

MOOCs Types and Course Development

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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 MOOCs 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 “Unity Augmented Reality 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.

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 (Shah, 2020b) conducted by the MOOC Class Central by the end of 2020 the size of the modern “MOOC movement” reached more than 950 universities, more than 180 million students (excluding China); the number of MOOC courses are more than 16,300. According (Shah, 2020a), one third of the learners that ever registered on a MOOC platform joined in 2020. The pandemic brought many people into online education. MOOC providers, in particular, attracted many learners with free online courses from top universities.

The largest provider of online courses Coursera (<https://www.coursera.org>) has expanded its audience to 76 million learners, edX (<https://www.edx.org>) – 35 million. Duolingo (<https://www.duolingo.com>), a popular language platform, has more than 300 million users (they do not receive formal certification, in contrast to the previously mentioned 180 million university students).


The top MOOC providers (Coursera, edX, and FutureLearn) registered as many new learners in April 2020 as in the whole 2019 year. Around 25–30% of their total registered users on these MOOC platforms

came after the pandemic. Coursera added the largest number of new learners (more than 35 million enrollments between March 2020 and July 2020).

Online learning helps students to improve their performance. Different online learning environments (OLE) have their own way of systems implementation. Technological developments made it a lot easier to develop and customized learning solutions that are focused on adaptive and personalized e-learning environments. OLE platforms can be adapted by higher institutions to enhance teaching and learning process. MOOC provides quality to e-learning from experts without almost no costs.

Despite the growing number of educators who have started to develop the MOOC courses, the design of the MOOC is not simple. Educators (developers of the MOOC) should be familiar not only with pedagogical approaches, but also with logistical, technological and financial issues. They need to plan carefully the feasibility of the course depending on the available resources. The authors of the paper (Alario-Hoyos et al., 2014) 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

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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 (Saltzman, 2014, 2017). MOOC companies need to cover the startup 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.

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 paper (Yousef et al., 2014). In the study (Shoufan, 2019) authors tried to find out what motivates students to give a positive or negative rate to an educational video. This study can help not only students searching for educational videos but videos developers towards improved content quality and learning outcomes.

Conole (Conole, 2016) presented the 7Cs (Conceptualize, Capture, Communicate, Collaborate, Consider, Combine, Consolidate) Learning design framework, which can be used to develop pedagogically based MOOCs. Daradoumis et al. (Daradoumis et al., 2013), Gros and García-Peñalvo (Gros and García-Peñalvo, 2016) analyzed the state of development of MOOC, studied Open Educational Resources (OER), providing strategic opportunities for improving the quality of education. Romero and Ventura (Romero and Ventura, 2017) presents a comprehensive overview of the data management applications that are used to analyze MOOCs. Periwai and Rana (Periwai and Rana, 2017) presented 4 models for dropout prophecy in MOOCs. After an empirical analysis and evaluation of these models, Periwai and Rana (Periwai and Rana, 2017) concluded that for imbalance MOOC class data the model created by the naive Bayes technique is more appropriate. Cook (Cook, 2017), Shahzad et al. (Shahzad et al., 2020), Fidalgo-Blanco et al. (Fidalgo-Blanco et al., 2016) suggested a methodology for modeling the audience of learners for MOOC. Cook (Cook, 2017) introduced the Open Learner Model. Hew and Cheung (Hew and Cheung, 2014) presented a review of the literature focusing on the MOOCs use by instruc-

tors 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. Baanqud et al. (Baanqud et al., 2020), Liyanagunawardena (Liyanagunawardena, 2015), Kaplan and Haenlein (Kaplan and Haenlein, 2016), Gené et al. (Gené et al., 2014) provides a large overview of the methods and techniques for assessing students who study courses through the MOOC platform. Some other studies of the MOOCs learners behavior, MOOC instructions, curricula described in the papers (Bralić et al., 2015; Wang and Chou, 2015; Long, 2017; Gentile et al., 2020; Gunawardena and Premawardhena, 2020; Atapattu and Falkner, 2018; Romadhon et al., 2020; Borrego, 2019). The predictive analysis, economic aspects of MOOCs presented in the papers (Mubarak et al., 2021; Ma and Lee, 2020; Epelboin, 2017).

