# Models of educational video implementation in massive open online courses

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***Abstract* — The development of the quality of online learning has recently gained much attention. The most significant trend in this area is the use of massive open online courses (MOOC), based on the implementation of educational videos. It is considered to be quite a new format for educational material presentation. Being created with the help of megaversities or large financial companies, MOOC can be a tool for individual study development as well as for educational environment expanding. The study of the effectiveness of video content, its structure and methods of implementation are underrepresented in the research literature. The article proposes the author's concept of implementation of massive open online courses.**

***Keywords— education informatization, open massive online courses, educational video***

## I. INTRODUCTION

There are several nationwide platforms of massive open online courses in Russia. Those are “National platform of open education” (https://openedu.ru), “Lektorium” (https://www.lektorium.tv), etc. Such projects are designed to improve the quality of higher education in the Russian Federation, the marketability of Russian organizations of higher education on the international stage and the social and economic progress of the regions. However, the high cost of entering into the nationwide informational space and its elitism put the brakes on the development of theory and practice of implementation of open online courses and set up imbalance between the regions.

## II. THEORETICAL AND EMPIRICAL ANALYSIS OF THE STATED PROBLEM

The term “massive open online courses” (MOOC) was introduced in 2008 by Canadian connectionists D. Cormier, G. Siemens, S. Downes, [3, 10].

Originally, the MOOC technology was based on student’s independent information search which included meaningful raw data. As we know the teacher played the part of a facilitator, who was motivating and helping students to learn. Later on, this model was called cMOOC or connectionist’s MOOC.

However, the leading universities tried to reexamine the first connectionist’s courses. That led to a new model known as xMOOC or Stanford’s MOOC. Its technology is based on using special platforms with video lectures. Students’ results are evaluated by tests or mutual check. The feedback is gained with the help of forums [1, 2]. Nowadays the xMOOC model is considered to be the model of massive open online courses.

We think that raise of interest to MOOC in our country is related to realization of federal grant projects under the program “Modern digital educational environment in the RF” and changes of the state’s educational policy. Currently, one of its main goals is development of online learning.

Traditionally, video content is considered to the basis of massive open online courses [6]. As video lectures have many advantages.

Firstly, video makes a synthesis of different kinds of imagery, including listening, seeing, linguistic, showing objects and metaphoric. We can watch, listen to or even read a video if it has subtitles that can be easily made. All these options provide possibilities for one-on-one training of audile, visual and tactile learners.

Secondly, when perceiving information auditively, one can be receptive to gestures, body language, facial expressions, outward appearances of communication participants at the same time. According to psychological researchers paralinguistic information forms up to 40% of total communication data. Text, however, does not have such options.

Thirdly, video influences students more emotionally than texts. Video can be emphatically engaging thus motivating students to learn.

Video lectures encourage student-centered education as a student can study the material in keeping with his learning pace revising important or little-understood fragments when necessary. However as a rule, the MOOC material is not of a differentiating character [12].

There are several risk groups in the process of implementation MOOC in universities. Those are technical risks, organizational and methodical risks, pedagogic risks.

*Technical risks* are associated with an increase in costs when compared to the traditional online learning model. The latter usually uses the free distance learning system Moodle or OpenEdx that do not require additional expenses from the educational organization for its operation. It is necessary to create a video studio or video laboratory for the production of video lectures. So, in addition to the video camera a number of special equipment is also needed, including:

- microphones and computer compatible external sound cards;
- background or chroma key;
- studio light boards or other lighting devices;
- a teleprompter, etc.

The above-mentioned equipment requires financial costs as well as professional skills to use it.

*The organizational and methodical risks* are associated with the creation of a video lecture model. The problem of student involvement is the main problem of developing a video lecture model. Involvement or interaction time is the time that a student spends watching a video (i.e., the duration of a video viewing session). Involvement depends on the length of the video. Typically, it decreases over 4-6 minutes when watching an explanatory video, and over 8 minutes when watching the screencast. Thus, the duration of the educational video should not be more than 6-8 minutes [5, 8].

The network approach can be viewed as the methodological basis for considering engagement or interaction time as a basis for classification. According to the network approach the aims of connections or relationships that are formed between the subjects of the educational process, not their qualities or properties, should be studied in the first place. The structure and nature of these relationships are taken as the key properties of the elements forming them. These key properties determine the participant's place of interaction among others, as well as his identity. The use of Educational Data Mining, a method of researching bodies of data for educational purposes, is quite advantageous for making educational decisions.

Involvement depends indirectly on the format of the educational video and on the model of the educational material presented. There are findings of the study of student interaction in massive open online courses by Philip J. Guo, Juho Kim, Rob Rubin [5].

