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MASSIVE OPEN ONLINE COURSE AS AN ALTERNATIVE WAY OF ADVANCED TRAINING FOR HIGHER EDUCATIONAL ESTABLISHMENT PROFESSORS

The UNESCO's emphasis on Lifelong Leaning most of all concerns university professors, who, despite heavy workload, sometimes lack of money and opportunities for official advanced training, always have to show supreme quality of their teaching and research efforts, constantly updating curricular content in accordance with the innovative educational processes and changes taking place in the world.

Degree and advanced training of university professors was addressed by O. Andreyev, M. Vaindorf-Sysoyeva, V. Kukharenko, S. Tyrtyy, Yu. Fokina, et al. [1 – 7].

The aim of the article is to study the advantages of MOOC as an alternative form of advanced training for university professors on the basis of the content analysis of several massive open online courses offered by Coursera, Udacity, edX and also taking into consideration author's own experience of participating in such courses in 2012.

MOOC (massive open online course) is an online course, in which a large number of participants can take part (up to 50000); in addition, it offers free access to all study materials via the Internet. Recently, a new term has even been coined: "massive open online course professor" or "professor 2.0" [2].

G. Seamens [20] distinguishes two types of MOOCs, which he, for convenience, calls cMOOC and xMOOC. The "c" in "cMOOC" stands for connectivism, and the examples of such courses are those designed by G. Seamens himself, as well as by S. Downes, J. Groom, et al. In Ukraine, this direction of MOOC development is implemented by V. Kukharenko [4], K. Buhaychuk [2]. For

instance, in 2012, V. Kukharenko conducted two open courses of this kind: *E-Learning Strategy in an Organization* and *Social Services in Distance Learning.* The second group of massive online courses – xMOOC – is usually attributed to the projects *Coursera* [13], *Udacity* [22], *edX* [14]. The results of the comparative analysis of cMOOC and xMOOC are represented in Chart 1.

Chart 1

cMOOC and xMOOC comparison

cMOOC	*xMOOC*
Knowledge is created and generated	Knowledge is replicated
Creativity	More traditional approach (video presentations, quizzes, and testing)
Not sponsored	Good financial support
Individual initiate of some members of educational community	Supported by prestigious universities
Large body of non-structured information	Course content is structured
Not controlled	Controlled
A team of volunteers	A team of co-workers

In the article, we are going to focus on xMOOC projects, which are usually associated with such systems, as *Coursera, Udacity, edX.*

Coursera Project was awarded *Best Educational Website of 2012* by *The Times-Journal* [13]. Its co-founders, professors Andrew Ng and Daphne Koller from Stanford University, described the goal of the project in such a way: "Education should be a right, not a privilege, and I believe *Coursera* is a way to make that happen" (D. Koller); "I want to give everyone access to the best professors in the best universities in the world, for free" (Andrew Ng) [13].

The dynamics of *Coursera, Udacity, edX* search engine enquiry frequency analysis conducted with the help of *Google Trend Service* (Fig. 3) also revealed that *Coursera Project* was the leading one among all xMOOCs.