This article is a continuation of the author's studies presented in (CP4B, 2016; Seidametova, 2016; Seidametova and Moskaleva, 2017; Seidametova, 2018) in which the technological, social, logistical and financial aspects of MOOCs were analyzed.

2 CLASSIFICATION AND COMPARISON OF MOOCs

There is an institutional classification of MOOC (Conole, 2016). 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 MOOC as acronym appeared in context of connectivism.

The main focus of the cMOOC is the accumulation of knowledge, creativity and communication of participants. The Web 2.0 platform is used. cMOOCs allow learners throw the Facebook, websites, Google meetings, Zoom, Discord, Telegram and etc. to share materials. information with the groups 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 (42 million users), Duolingo (300 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. Three key components of xMOOCs are content, evaluation and communication.

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 (Kaplan and Haenlein, 2016).

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. Quasi MOOCs are shorter MOOCs for contents and skills and do not require a semester course structure.

The purpose of the quasi MOOC is to provide access to collections of free learning of the mini-lectures in various disciplines and for different age groups of students. Quasi MOOCs can be content-based (xMOOCs), task-based, network-based (cMOOCs).

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

In addition to the listed MOOCs, there are also SPOC (small private online course) (Seidametova, 2016), COOC (corporate open online course), BOOC (big open online course), aMOOC (adaptive massively open online course), bMOOC (blended massive open online course) (Kaplan and Haenlein, 2016),

sMOOC (semi-massive open online course) (Conole, 2016), etc. The terminology in this new field is still not well established.

The pedagogy of MOOCs depends on the following requirements: a curriculum (lessons, exercises, learning results), video and interpretations, forums (as interfaces for learning), jobs, exams and projects. Table 1 illustrates the differences between cMOOCs and xMOOCs.

Table 1: Differences between cMOOCs and xMOOCs.

cMOOCs	xMOOCs
Self-organized	Teacher-based
Networked	Centralized
Content: learner generated	Content: teacher-defined
flexible, distributed, video lecture	short assignment, video lecture
Self- and peer-assessment, e-test	Quiz, e-test, peer-review, certificate
Open networking communication	Limited interaction
Communication outside MOOC platform	Built in the MOOC platform

3 LOGISTIC OF THE MOOCs DEVELOPMENT AND DEPLOYMENT

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

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.