*A. Students' engagement is higher when educational videos are shorter.*

As a result of interviewing the developers of educational video the idea has been formed that shorter videos contain higher-quality training content. This is not only about the mechanical fragmentation of educational material as shorter videos require more careful planning to explain the concept as neatly as possible. However, the authors hold off on more global conclusions.

*B. Talking head is more interesting.*

The videos for the two experimental courses, 6.00x and PH207x, were mainly created in the style of PowerPoint presentation and screencast code. However, some of these videos (60% for 6.00x and 25% for PH207x) were edited, so the presentation and demonstration of the screencast code were mixed with a "talking head".

Figure 1 shows that for both courses students' interaction increased with the video containing a "talking head". Students watched videos with voice guidance longer in both courses.

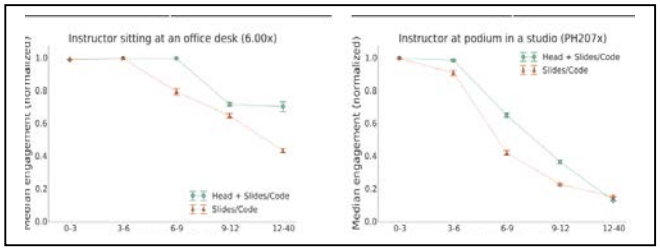


Fig. 1. The median of interaction with the educational video for the 6.00x course (left) and for the PH207x (right).

The reason for the increase in the interaction time may be replays or pauses. To exclude such a possibility, the authors compared the number of replays and pauses and did not find significant differences. Moreover, students of the 6.00x course made more attempts at tests, when compared to the PH207x course (46% and 33%, respectively).

These results have aligned the findings of the interviewing edX educational video developers. The developers pointed out that the teacher's recording provided a more "intimate and personal" approach and also broke the monotony of the PowerPoint presentation. They also admitted that the type of video with a "talking head" was chosen instinctively without taking into account any "pedagogical templates".

Therefore, to improve interaction the educational video should contain a "talking head". However, the questions when and how often to mix the teacher's record and text content are open for debates. Also, a number of students noted that the transition from the "talking head" to the presentation was too abrupt. That is one of the points, that should be taken into consideration when developing educational video.

*C. High video production costs don't matter.*

The courses 6.00x and PH207x were shot at major research universities, in the same style of mixing a "talking head" and text presentation. However, the degree of students' interaction in the 6.00x course was higher than in the PH207x course. The students of the 6.00x course interacted with the educational video almost twice as active (for the videos with duration 6–12 minutes) and almost three times more active (for the videos with duration more than 12 minutes) in comparison to the PH207x. It is relevant to mention that the 6.00x course was created in a less formal setting, whereas the PH207x was filmed in a multi-million TV studio.

The educational videos of the course 6.00x show that the teacher was shot in close-ups. That helped to achieve more active visual contact with the students. On the other hand, the PH207x teacher looked at the audience from the podium and did not work directly on the camera. The edX video developers noted that the 6.00x teacher was more comfortable when recording video, using the style of a face-to-face conversation. The producers of the educational video called this style "desired personalization" as the students felt that the teacher addressed them directly. In contrast to that, the PH207x teacher looked more detached, giving a lecture from the podium.

To sum it up, the PH207x teacher chose a more traditional lecture format but despite his extensive teaching experience, this form appeared to be less effective than the format chosen by the 6.00x teacher. This example clearly shows that what

works well in a live audience might not be effective an online video, even recorded in an expensive studio.

The authors of the article emphasize that only one pair of courses was compared and the differences could be caused solely by the teachers' skills.

*D. Khan-Style educational videos are more interesting.*

Next, the authors conducted a study of educational step-by-step videos for solving problems. In the four examined courses Khan-Style educational videos (the videos where the teacher draws on the tablet during the explanation) turned out to be more interesting to the students than PowerPoint slides or screencast code. The duration of interaction with the video in the Khan-Style has increased by 1.5 -2 times compared with other formats.

Moreover, 40% of students went on to perform tests after watching the videos. A possible explanation for the interest to that format can be the fact that a handwritten sketch imitates natural human behavior, which is more appealing than any computer style.

The edX educational video developers agreed with this conclusion. In particular, they noted that the Khan-Style educational videos allow the teacher to change the position of the lecturer "from above" to the position of an equal dialogue partner. In other words, this type of videos encourages a more person-centered model, while PowerPoint presentation unintentionally interferes with personalization. However, the Khan-Style educational videos require more detailed planning and, therefore, are more time-consuming. The videos of the best quality were created by teachers with beautiful handwriting, good drawing skills and careful selection of graphic objects.

