to such activities. So, it shows the feasibility of using such MOOCs.

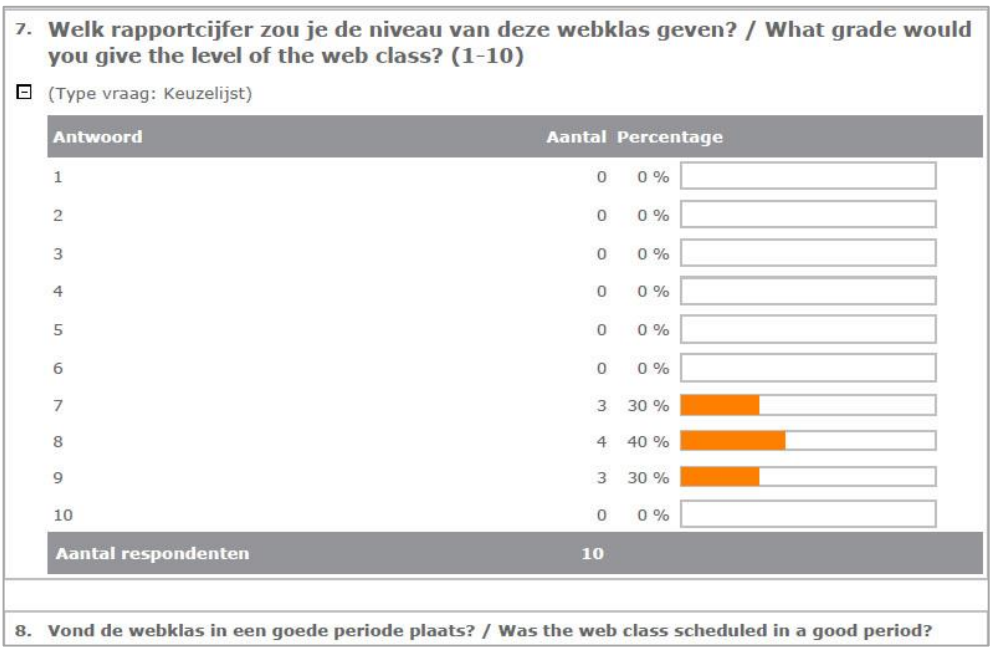

Figure 5. Example of evaluation of MOOC "*Web Class Computing Science*" by students (March 2015)

Source: Own work

Authors also plan to introduce the MOOCs to prepare applicants for entry into the Dragomanov National Pedagogical University.

4.2. ADDING OF ONLINE COURSES TO THE TRADITIONAL LEARNING

Authors research how they could introduce MOOCs to face-to face learning for training of the future computer science teachers. For this authors have analyzed the Bachelor and Master curriculum (in Informatics, qualification "**Computer Science Teacher**").

The Bachelors of Informatics curriculum consists of three cycles:

1. Cycle of humanitarian and socioeconomic training.
2. Cycle of science and mathematics training.
3. Cycle of professional and practical training:
    - Cycle of professional pedagogical training.
    - Cycle of scientific subject oriented training and special courses and elective courses (depth level of training **Computer Science** and **Programming**).
    - Cycle of practical training.

Based on this plan, it should be noted that for studying of disciplines of professional and practical training in the field of ICT (**Computer Science, Programming**) is devoted 81 ECTS credits (from total 240 ECTS credits).

The Master of Informatics curriculum consists of three cycles:

1. Cycle of professional oriented humanitarian and socioeconomic training.
2. Cycle of natural sciences, professional and practical training.
3. Cycle of practical training.

According to the Master curriculum, for studying of disciplines of professional and practical training in the field of ICT (**Computer Science, Programming**) should be devoted 8 ECTS credits (from total 61 ECTS credits).

Authors believe that these hours are not enough for gaining high-quality ICT competences by students, future computer science teachers, because of the quick development in the ICT sector. That's why authors offer complementing the full-time study with the elements of MOOCs.