At the stage of preliminary preparation of the

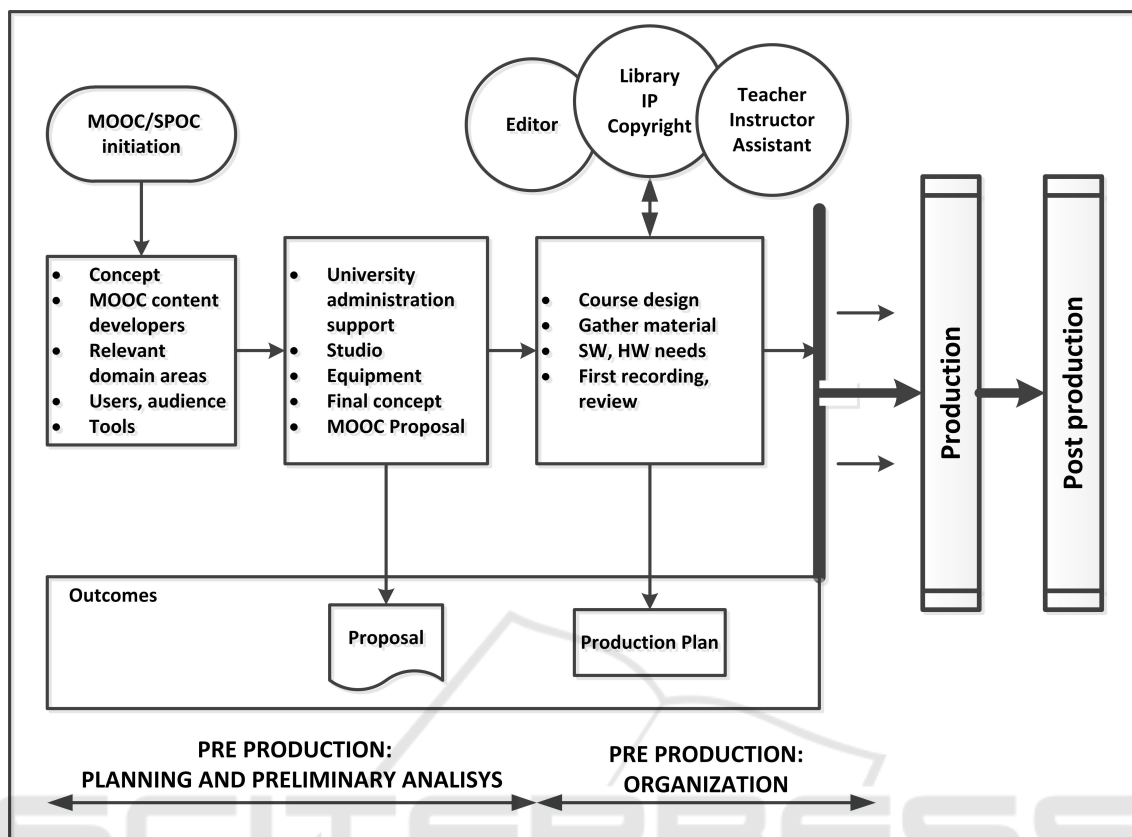


Figure 1: The MOOC preproduction process.

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 2 presents the video content matrix of the MOOC "Unity Augmented Reality for Beginners" (UnityAR4B) (see also figures 4, 5) prepared in the framework of research work by graduates of Applied Informatics major at the Crimean State Engineering-Pedagogical University. The students prepared 8 videos with duration of 3-5 minutes each (the videos can be viewed on our YouTube channel CP4B, <https://t.ly/c3b4>). The language of these lectures and videos is Russian.

