Design and Development of MOOCs

Zarema Seidametova

Crimean Engineering-Pedagogical University, Simferopol, 95015, Ukraine
z.seydametova@gmail.com

Abstract. Massive open online courses (MOOCs) are the new additional dimension of education that allow to study online courses from different universities geographically located anywhere around the world. We consider the MOOC's classification based on pedagogical approaches and product functionalities (cMOOC, xMOOC, quasi MOOC). We present diagrams of the planning, prior preparation and the development of the MOOC. There are four stages of the process: preproduction, production, postproduction and maintenance. We present the typical roadmap of MOOC development: guidelines to develop course content, video content implementation, and development of roles. We introduce as example the video content matrix of the quasi-MOOC "Ruby on Rails Web Framework for Beginners". We recommend the following roles for the MOOC development team: experts, curriculum designers and technical specialists. This set of roles needs for effective design of MOOC.

Keywords: Massive Open Online Courses, cMOOC, xMOOC, quasi MOOC, MOOC design, Video Lectures.

1   Introduction

The educational community has begun to use since 2008 the term – *massive open online courses* (MOOCs) to denote a certain format of open online courses. According a study [1] conducted by the MOOC Class Central by the end of 2017 the size of the modern "MOOC movement" reached more than 800 universities, more than 81 million students; the number of MOOC courses are more than 9,400. The largest provider of online courses Coursera (www.coursera.org) has expanded its audience to 30 million students. Duolingo (www.duolingo.com), a popular language platform, has 200 million users (they do not receive formal certification, in contrast to the previously mentioned 81 million university students).

Despite the growing number of teachers who have started to develop the MOOC courses, the design of the MOOC is not simple. Teachers – developers of the MOOC – should be familiar not only with pedagogical approaches, but also with logistical, technological and financial issues. The authors of [2] propose the conceptual environment "MOOC Canvas" to support teachers in the description and design of the MOOCs.

The desire of educational institutions to improve the quality of education leads to the need to increase the cost of the development and maintenance for educational

services, and, consequently, the final cost of training increases. In the economic scale, the MOOCs model reduces the cost of learning per student. For example, if $300,000 were spent on the development of one MOOC with an audience of 100,000 students, then we got about $3 per student [3]. MOOC companies need to cover the start-up costs and financing activities. For example, Coursera in November 2013 attracted $85 million of venture capital, including funding from partner universities, the World Bank and venture capital companies. MIT and Harvard University allotted $30 million each, creating EdX (www.edx.org).

The original concept of the MOOC assumed that MOOCs are free courses with open access for a huge number of learners from all over the world. In recent years a large number of researchers have discussed the development of MOOCs in terms of social, institutional, technological, and economic issues. However, this discussion does not pay enough attention to the issues of quality design of the MOOC both in the technological and pedagogical perspectives.

Prospects of MOOC learners, quality criteria in MOOC design are presented in the article [4] by Yousef, Chatti, Schroeder and Wosnitza.

Conole [5] presented the 7Cs (Conceptualize, Capture, Communicate, Collaborate, Consider, Combine, Consolidate) Learning design framework, which can be used to develop pedagogically based MOOCs. The article [6] analyzed the state of development of MOOC, studied Open Educational Recourses (OER), providing strategic opportunities for improving the quality of education. The study [7] presents a comprehensive overview of the data management applications that are used to analyze MOOCs. In the article [8] Periwal and Rana presented 4 models for dropout prophecy in MOOCs. After an empirical analysis and evaluation of these models, Periwal and Rana concluded that for imbalance MOOC class data the model created by the naïve Bayes technique is more appropriate. Cook, Kay, Kummerfeld in [9], [10] suggested a methodology for modeling the audience of learners for MOOC. Cook in his master's thesis [10] introduced the Open Learner Model. In [11] Hew and Cheung presented a review of the literature focusing on the MOOCs use by instructors or students. They suggested reasons why students sign up for MOOCs: (1) the desire to learn about a new topic, (2) to extend current knowledge, (3) for personal challenge, and (4) the desire to collect completion certificates. The article [12] provides a large overview of the methods and techniques for assessing students who study courses through the MOOC platform.

This article is a continuation of the author's studies presented in [13], [14], in which the technological, social, logistical and financial aspects of MOOCs were analyzed.