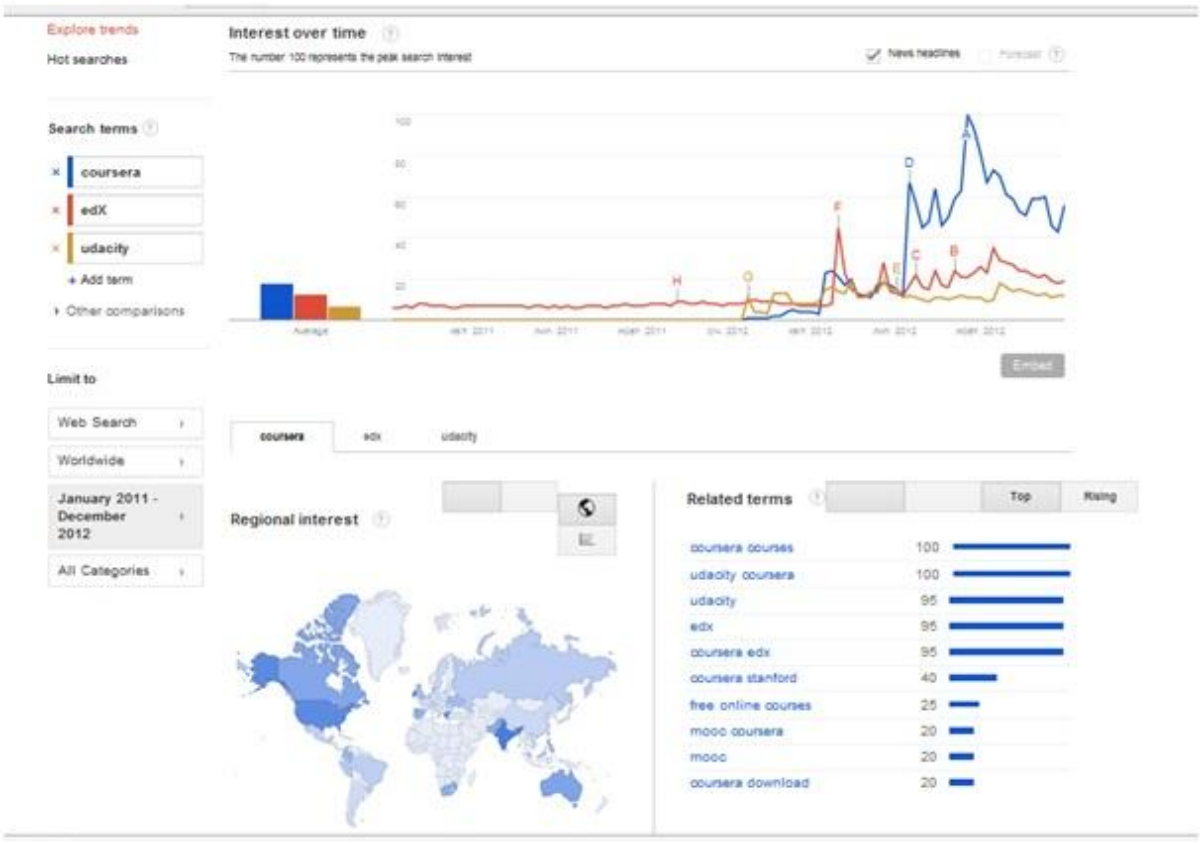

Fig 1. The Dynamics of *Coursera, Udacity, edX* Search Engines Enquiry

By the end of 2012, *Coursera Project* embraced 220 courses from 33 universities, which were grouped in 20 categories. The overall number of students who took the courses is 2 083 445.

The analysis of *Coursera* courses demonstrates their orientation to Computer Science (CS), which is represented in four subcategories: *CS: Theory; CS: Artificial Intelligence; CS: Software Engineering; CS: Systems and Security* (fig. 2).

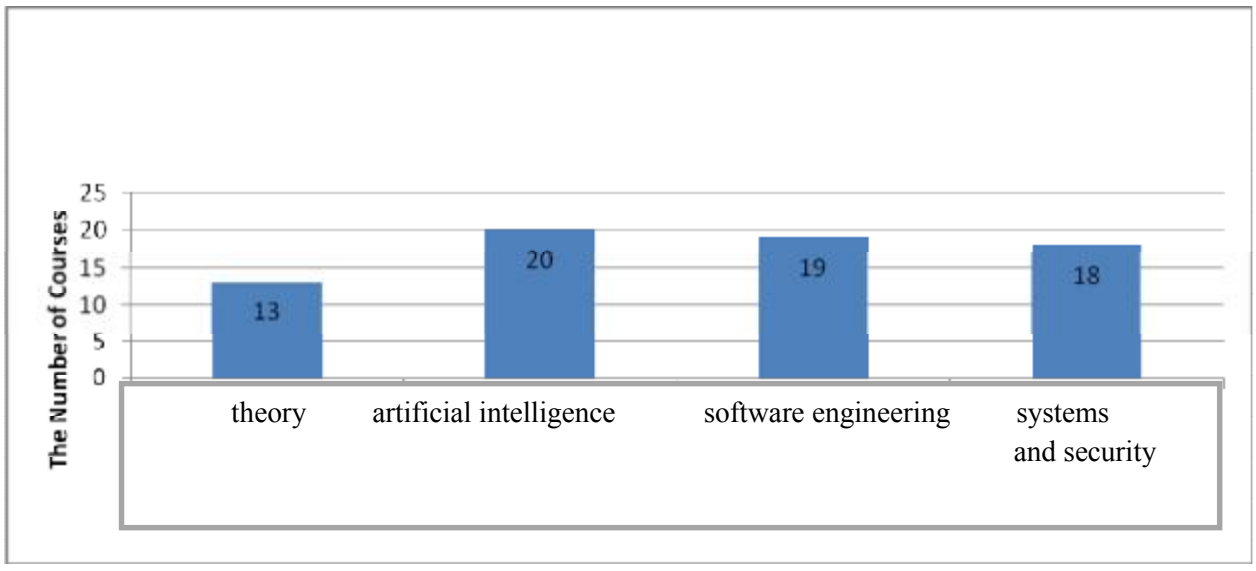

Fig. 2. The Distribution of Computer Science Courses at *Coursera Project* Website