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

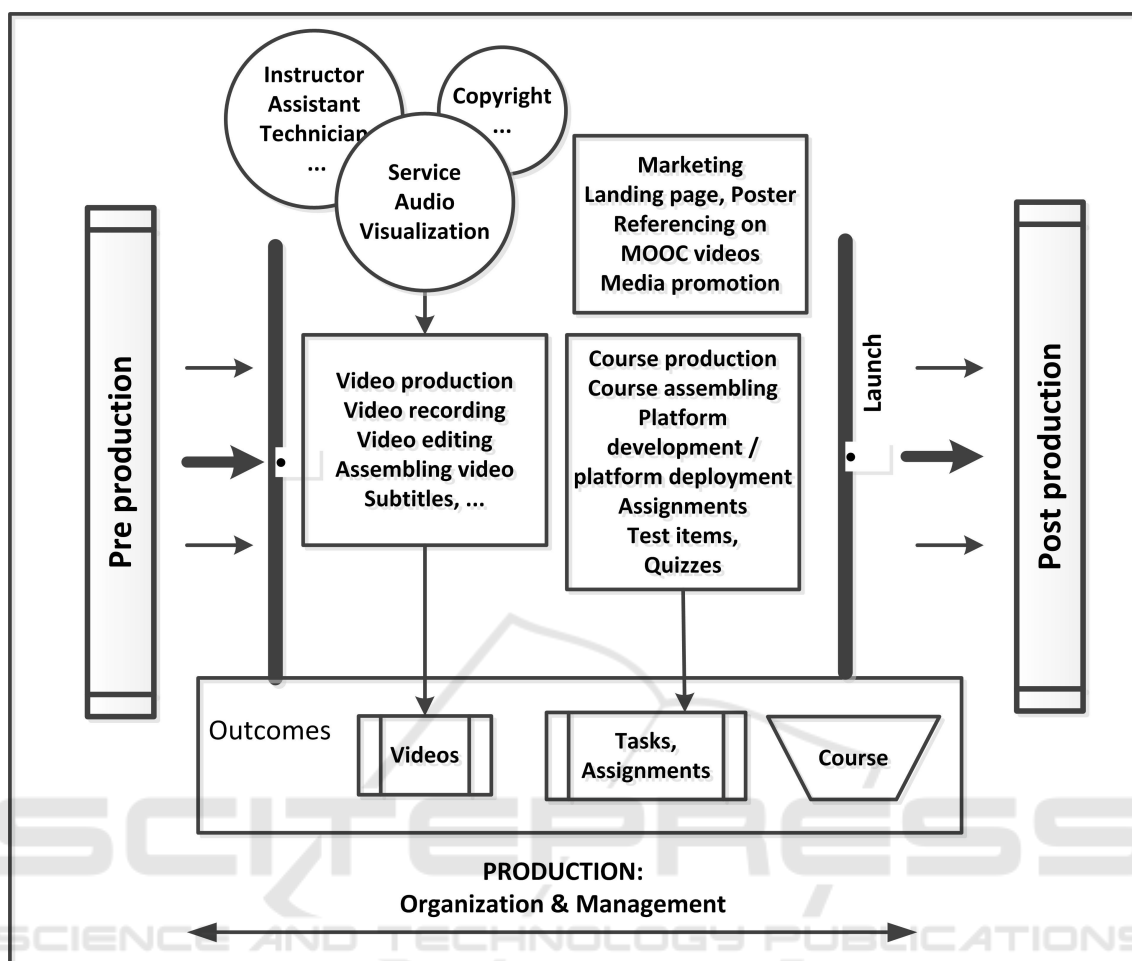


Figure 2: The MOOC production process.

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.

- The optimal video length between three and six minutes.
- Voice guidance of the video cast 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.

- The screencast format allows the instructor to include point slides, images, or motion (for example, hand drawing on the board).
- Simulations can be used for illustrating course concepts and engaging students, such videos can be linked to an assignment or learning activity.
- Summarizing – the instructor / teacher summarizes the topic and gives the guidelines for the next topic, i.e. establishes a link between the topics.

5 TOOLS FOR VIDEO PROCESSING

Designing video for learning purposes is something like a conceptual challenge. Gunawardena and Premawardhena (Gunawardena and Premawardhena, 2020), Atapattu and Falkner (Atapattu and Falkner,