2 Classification of MOOCs

There is an institutional classification of MOOC [5]. For our purposes, more useful is the classification based on the pedagogical approaches and training functions of MOOC. Depending on the pedagogical approaches, there are following main types of MOOCs:

1) cMOOC (connectivist MOOCs) is associated with a socially-constructivist pedagogical approach to learning. cMOOC uses blogs, wikis, social media for searching knowledge. The main interactions take place in the formats "learner-learner" and "learner-teacher".

The main focus of the cMOOC is the accumulation of knowledge, creativity and communication of participants. The Web 2.0 platform is used. The pedagogical approach used in the cMOOC is flexible and sensitive to the specific needs of the participants. It helps to find like-minded people and gives an opportunity to expand the network of contacts. Examples of platforms that use the cMOOC approach are SoloLearn (5 million users), Duolingo (200 million users).

The aim of cMOOC is to improve the quality of education through the strengthening of horizontal links and the stimulation of joint cooperation in groups of learners.

2) xMOOC ("MOOC as eXtension of something else") uses the behavioral principle of acquiring knowledge, by repetition and testing of knowledge. xMOOC contains lectures, quizzes to test the mastery of theoretical material, forums for communicating with the instructor and other students of the course. This brings together xMOOC with the format of the traditional academic courses. Usually, students must comply with the deadlines for submitting completed assignments.

The content of the courses is focused on duplication of knowledge. The goal of xMOOC is effective delivering of content to a wider audience.

xMOOC uses its own technology platform. Three main providers Coursera, edX, and Udacity use xMOOCs.

The terms cMOOC and xMOOC were introduced by Stephen Downes, one of the creators of the first cMOOC (2008) [15].

3) Quasi MOOC uses online training, offers online courses, representing an online resource, for example, such as open courses: Khan Academy or MIT OpenCourseWare. Online quasi MOOCs are developed by teachers that can be not certified.

The purpose of the quasi MOOC is to provide access to collections of free learning of the mini-lections in various disciplines and for different age groups of students.

4) hMOOC is the hybrid MOOC or MOOC 3.0. This concept supports hybrid or flipped classes, integrates and combines online and face-to-face teaching/learning.

In addition to the listed MOOCs, there are also SPOC (small private online course) [16], COOC (corporate open online course), BOOC (big open online course), aMOOC (adaptive massively open online course), bMOOC (blended massive open online course), sMOOC (semi-massive open online course) [5], etc. The terminology in this new field is still not well established.