For this purpose authors have analyzed the number of **Computer Science** and **Programming** MOOCs (see in Fig. 6):

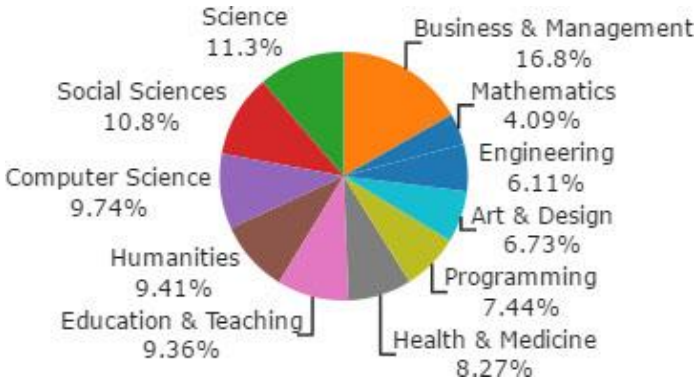

Figure 6. Course Distribution by Subjects in 2015

Source: Data retrieved from MOOC aggregator "Class Central"
(https://www.class-central.com/report/moocs-2015-stats,
accessed on 25 July 2016)

Last year saw an increase in the percentage of courses in the field of technology and business. The percentage of **Computer Science** and **Programming** courses grew by more than 10% (Shah, 2015).

As authors can see from Fig. 6 the number of **Computer Science** courses is 453 (9,74% from total). The number of **Programming** courses is 313 (7,44% out of the total). Thus, there are quite big number of the courses to make a choice between them for adding to full-time education curriculum of future Computer Science teacher.

As noted above, MOOCs are mainly conducted in English (see Fig. 3). Therefore, the relevance of learning English by the Ukrainian students is very important. According to the curriculum for future computer science teachers in the Dragomanov National Pedagogical University, students get 5 ECTS credits (Bachelor level) for learning English. This is not enough to gain the appropriate English knowledge required to pass the MOOCs.

4.2.1. MOOCs RECOMMENDED FOR THE 1st YEAR STUDENTS (BACHELOR LEVEL)

An important task of the 1st year students is to improve English knowledge as this is required for the initial introduction of MOOCs (at least **Intermediate level**).

Beside English MOOCs, authors also offer Mathematical MOOCs, because mathematical disciplines are fundamental for future computer science teachers and IT specialists (see Table 2). The courses are offered for passing during the students' individual work.

Table 2.

MOOCs recommended for 1st year students (Bachelor level)

Name of MOOCs	MOOC provider
Teach English Now! Foundational Principles	Coursera
Teach English Now! Theories of Second Language Acquisition	Coursera
Teach English Now! Lesson Design and Assessment	Coursera
Teach English Now! Second Language Listening, Speaking, and Pronunciation	Coursera
Understanding Language: Learning and Teaching	FutureLearn
Tell Your Story in English: Reading & Writing Skills for Language Learners	Canvas.net
Calculus One	Coursera
Mathematics: the Language of Nature	World Science U
Introduction to Mathematical Thinking	Coursera
Science Fiction/Science Fact: Predictions and Math (Lite)	Canvas.net
Introduction to Numerical Methods - Part 1 of 2	Canvas.net
Linear Algebra (in Russian)	Coursera

Source: Own work

4.2.2. MOOCs RECOMMENDED FOR 2nd YEAR STUDENTS (BACHELOR LEVEL)

The 2nd year students should be professionally oriented concerning the learning of the English language (see Table 3).

• Learning of the IT-specific terminology.

• Introduction to specialized English texts.

• Improving of English speaking skills.

• Review, discussion and analysis of relevant videos.

• Support for learning of basic math courses (probability theory, statistics, etc.).

Table 3.

MOOCs recommended for 2nd year students (Bachelor level)

Name of MOOCs	MOOC provider
English Conversational Skills	edX
Speak English Professionally: In Person, Online & On the Phone	Coursera
Differential Equations in Action	Udacity
Maths Puzzles: Cryptarithms, Symbologies and Secret Codes	FutureLearn
Bayesian Statistics: From Concept to Data Analysis	Coursera
Statistics: The Science of Decisions	Udacity
Introduction to Probability, Statistics, and Random Processes	Independent
Introduction to Computer Science	edX
MyCS: Computer Science for Beginners	edX

Source: Own work

4.2.3. MOOCs RECOMMENDED FOR 3rd AND 4th YEAR STUDENTS (BACHELOR LEVEL)

MOOCs for 3rd and 4th year students are recommended to be used in the following ways in order to prepare future computer science teachers (see Table 4):

• Introduction to the existing online courses of professional disciplines, free surfing on them.

• Advanced training of students of students by introducing of some parts of online courses to the learning process of certain disciplines (**Computer Science, Programming** and **Education & Teaching**).

• Use of MOOCs during within pedagogical practice in schools (to create educational videos, video lessons for pupils).

• Writing of term papers and theses.

Table 4.