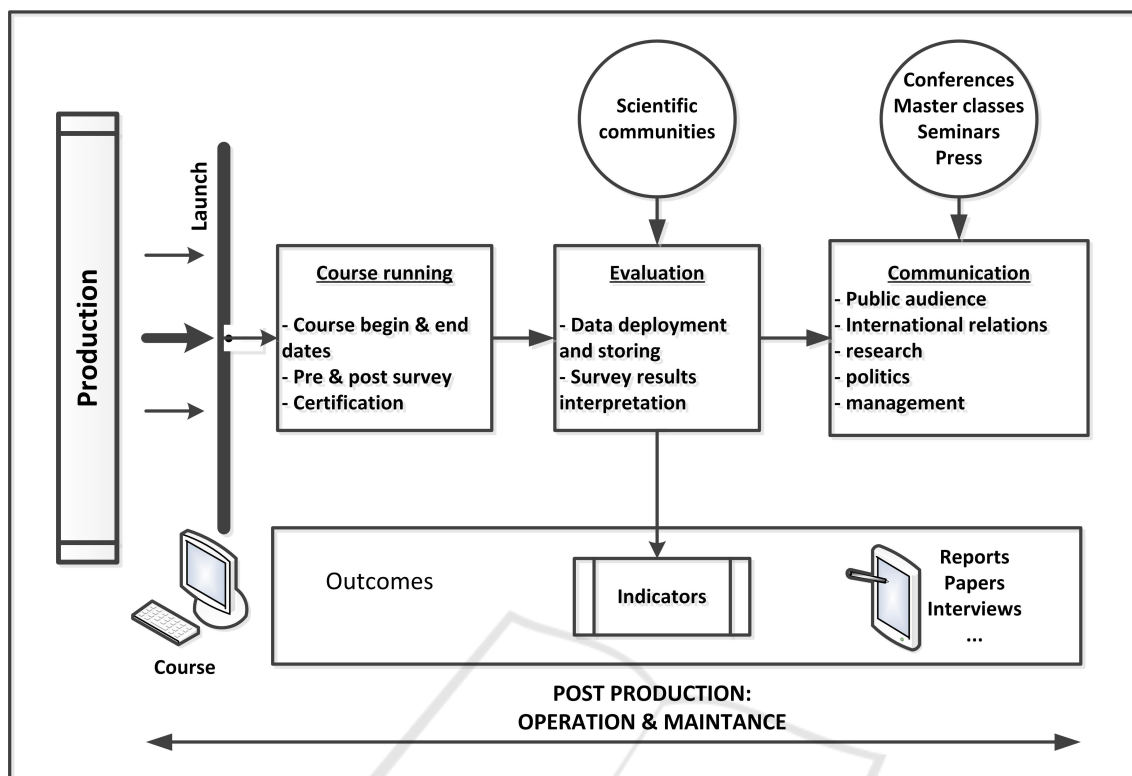


Figure 3: The MOOC postproduction process.

2018), Romadhon et al. (Romadhon et al., 2020) show that videos used in a presentation mode foster passive watching instead of reflective-learning activities.

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

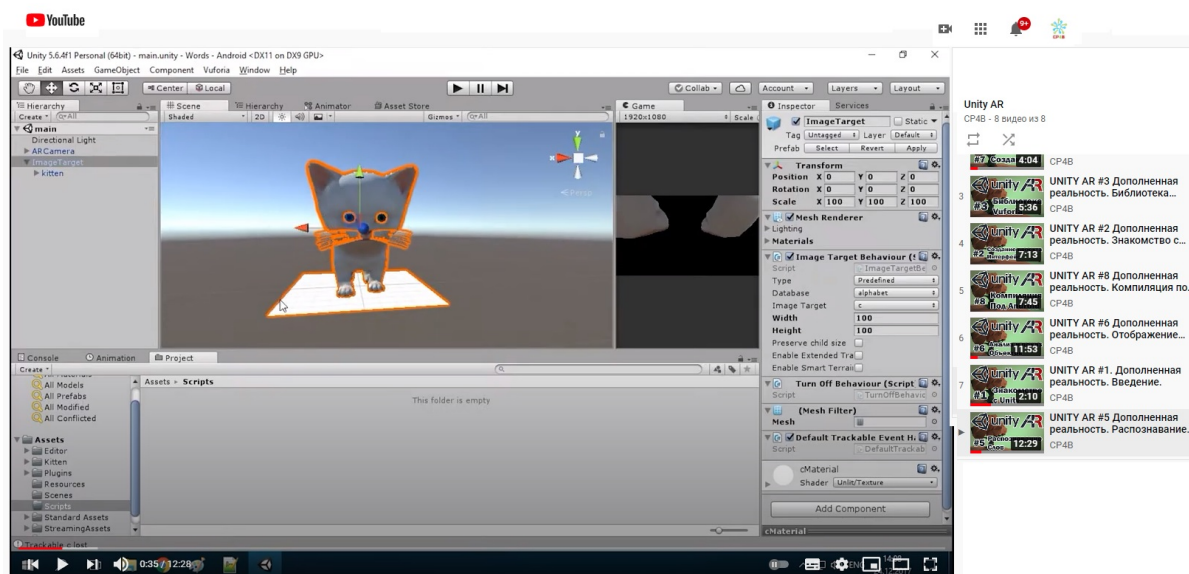
- Edius (<http://www.grassvalley.com/products/subcat-editing-software>) – proprietary video editing software for computer running Windows, the latest version is Edius 9.10.
- Camtasia Studio / Camtasia for Mac (<https://www.techsmith.com/camtasia.html>) – shareware software for capturing video from the 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 macOS operating system, Apple Inc. for screen casting and video editing.
- Apple iMovie is a video editing software application for macOS, iOS devices.