3 Logistic of MOOCs deployment

Based on the author's experience acquired in the development of the MOOCs, we present the logistics chain of MOOCs deployment on the Fig. 1, 2, 3. These presentations allow understanding the scope of the preliminary training (planning), as well as organization and management work.
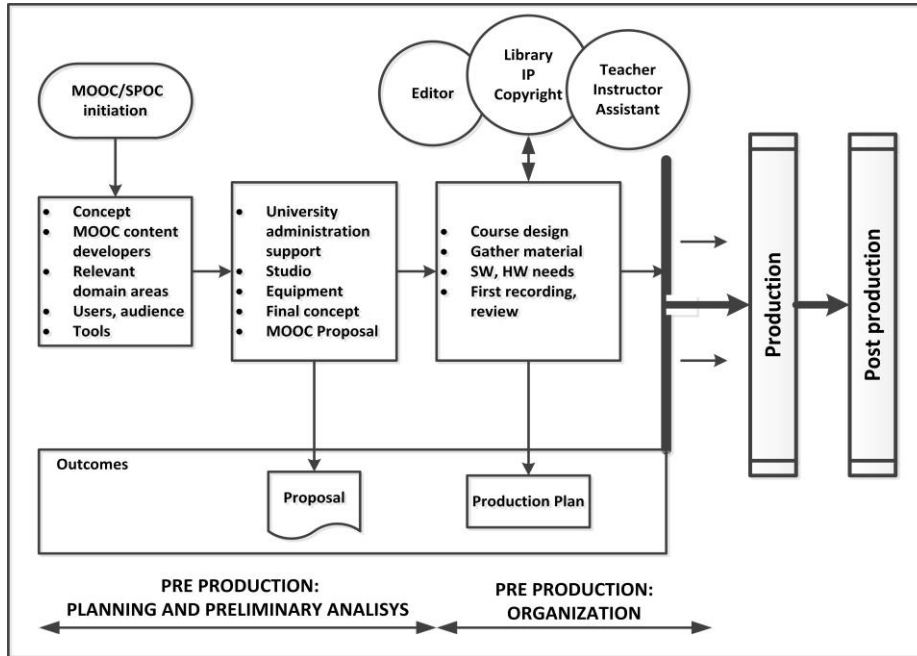
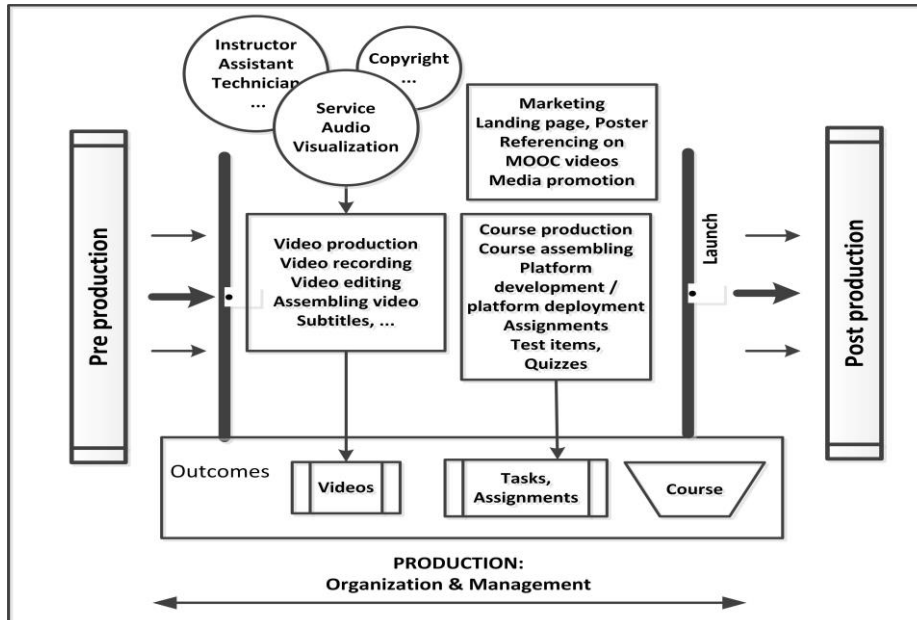**Fig. 1.** MOOC preproduction process.

Fig. 2. MOOC production process.

The development of the MOOCs begin with a preparatory stage, during which it is necessary to understand the domain area, identify the target audience, determine the development tools, and calculate the project parameters (cost, capacity, quality, and duration). At the end of this stage, a plan-project should be prepared. Then the organizational stage begins – designing the course, preparing the material, selecting trainers, solving copyright problems, preparing video materials, etc. All this is displayed in the production plan. After preparing scenarios for lessons, videos, tests, interviews, the penultimate stage of development begins – the management stage. This stage implies marketing, course assembly, approbation. The last stage of development is the launch of the course.
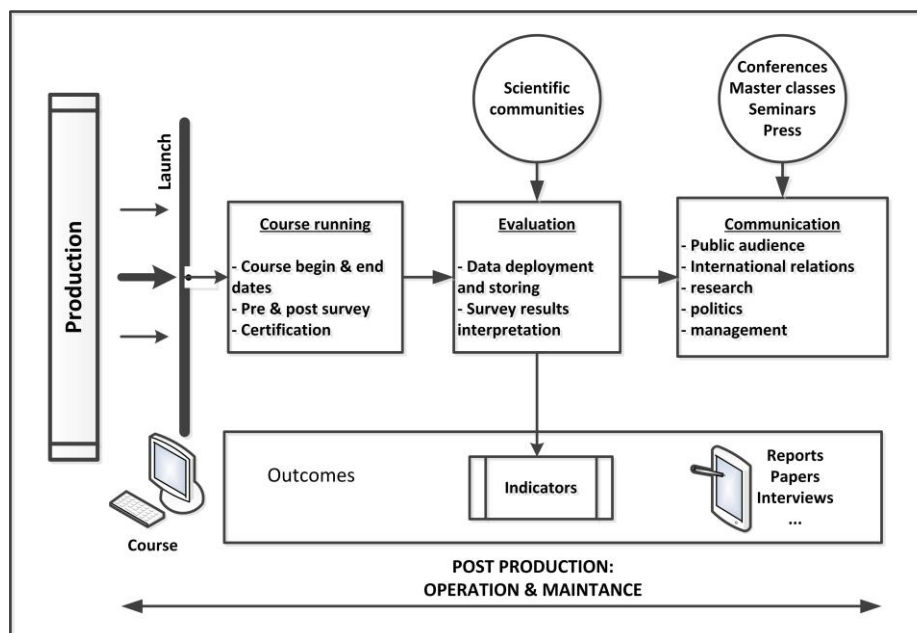
Fig. 3. MOOC postproduction process.