The CS category is interrelated with *Statistics and Data Analysis*. The information about the latter is represented in the diagram below (Fig. 3).

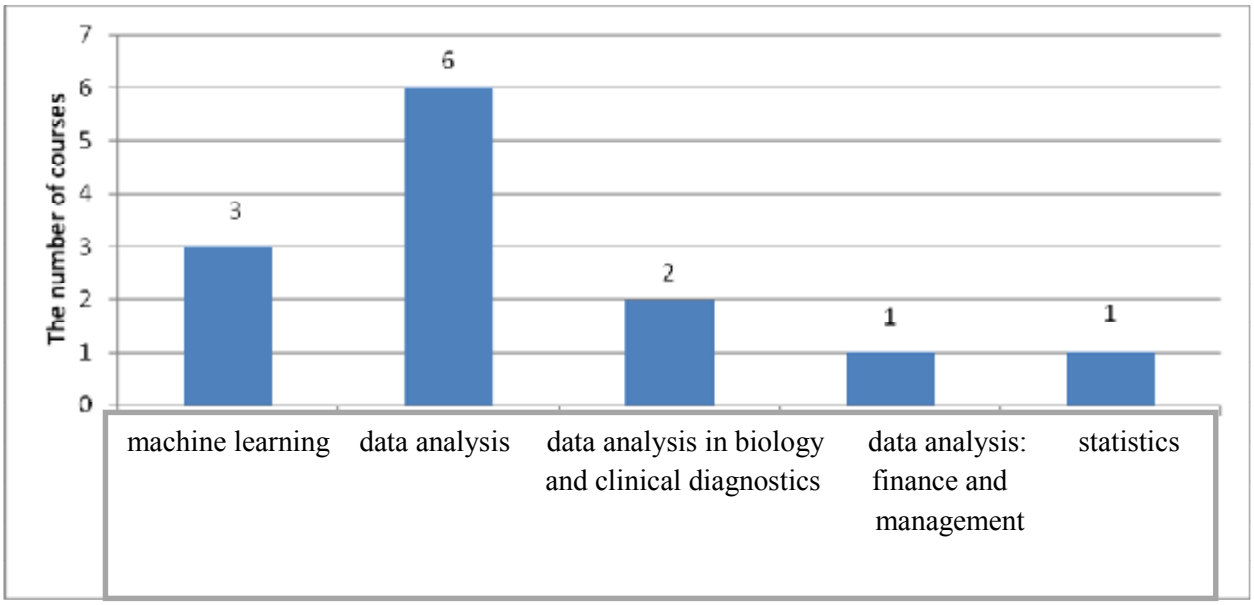

Fig. 3. The Distribution of *Statistics and Data Analysis Courses*

Thus, the *Machine Learning* category embraces 3 courses, *Data Analysis* – 6, *Data Analysis in Biology and Clinical Diagnostics* – 3, *Finance* – 1, *Linear Algebra* – 1, *Statistics I* – 1 (see Chart 2).

The authors of the project claim that they offer the courses in Humanities and Social sciences as well. But one can find only four courses in *Education* category, two of which are on the theory and the construction of distance learning courses. The *Social Sciences* category includes *Introduction to Sociology, Social Psychology,* and *The Laws of the European Union.*

Chart 2.