MOOCs recommended for 3rd and 4th year students (Bachelor level)

Name of MOOCs	MOOC provider
Codecademy	http://www.codecademy.com
Teaching with Moodle	Independent
Introduction to Programming with Java – Part 1: Starting to Program in Java	edX
Programming in Scratch	edX
Data Structures	Coursera
Introduction to Computer Programming, Part 1	edX
Paradigms of Computer Programming - Fundamentals	edX
Programming Mobile Applications for Android Handheld Systems: Part 1	Coursera
How To Create a Website in a Weekend! (Project-Centered Course)	Coursera
Object Oriented Programming in Java	Coursera
Code Yourself! An Introduction to Programming	Coursera
HTML, CSS, and Javascript for Web Developers	Coursera
Java Programming Basics	Udacity

Name of MOOCs	MOOC provider
C++ For C Programmers, Part A	Coursera
C# Programming Basics (in Ukrainian)	Prometheus
Java Programming Basics (in Ukrainian)	Prometheus
Design and analysis of algorithms. Part 1 (in Ukrainian)	Prometheus
Programming Basics (in Ukrainian)	Prometheus

Source: Own work

For the last academic year (2015-2016) authors have implemented advanced training for students by introducing of certain parts of online courses to the learning process of 2nd and 3rd bachelors and future computer science teachers ("**Programming Technologies"** and **"Programming"**).

During the course "**Programming Technologies"** (http://www.moodle.fi.npu.edu.ua/course/view.php?id=92) students were performing the following:

- improving their own qualification by learning parts of courses within the discipline "Programming Technologies". The MOOCs courses were asynchronized with the computer science classes at the university. Students were following the online materials chosen by teachers without completing assignments for them. The class-time was freed up by the MOOC, the teacher was focusing on in-class activities, projects, and assessments with the use of the distance course *"**Programming Technologies"***;
- using of the MOOCs during the preparing of term papers.

4.2.4. MOOCs RECOMMENDED FOR 1st and 2nd YEAR STUDENTS (MASTER LEVEL)

There are following ways of the use of MOOCs for preparing of masters of Computer Science (see Table 5):

• Training on methods of online courses developing.

• Advanced training of students of students by studying the online courses of the disciplines (**Computer Science, Programming** and **Education & Teaching**).

• Use of MOOCs during within pedagogical practice in schools and universities (to create educational videos, video lessons for pupils and students).

• Writing of term papers and theses.

Table 5.

MOOCs recommended for 1st and 2nd year students (Master level)

Name of MOOCs	MOOC provider
Understanding IELTS: Techniques for English Language Tests course	FutureLearn
How to create a Windows 8 App	Independent
Codecademy	http://www.codecademy.com
Python For Informatics	Independent
Design and Development of Educational Technology	edX
Cloud Computing Concepts, Part 1	Coursera
Introduction to the Internet of Things and Embedded Systems	Coursera
Java for Android	Coursera
Beginning Game Programming with C#	Coursera
English for Teaching Purposes	Coursera
Fundamentals of Online Education: Planning and Application	Coursera
Teaching Math Through Problem-Solving K-12	Canvas.net

Name of MOOCs	MOOC provider
How to create MOOC (in Ukrainian)	Prometheus

Source: Own work

For the last academic year (2015-2016) authors have introduced basics of methods of online course developing to the learning process of masters and future computer science teachers ("***Organization of Distance Learning***" and "***Social Informatics***").

During the course "***Organization of Distance Learning***" (http://www.moodle.fi.npu.edu.ua/course/view.php?id=205) students were performing the following:

- getting acquainted with the existing online courses of professional disciplines, free surfing on them;
- analyzing and choosing of the course for their own advanced training;
- improving their own qualification by learning one chosen online course within the discipline on the platform ***Codecademy*** (http://www.codecademy.com):
  - HTML & CSS (Learn how to create websites by structuring and styling your pages with HTML and CSS);
  - Make a Website (Explore HTML & CSS fundamentals how to build a website in this introductory course to web development).
- learning of certain elements of methods for creating of online courses (analyzing of the legal framework of Ukraine related to online training on information and copyright relationships; acquainting with the structures of online courses, methods of video lectures and tests).
- using of the MOOCs during the preparation of term papers and theses.

During the course "***Social Informatics***" (http://www.moodle.fi.npu.edu.ua/course/view.php?id=87) students were performing the following:

- analyzing of characteristics of MOOC providers;
- developing of the MOOC structure;
- working in pairs and developing of group projects to create MOOC elements (trailers, video lectures, and tests to video lectures).

After the end of the academic year authors offered our students a questionnaire regarding the advantages and disadvantages of using MOOCs in the educational process. According to the survey results, authors can draw conclusions about the positive attitude of students to the introduction of the technology to support of full-time education.