At the stage of preliminary preparation of the MOOC it is necessary:

1. Identify the narrowed, desired learning outcomes for students.

2. Provide a strategy for evaluating students, verifying the mastery of knowledge in accordance with specified learning outcomes.

3. Develop a sequence of tasks and actions that will support the student's actions in mastering the learning objectives (knowledge, skills, activity):

• Availability of content that will support active learning; model of activity / skills for students.

• Duration of the course, the course building from basic knowledge to higher order of skills, such as application, integration and analysis.

4. Ensure a balance between the presence of the teacher / instructor, social and expert cooperation, and the presence of cognitive challenges.

For the pedagogical design of each week (each session) of the course, it is necessary to allocate: planned results, content, activities, evaluation.

4   Video content matrix by weeks of study

The matrix of video content for the weeks of study should correspond to the expected learning outcomes. It is a kind of template for displaying educational material. Table 1 presents the video content matrix of the MOOC "Ruby on Rails Web Framework for Beginners" (RoR4B) (see also Fig. 4, 5) prepared in the framework of research work by graduates of Applied Informatics major at the Crimean State Engineering and Pedagogical University. The students prepared 12 videos with duration of 3-5 minutes each (the videos can be viewed on our YouTube channel CP4B, https://goo.gl/BMLXMB). The language of these lectures and video is Russian.

Table 1. Quasi MOOC "Web-framework Ruby on Rails for beginners" (RoR4B)
video content matrix by weeks of study.

	Lesson 1	Lesson 2	Lesson 3
Week 1	1.1 Introduction to Ruby on Rails.	1.2 Installation and deployment of Rails.	1.3 Creation a simple application (starting up the server, accessing the server from the browser, generating dynamic content, adding hypertext links, transferring data from the controller to the view).
Week 2	2.1 The architecture of Rails applications (MVC: model, view, and controller).	2.2 Introduction to Ruby I. (objects: names and methods, data: strings, arrays, hashes, and regular expressions; controls: if, while, blocks, iterators, and exceptions).	2.3 Introduction to Ruby II. (building blocks: classes and modules; YAML and marshaling; idioms used in Ruby).
Week 3	3.1 Creating the blog application.	3.2 Creating the blog application.	3.3 Creating the blog application.
Week 4	4.1 Creating the online store application.	4.2 Creating the online store application.	4.3 Creating the online store application.

We can make the following recommendations on the variety of presentation forms of the video content. These recommendations are based on the experience of the videos production. Video content for the MOOC can be represented by following video options:

- An introduction to the topic or subtopic with the explaining teacher on the screen: the head or 1/3 of the upper part of body. This option usually uses to activate the previously studied material. It contains background information (formulas, schemes, diagrams, etc.), presents the learning objectives of the topic.

- Voice guidance of the videocast with the presentation of the educational material. We can see on the video slides of the presentation, screen cast, annotations using the tablet or iPad, frames, programming environment, etc.
- Video taken in a specially equipped room or in a certain location – if it is acceptable, the instructor can be placed in a different context for connection with key concepts or with the professional community.
- Interviews – for example, it can be a short interview with a regional representative, or an expert on a given topic.
- Summarizing – the instructor / teacher summarizes the topic and gives the guidelines for the next topic, i.e. establishes a link between the topics.
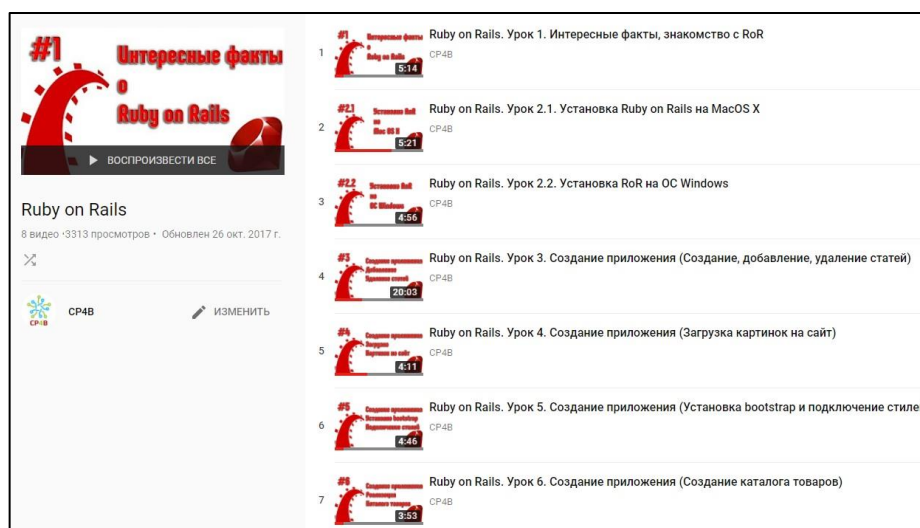