Statistics and Data Analysis **Category Courses**

Name of the Course	*University*	*Author*
Machine Learning	Stanford University	Andrew Ng
Machine Learning	University of Washington	Pedro Domingos
Neural Networks for Machine Learning	University of Toronto	Geoffrey Hinton
Computing for Data Analysis	Johns Hopkins University	Roger D. Peng
Computational Methods for Data Analysis	University of Washington	Nathan Kutz
Scientific Computing	University of Washington	*J. Nathan Kutz*
Data Analysis	Johns Hopkins University	Jeff Leek
Passion Driven Statistics	Wesleyan University	Lisa Dierker
Introduction to Data Science	University of Washington	Bill Howe
Financial Engineering and Risk Management	Columbia University	Martin Haugh and Garud Iyengar, with guest lectures by Emanuel Derman
Coding the Matrix: Linear Algebra through Computer Science Applications	Brown University	Phil Klein
Mathematical Biostatistics Boot Camp	Johns Hopkins University	Brian Caffo
Network Analysis in Systems Biology	Princeton University	Avi Ma'ayan
Data Management for Clinical Research	Vanderbilt University	Paul A. Harris, Stephany Duda, Firas Wehbe
Statistics One	Princeton University	Andrew Conway

The authors of the project managed to create a platform for education, which allows students to master curricular content quickly and efficiently. The pedagogical foundations of such learning are grounded in the following principles [19]:

- the efficiency of online learning is, at least, not lower than that of traditional one;

- homework and tests are not seen as the means of assessment; they guarantee revision and help the students to retain information longer;
- tests can be taken several times to allow students to improve the result;
- peer assessment;
- active learning in the classroom.

We deem it essential to discuss some of the principles and their advantages and disadvantages in detail.

The possibility of test retake to improve the result. Many tasks are constructed in such a way that they students are prompted to get back to the content several times and retake the test. Feedback is given immediately, and the mistakes made in the test are explained. According to some research, as Coursera Project reports, in the traditional classroom, 50% of students master the course material, while this methodology increases the number to 84%.

Peer assessment. The courses often include the tasks that cannot be machine-graded (essays, poems, business plans, software products, etc.). These tasks are typical of humanities, social sciences, business, design, and other courses. In such cases, peer assessment is used. For instance, in *Social Networks Analysis* Course (completed by the author of the article), the final project of each student was evaluated by three other participants of the course (peers) according to the criteria specifically designed to eliminate subjectivity. This student was, then, to assess three projects of other students.

Data acquisition, analysis, and interpretation were the three aspects to be assessed; each one was assigned a particular number of points, which were further distributed among the criteria specified below.

1. *Data Acquisition* (8 points)

- 2 points for the description of the way in which data was acquired (constructed or obtained from the existing data arrays, source code scripts (if necessary);
- 2 points for the explanation of the criteria for including the nodes and ties between them;

- 3 points for interesting or unusual data, presented in the collection.

2. Data Analysis (17 points)

- 3 points – the use of at least three metrics studied in the course;
- 4 points – the application of the metrics;
- 2 points – the use of at least one additional technology that was not covered in the course;
- 5 points – the use of visualization and its efficacy in data interpretation;
- 3 points – the code of the program or step-by-step instructions that allow to reconstruct the results achieved.

3. *Interpretation* (5 points)

- 3 points – adequate address of the data;
- 2 points – new vision of the phenomenon (process) provided by the data analyzed.

Active learning. It is reported that traditional lectures are not the most effective form of teaching. Lecture material found in the course is presented in the form of short, seven-to-fifteen-minute, video fragments, PowerPoint presentations, PDF files, subtitle files, MP4 video-files *(Fig. 4)*.

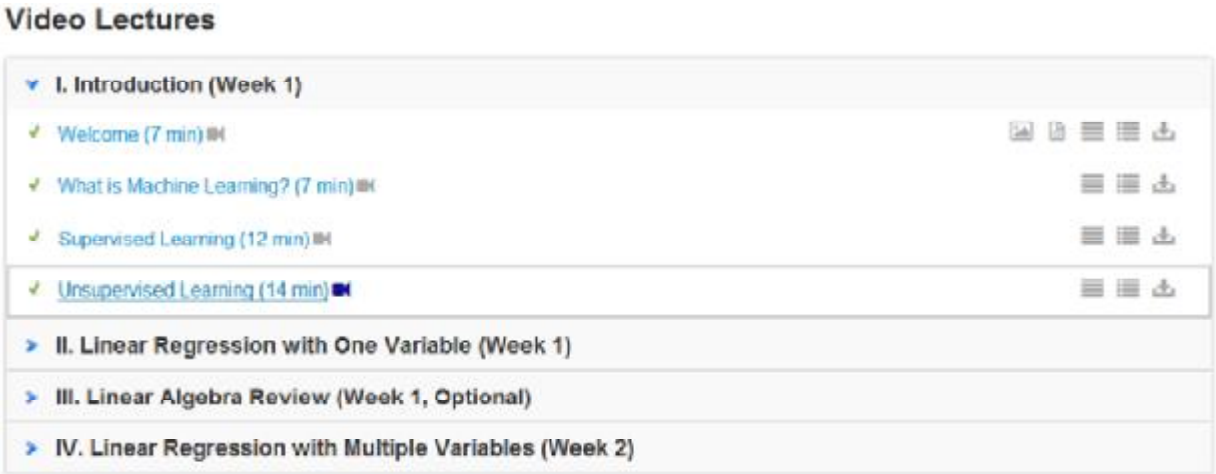

Fig. 4. The Forms of Lecture Material Presentation in *Machine Learning* Course by Andrew Ng