*E. Pre-planning of educational video improves its interaction.*

Earlier the authors discussed the impact of production and postproduction on the interaction with the video. However, the edX educational video developers believe that planning of the recording also has an impact on engaging in viewing.

So, the authors compared the interaction for the courses CS188.1x and 3.091x. Both courses refer to the disciplines related to Math, the teachers of these courses are considered excellent educators in their universities. Originally, it was planned to record lectures in front of a live audience. However, due to the problems with logistics, the 3.091x teacher did not have enough time to record his classes. Therefore, the producers decided to use the old set of lecture videos recorded on campus a few years earlier.

Figure 2 shows that the interaction of the students in the CS188.1x course was higher compared to the rate of the 3.091x course, especially in longer videos.

Moreover, 55% of the students in the CS188.1x course went on to test control, versus 41% of the 3.091x course students [5].

EdX employees who worked with the teachers of the CS188.1x course noted that even if they recorded traditional one-hour lectures in front of a live audience, the teachers carefully planned every hour as a series of short discrete fragments. In the following, those segments could be easily edited for the online format.

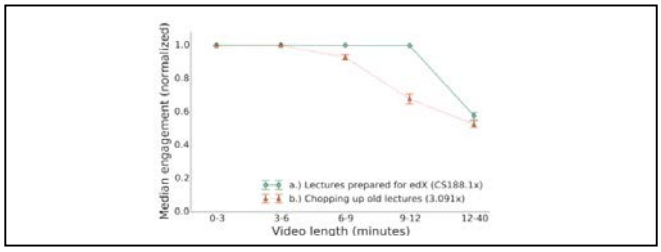


Fig. 2. The medians of interaction time for the course, the content of which was previously planned (a) and the course compiled from old fragments and not adapted to the MOOC format.

On the other hand, the 3.091x course was difficult to imagine as a sequence of short videos adapted to the MOOC format.

*F. Speech tempo affects interaction with educational video.*

The interaction of students with educational videos turned out to be higher for the videos with a high tempo of speech. The authors refer to the recommendations of 1967, where the optimal rate was 160 words per minute. Although these recommendations apply to traditional lectures, they can also be applied to educational videos.

*(It should be taken into consideration that the optimal tempo of speech varies in different languages. For the Russian language, the rate of 60-100 words per minute can be considered optimal. There is also such an indicator as "hearing speed", which when exceeded causes bad understanding of the speaker. For a Russian person, the hearing speed is 130-170 words per minute. Interestingly, there is also a "perception speed." This indicator is naturally lower than the hearing speed, as for the speaker get to the message across to the listeners – authors' note).*

The authors analyzed random videos and came to the conclusion that the teacher's high tempo combined with great enthusiasm was probably the main reason for the high degree of interaction. They note that even an accelerated rate (254 words per minute) did not cause problems with understanding, as it was accompanied by a PowerPoint slideshow. On the other hand, teachers with an average tempo (160-165 words per minute) were less emotional. The low rate of speech (48-130 words per minute) was characteristic for the teachers who accompanied the explanation with notes on the blackboard.

The authors turn attention to that the tempo of speech is a formal component. The high tempo of speech is not the main indicator that influences the students' interaction with educational video. Moreover, educational video developers noted that speech pauses, usually needed traditional lectures, are not useful in video lectures as students can always pause the video.

*G. Students interact differently with video lectures and tutorials (video instructions).*

Video lectures usually contain conceptual (declarative) knowledge, while tutorials are aimed at developing practical (procedural) knowledge. Students watch an average of 2-3 minutes of lecture videos, regardless of their length. Figure 3 shows that students review tutorials more often than lecture videos.

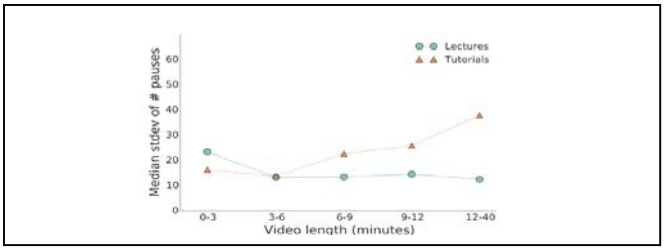


Fig. 3. The medians of interaction with video lectures and video tutorials.

These data suggest that students often replay and switch to more relevant in their opinion sections in longer videos. Adding hyperlinks or visual pointers to different sections in a video can improve interaction and viewing process [5].