Fig. 4. The screenshot of the play list of the MOOC "Ruby on Rails Web Framework for Beginners" (RoR4B).

5 Tools for video processing

To prepare the video content, it can be used one of the video processing software:

- Edius (http://www.grassvalley.com/products/subcat-editing_software) – proprietary video editing software for computer running Windows, the latest version is Edius 9.10;
- Camtasia Studio / Camtasia for Mac (https://www.techsmith.com/camtasia.html) – shareware software for capturing video from the screen, allows to record audio from a microphone, and allows to place on the screen videos from a webcam;
- ScreenFlow (Mac) (http://www.telestream.net/screenflow/overview.htm) – proprietary commercial software for the OS X operating system, Apple Inc. for screen casting and video editing.
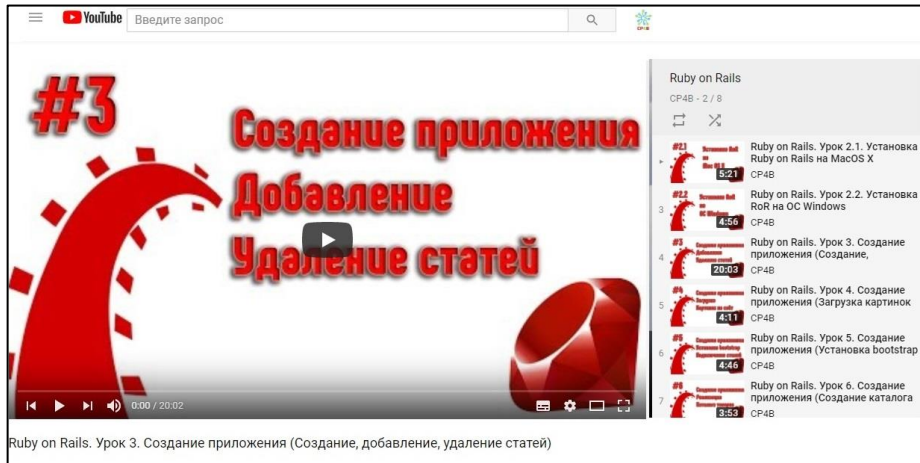
Fig. 5. MOOC "Ruby on Rails Web Framework for Beginners" (RoR4B): The screenshot of lesson #3 video

6   Possible roles for participants of the MOOC development team

To effectively design and develop a high-quality MOOC, the development team needs the following roles, representing domain experts, curriculum designers, and technically skilled specialists. Based on the experience of preparing the MOOC "Web-framework Ruby on Rails for beginners" (RoR4B), these roles can be described as follows:

- Head / expert on educational technologies – conducts consultations and gives recommendations on MOOC planning, an educational strategies, administrative process, resources, educational policies.
- Instructor / teacher – allocates the appropriate material for the course, designs the main activities and evaluation, plans to the presentation of the content, the rubric for expert evaluation.
- Copywriter – helps in choosing resources and copyright issues.
- Assistant (TA) – helps in the design of resources, the selection of materials, the preparation of written questions, development and maintenance, for example, in aspects that require special knowledge of content. TA monitors the discussion forums of the MOOC and evaluation components during the activity of this course.
- Video specialist – responsible for the production of video materials, video. Video specialist edits, mounts the original video, creates a video project, and synchronizes the sound with the video image and uploads the video to the MOOC platform, on YouTube.