The attendance of active learning lectures is 20% higher compared to traditional lectures, while average grades for the same test are up to 74% from 41%,

respectively (whereas random answers give 23%) [19]. Active participation is achieved through quizzes used in the course of the lecture, tests and additional tasks on each topic, involvement of students in forum discussions and peer assistance, use of peer assessment for the final project evaluation, and creation of discussion groups.

The Forum is an important part of Coursera learning, where students can help each other. For example, 2000 out of 20000 students doing Andrew's Ng Machine Learning course made the same mistake, so they could easily detect the problem and help other participants of the course. During the fall semester of 2011, the median time for answers to the questions at the forum was about 22 minutes.

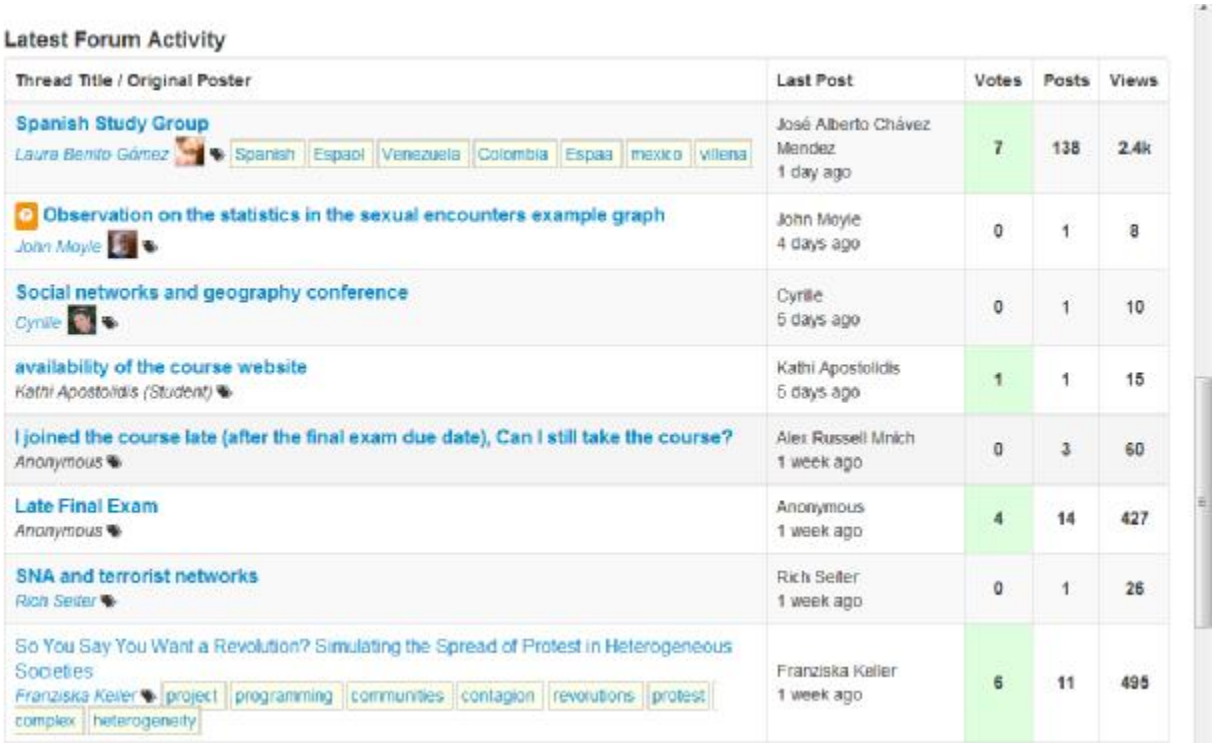

Fig. 5. The Forum for *Social Networks Analysis* Course *(Coursera)*

In Chart 3, we summarized the information about the projects *Coursera, Udacity, edX,* etc. according to the following criteria: the number of courses; the number of universities participating; the number of categories into which the courses are subdivided; and the year when the site was constructed.