4.3 PROFESSIONAL IMPROVEMENT AND RETRAINING

MOOCs offer challenging opportunities for teachers to improve their knowledge in their own professional field and their competences and skills in adopting of new models of open educational practices (Holotescu et al., 2014). So, the third way of using MOOCs is professional improvement and retraining.

Some experience of such use of MOOCs has been taken from the Laboratory of Informatics, Robotics and Microelectronics of Montpellier (France), (http://www.lirmm.fr/). The platform FUN is used to improve the skills of scientists (free and open to all (https://www.fun-mooc.fr/)).

FUN platform delivers online courses such as MOOC (Massive Open Online Course) Free Online Courses open for all, proposed, designed and animated by the French higher education institutions and their partners.

For further information on FUN, please follow https://www.fun-mooc.fr/cours/.

Authors are planning to implement similar MOOCs in the Dragomanov National Pedagogical University as a required step of professional improvement and retraining.

4. DISCUSSION

So this paper addressed the following mentioned above questions: analysis of global trends in MOOCs development; analysis of problems and perspectives of using MOOCs in Ukraine; analysis of some experience of using MOOC in HEI of the Netherlands and France; consideration of ways of introducing MOOCs to the traditional learning during the process of training of future Computer Science Teachers in the National Pedagogical Dragomanov University.

Last research question about the ways of introducing MOOCs into traditional learning require more details explanation.

On one hand, after we had experience of using MOOCs in the National Pedagogical Dragomanov University for supporting face-to-face learning we gained some solutions, but on other hand, we still have unsolved problems.

According to the three stages of MOOC's introduction we can make follows conclusions as:

a. *in first one (pre-university preparing of students)* in the National Pedagogical Dragomanov University we have very low experience of using MOOCs yet.
   Regularly we pass online conference for pre-university preparing of students from remote regions of Ukraine. But it is online mode, and there is no possibility for applicants to re-study materials.
   So first step for future research is to create pre-study online courses for already existing materials of online conferences. Next step is to adapt courses of university professors for pupils to make them acquainted with the peculiarities of specialties and/or disciplines which pupils plan to study in future. It is helps future students to understand what exactly they are going to study.
   As we wrote above we have some experience of supervising pre-university students and we are planning to use this experience.

b. *in second one (additions to the traditional courses with MOOCs training elements)* in the National Pedagogical Dragomanov University we already have experience of using MOOCs for several courses. And how is mentioned above we prepared a list of MOOCs courses that we will use in face-to-face learning process. So this is another direction our research that is in process now.

   In this 20016-2017 academic year we started to introduction for 2nd year students of Master level the course "Creation and administration of distance educational resources" where students are training on methods of online courses developing. This can solve the problem of adapting courses of university professors using knowledge of this young scientific. Maybe this partly can help in third stage of introduction MOOCs that will mentioned below.

c. *in third one (advanced training and retraining of specialists)* like in first in the National Pedagogical Dragomanov University we have also very few experience of using MOOCs still.

   In this direction we have to prepare a list of existing MOOCs courses that we can use and have to create our own MOOCs courses in respect that specific our work using knowledge of young scientific that were trained by us.

Also it needs more detailed examination of hypothesis of research about increasing the level of training and efficiency of education in three stages of using MOOC. Today we have only examination of the second stage via pedagogical experiment.

5. CONCLUSIONS

Now, the use of MOOCs is a new important trend in the modern education. This is the transformation of the educational process inside and outside the educational institutions.

On the one hand, open learning with MOOCs is becoming a part of student's daily life as a form of informal learning (Selwyn, 2010). On the other hand, teachers will face with the following dilemma. Should face-to-face learning compete with MOOC-based curricula head-to-head, or should they begin to assimilate MOOCs into their traditional, residency-based curriculum?

Basing on the experience gained in this research and on the feedback received from students, authors are planning a more complex scenario for the next ways of using MOOCs for supporting face-to-face learning of the students:

1. Pre-university preparing of students.
2. Adding of online courses to the traditional learning.
3. Advanced training and retraining of specialists.

Even now researchers are discussing the issue concerning the necessity of creating of MOOC-oriented educational curricula and combining them with the traditional curricula.

Another important issue concerns modern teachers. As mentored above, MOOCs offer challenging opportunities for teachers to improve their knowledge, competences and skills for adopting of new models of open educational practices. So, the third way of using MOOCs is professional improvement and retraining. Solutions which could be beneficial in introduction of these three ways of using MOOCs were formulated.

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