- The course's producer (CP) – CP edits screen capture components, organizes video in sections (lessons) of lectures. CP adds meaningful questions to the video content / captured screen. CP constructs a survey, homework or evaluation components.

7   Conclusions

Nowadays MOOCs movements are one of the most innovative initiatives within e-learning and distance education that create new learning opportunities in open and university education. However, there are not consolidated approaches regarding the logistic of MOOCS design and development.

Students who register for MOOC pursue different goals. Designing the MOOC as training course, it is necessary to take into account all the wishes and opportunities of the learner's audience. The implementation of the MOOC described in the article, is a typical MOOC development roadmap: recommendations for content preparation, video content, automatic evaluation, role-based specifications.

The roadmap is derived from the experience of developing MOOC in the discipline "Web-framework Ruby on Rails for beginners" (RoR4B) [17]. In the future it is planned to develop statistical tools for this MOOC, as well as to study personalization issues that will take into account the desires and opportunities of students.

References

1. By the numbers: MOOCs in 2017. Class Central. January 18. 2018, https://www.class-central.com/report/mooc-stats-2017, last accessed 2018/03/25.
2. Alario-Hoyos, C., Pérez-Sanagustín, M., Cormier, D., Delgad-Kloos, C.: Proposal for a conceptual framework for educators to describe and design MOOCs. Journal of universal computer science 20 (1), 6–23 (2014).
3. Saltzman, G. M.: The Economics of MOOCs. The NEA 2014 Almanac of Higher Education. 19–29 (2014), https://www.nea.org/assets/docs/HE/2014_Almanac_Saltzman.pdf, last accessed 2018/03/25.
4. Yousef, A.M.F., Chatti, M.A., Schroeder, U. and Wosnitza, M.: What drives a successful MOOC? An empirical examination of criteria to assure design quality of MOOCs. In: Advanced Learning Technologies (ICALT), IEEE 14th International Conference, pp. 44–48. IEEE, NY (2014).
5. Daradoumis, T., Bassi, R., Xhafa, F. and Caballé, S.: A review on massive e-learning (MOOC) design, delivery and assessment. In: P2P, Parallel, Grid, Cloud and Internet Computing (3PGCIC), Eighth International Conference, pp. 208-213. IEEE, NY (2013).
6. Romero, C., Ventura, S.: Educational data science in massive open online courses. Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 7(1), 1–12 (2017).
7. Periwal, N., Rana, K.: An empirical comparison of models for dropout prophecy in MOOCs. In: Computing, Communication and Automation (ICCCA), 2017 International Conference, pp. 906-911. IEEE, NY (2017).
8. Cook, R.W.: MOOClm: Learner Modelling for MOOCs (Master's thesis, University of Sydney). 2017., http://hdl.handle.net/2123/17023, last accessed 2018/03/25.
9. Cook, R., Kay, J., Kummerfeld, B.: MOOClm: User Modelling for MOOCs. In: Ricci, F., Bontcheva, K., Conlan, O., Lawless, S. (eds) User Modeling, Adaptation and Personaliza-

tion. UMAP. Lecture Notes in Computer Science, vol 9146, pp.1-12. Springer, Cham (2015).

10. Conole, G.: MOOCs as disruptive technologies: strategies for enhancing the learner experience and quality of MOOCs. RED. Revista de Educación a Distancia 50(2), 1–18 (2016).
11. Hew, K.F., Cheung, W.S.: Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges. Educational research review 12, pp.45-58 (2014).
12. Sandeen, C.: Assessment's place in the new MOOC world. Research & Practice in Assessment Journal 8, pp. 5-13 (2013).
13. Seidametova, Z.: MOOC course development: video content matrix and role specification (in Russian). Information and computer technologies in economics, education and social domain 1 (11). 5–16 (2016).
14. Moskaleva, Y., Seidametova, Z.: Logistics and business models of MOOC/SPOC courses (in Russian). Scientific notes of the Crimean Engineering-Pedagogical University 3 (57). 60–65 (2017).
15. Liyanagunawardena, T.R.: Massive Open Online Courses. Humanities 4(1). 35-41 (2015).
16. Kaplan, A.M., Haenlein, M.: Higher education and the digital revolution: About MOOCs, SPOCs, social media, and the Cookie Monster. Business Horizons 59(4), 441-450 (2016).
17. CP4B. Applied Informatics of CEPU. YouTube Playlist. http://bit.ly/1WHQtvq, last accessed 2018/03/25.