6 POSSIBLE ROLES FOR PARTICIPANTS OF THE MOOC DEVELOPMENT TEAM

The MOOC involves many staff – the teaching team that designed the course, the teaching team that led the course, researchers, university staff, tutors.

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 strategy, 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.



UNITY AR #5 Дополненная реальность. Распознавание букв и слов

Figure 4: The screenshot of the video 5 “Augmented Reality. Letters and words recognition” from play list of the q-MOOC “Unity Augmented Reality for Beginners” (UnityAR4B).

Table 2: Quasi MOOC “Unity AR for beginners” video content matrix by weeks of study.

	Lesson 1	Lesson 2	Lesson 3
Week 1	1.1 Introduction to Augmented Reality	1.2 Installation of Unity. Unity Interface. Understanding different panels in Unity. Moving, rotating and scaling. Objects in Unity. Physics in Unity	1.3 Vuforia package. Importing Vuforia inside Unity. Capturing an Image. Creating a Vuforia Database. Image Targets
Week 2	2.1 Creating a Canvas and adding a Background image	2.2 The Recognition of the letters and words	2.3 Projecting 3D Model on Image Target. Customizing the letters image target
Week 3	3.1 Designing UI buttons inside the Canvas. Programming the UI buttons. Programming Back and Exit button inside the AR Scene	3.2 Building the app and testing the output	3.3 Compiling AR app to Android devices

- 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 differ-

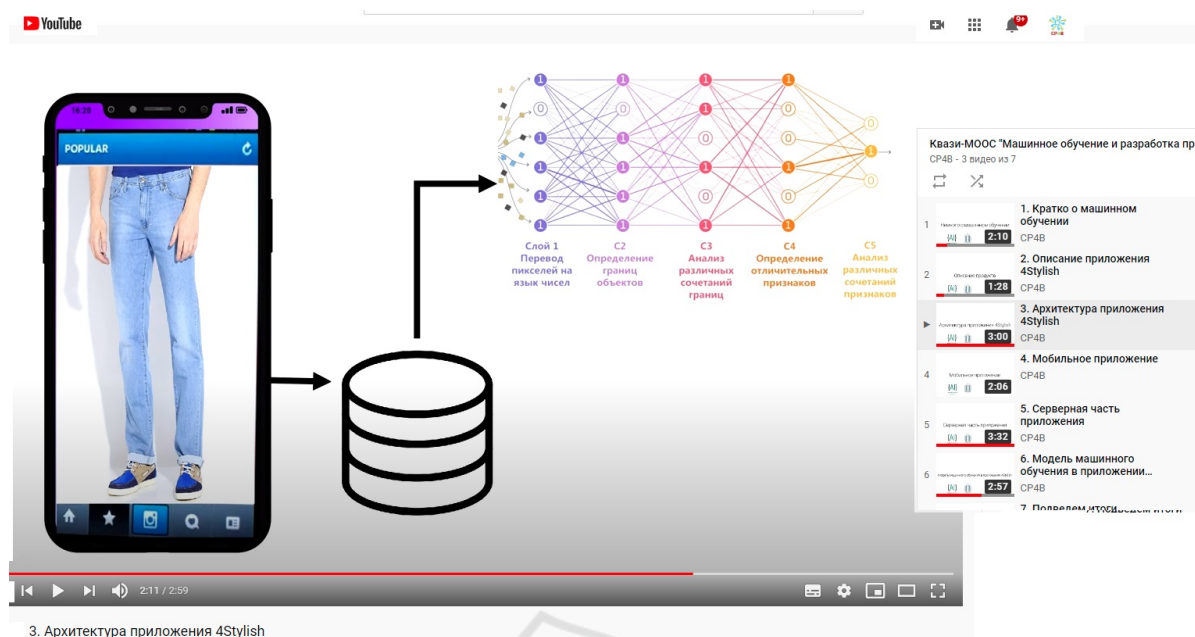


Figure 5: The fragment of the video “Architecture of the 4Stylish Application” from play list of the q-MOOC “Machine Learning for beginners” (ML4B).

ent 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 “Unity Augmented Reality for beginners” (UnityAR4B) (CP4B, 2016). 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.

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