Chart 3

Coursera, Udacity, edX: Comparative Analysis

Project	*The number of courses*	*Universities*	*Categories*	*Year of construction*
Coursera	210	33	20	2011
Udacity	19	-	4	2011
edX	15	Harvard University, Massachusetts Institute of Technology, Berkeley University of California, The University of Texas	Statistics – 1, Computer Science – 9, Chemistry – 1, Physics –1, Greek Literature – 1, Justice – 1, Health – 1	2012
MITx		MIT	19	2012
CanvasNet	9	Ball State University, Brown University	-	2013
FutureLearn	-	12 (The Open University + eleven universities in Great Britain)	Have not been announced yet	2013

Udacity Project courses, which are mainly related to Computer Science, are of three levels: beginner, intermediate, advanced. Beginner level courses can be taken by anyone irrespective of their background. Intermediate and higher level courses participation is subject to certain prerequisites, which ensures the principle of

succession in learning. In Chart 4, the results of the quantitative and qualitative analysis of the courses from each category are demonstrated:

Chart 4

Udacity Online Courses

(Http://www.udacity.com/courses)

Category (level)	*Number of Courses*	*Subject matter*
Beginner	3	Introduction to Computer Science, Physics, Statistics
Intermediate	11	Algorithms, Differential Equations in Action, Web Development, Game Development Software Testing, Programming Languages, Introduction to Artificial Intelligence, Intro to Theoretical Computer Science, How to Build a Startup
Advanced	5	Design of Computer Programs, Intro to Parallel Programming, Functional Hardware Verification, Artificial Intelligence for Robotics, Applied Cryptography

As opposed to *Coursera Project* courses, Udacity does not award any certificates of completion, but the best students can be offered a job in prestigious companies, with which the administration of the project cooperates. Moreover, the courses offered are the so-called "self-paced" courses, which means they are rolling and allow the students to proceed in their own pace depending on their abilities and time they have.

EdX (https://www.edx.org/) is a non-profit enterprise, founded by Harvard University and the Massachusetts Institute of Technology. Other partners, which joined the Project later, are Berkeley University and the University of Texas. EdX platform is an open resource, the mission of which is to enhance the process of

learning and teaching by experimenting with the hybrid model of leaning and to support the faculty in their pedagogical research.

Canvas Network Project [8] allows the educational institutions to design and teach the type of open courses that best fit them and their vision. Some institutions prefer massive open online courses, others choose small courses with a limited number of students to promote student-teacher cooperation. The universities participating in the Project are BSU (Ball State University), the University of Utah (famous for its contribution to the development of ARPANET, the predecessor of the Internet), Brown University (one of the oldest universities, the Ivy League school), et al.

In 2013, new free online courses within *FutureLearn Project* will appear. This project unites leading British universities, including King's College London, Bristol University, the University of Birmingham, the University of Southampton, belonging to the Russell Group. Martin Bin, the Vice President of the Open University, stated that the appearance of massive open online courses required from British universities either to "to bury their head in the sand" or to accept the challenge of the international online race.

With the introduction of new courses or old ones changing their platforms, MOOC change rapidly. A free online MOOC aggregator can help to find the courses (Chart 5). At the end of 2012, it contained links to 7 courses that had started some time ago or were about to start; 34 courses open for enrollment; 18 courses under development; 248 courses were to be launched in the nearest future, 18 rolling courses; and 92 courses that had been closed.

Chart 5

The Distribution of Courses according to the Project

(MOOC aggregator, December 2012)

Project	**Number of Courses**
Coursera	269
Udacity	20

edX	23
CanvasNet	25
Others (10gen, NPTEL, CalTech, CourseSite, Brown university)	37

The *CanvasNet Project* has recently announced the *MOOC on MOOC* course that will focus on the study of the massive open online courses phenomenon [9].

The experiment that we conducted with the help of a visual recommendation service Yasiv at http://www.yasiv.com/ service [23] can serve as yet another evidence of MOOC's popularity. The service found 65 books tagged MOOC on Amazon.com and visualized the links among them (Fig. 6):

Fig. 6. Visualization of Books Tagged MOOC at Amazon.com

The author had an opportunity to participate in several MOOCs in 2012, namely: *Machine Learning* (Stanford University), *Model Thinking* (University of Michigan), *Social Network Analysis* (University of Michigan), *Computing for Data*

Analysis (Johns Hopkins University) offered at http:// coursera.org (*Coursera Project*) [12; 17; 18; 21].

The analysis of the available research on the topic, as well as author's experience of participation in MOOC, allow us to determine the advantages of MOOCs as the courses for advanced training of university faculty:

- participation is free of charge;
- opportunity for on-the-job advanced training;
- introduction to individual teaching styles of the leading professors of some well-known universities;
- possibility to compare the methodological basis of different courses;
- distance learning experience in the role of a student;
- experience in forum discussions participation;
- experience in peer assessment practices;
- broadening one's horizons and knowledge of teaching methodology;
- opportunity to expand the courses taught at the university incorporating knowledge of MOOC;
- intercultural competency development;
- English listening, reading, and writing skills enhancement;
- expanding the range of software;
- establishing new professional contacts; and
- reflecting on one's own educational activity from a new angle.

We believe that the administration and leadership of Ukrainian universities should consider regarding the MOOC certificates of completion as the evidence of advanced training.

Prospective research in this area will include the study of the integration of MOOC into the educational process of Ukrainian universities.

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Панченко Л. Ф. Масовий відкритий онлайн-курс як альтернативна форма підвищення кваліфікації викладача вищої школи

У статті розглянуто можливості феномену масового відкритого онлайн-курсу (МООС) як альтернативної форми підвищення кваліфікації викладачів вищих навчальних закладів. Проведено зіставний аналіз двох різновидів МООС: cMOOC та xMOOC; проаналізовано динаміку популярності пошукових запитів, пов'язаних з проектами Coursera, Udacity, edX; розглянуто педагогічні платформи для масових онлайн-курсів. Розкрито структуру лекцій та питальників, визначено основні характеристики активного навчання в МООС, а саме – короткі відеолекції з убудованими питальниками, тести та завдання до кожної теми курсу, оперативний зворотній зв'язок, включення студентів у форум, взаємодопомога та взаємне оцінювання.

Ключові слова: масовий відкритий онлайн-курс, підвищення кваліфікації викладачів, Coursera, Udacity, edX.

Панченко Л. Ф. Массовый открытый онлайн-курс как альтернативная форма повышения квалификации преподавателя высшей школы

В статье рассматриваются возможности массового открытого онлайн-курса как альтернативной формы повышения квалификации преподавателей высших учебных заведений. Сопоставляются две разновидности МООС: cMOOC и xMOOC; анализируется динамика популярности поисковых запросов Coursera, Udacity, edX; рассматриваются педагогические платформы для массовых онлайн-курсов. Раскрыта структура лекций и опросников, определены основные характеристики активного обучения в МООС, а именно – короткие видеолекции со встроенными опросниками, тесты и задания по каждой теме курса, оперативная обратная связь, включенность студентов в форум, взаимопомощь и взаимное оценивание.

Ключевые слова: массовый открытый онлайн-курс, повышение квалификации преподавателей, Coursera, Udacity, edX.

Panchenko L. F. Massive Open Online Course as an Alternative Way of Advanced Training for Higher Educational Establishment Professors

The article discusses the importance of university professors' advanced training as one of the possible ways of the realization of the "lifelong learning" strategy. It focuses on the educational potential of the massive open online course (MOOC) phenomenon as an alternative form of the advanced training of the faculty. The analysis is conducted on the basis of the content analysis of several projects (Coursera, Udacity, edX, etc.), as well as author's own experience of participation in the courses *Machine Learning* (Stanford University), *Model Thinking* (University of Michigan), *Social Network Analysis* (University of Michigan), and *Computing for Data Analysis* (John Hopkins University) in 2012. Two varieties of MOOC (cMOOC and xMOOC) are compared, the dynamics of "Coursera", "Udacity", "edX" search engine enquiry frequency is analysed, and the pedagogical foundations of the platforms for massive on-line courses are examined. The author describes the structure of lectures and quizes used in the courses and determines the principal features of active learning methodology embedded in MOOC. An example of the latter is short video lectures with built-in quizes, tests, and assignments to follow up on every topic of the course, efficient feedback, message board participation, peer help, and peer assessment. Peer assessment criteria used in *Analysis of Social Networks* course are examined.

Key words: massive open online course, advanced training for university professors, Coursera, Udacity, edX.

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