*The pedagogical risks* are associated with the form of presentation of educational material in video lectures. Translation of written speech (presented, for example, in a textbook) into oral, as well as the implementation of the principles of the activity education are necessary for a video format [4]. A number of MOOCs that we studied on the Russian platform OpenProfession ignored this fact. As a result, their video material was informationally overloaded, it was hard to absorb abstract concepts and theories.

Recently, the storytelling approach has become very popular. Storytelling is a method of presenting educational videos with the help of stories that encourage students to have emotions and thinking [11, 13]. The characteristics of storytelling are:

- the presence of a character, hypothetical or real;
- the introduction of events important to this character. Otherwise, the story loses its meaning;
- an emotional for the listener story that helps to experience and associate himself with the main character;
- the reality of events;
- headings, pictures, diagrams, etc. that accompany the story;
- the reality of the story: real events, phenomena, living examples, no general phrases.

Different ways of the organization of students' work with educational material are important in addition to the presentation of educational material. The following techniques are described in the literature [7, 9]:

- active viewing;
- scene freeze and prediction;
- silent viewing. Typically, this technique is used when watching videos in a foreign language;
- replay and role-playing games.

We consider introduction of tests in educational videos most effective. This technique is based on programmed learning: the educational material (video) is divided into small fragments, followed by assessments. There are several services that allow to implement such a mechanism. Those are P5H, LearningApps and several others. YouTube videos can be used as a source. However, the disadvantage of this approach is the inability to accurately select the starting time of tests as it is set to a second, which does not exclude the break of the lecturer's monologue. As countermeasures, the setting of special "technological" gaps in the video lecture scenario, accompanied by a lecturer's instruction, is possible.

In 2015-2017, at Kursk State University, during the research work, a model for the creation and implementation of the MOOC in the educational process was tested. A course called "Moodle 2 for beginners" has been created (Now it is renamed "Moodle 3 for beginners"). The MOOC was developed in the screencast genre and hosted on the Udemy platform. An analysis of students' interaction with educational videos showed an average percentage of 79. In other words, on average, 79% of listeners watch a screencast to the end.

TABLE I. THE TIME OF USERS' INTERACTION WITH THE EDUCATIONAL VIDEOS IN THE COURSE "MOODLE 3 FOR BEGINNERS"

| **The educational videos in the course "Moodle 3 for beginners"** | **The time of users' interaction** |
|---|---|
| Lecture 1. First steps in Moodle. Resource moodle addition | 85% |
| Lecture 2. Navigation in Moodle 3 | 81% |
| Lecture 3. Adding URL to Moodle 3 | 87% |
| Lecture 4. How to work with Html TinyMce в Moodle 3 | 87% |
| Lecture 5. Resource Management in Moodle 3 | 89% |
| Lecture 6. How to edit a topic in Moodle 3 | 91% |
| Lecture 7. How to add File and Folder in Moodle 3 | 89% |
| Lecture 8. How to add a page in Moodle 3 | 95% |
| Lecture 9. Label in Moodle 3 | 94% |
| Lecture 10. About the "Book" resource in Moodle 3 | 89% |
| Lecture 11. General settings of Lesson in Moodle 3 | 91% |
| Lecture 12. Adding content page in Lesson in Moodle 3 | 93% |
| Lecture 13. How to add a question page in Lesson in Moodle. Part 1 | 94% |
| Lecture 14. How to add a question page in Lesson in Moodle. Part 2 | 91% |
| Lecture 15. How to add a question page in Lesson in Moodle. Part 3 | 94% |
| Lecture 16. Moodle Clusters | 97% |
| Lecture 17. General settings of quiz in Moodle | 87% |
| Lecture 18. Questions in Moodle. Part 1 | 87% |
| Lecture 19. Questions in Moodle. Part 2 | 93% |
| Lecture 20. Questions in Moodle. Part 3 | 94% |
| Lecture 21. Questions in Moodle. Part 4 | 92% |
| Lecture 22. How to create random questions in Moodle | 92% |
| Lecture 23. Assignment in Moodle | 88% |
| Lecture 24. How to work with activity "Workshop" in Moodle | 91% |
| Lecture 25. How to add IMS Content Package in Moodle | 92% |
| Lecture 26. Database in Moodle | 91% |

| The educational videos in the course "Moodle 3 for beginners" | The time of users' interaction |
|---|---|
| Lecture 27. Feedback and Survey in Moodle | 90% |
| Lecture 28. Forum and Chat in Moodle | 92% |
| Lecture 29. Wiki in Moodle | 92% |
| Lecture 30. SCORM & Moodle | 94% |
| Lecture 31. Glossary in Moodle | 88% |
| Lecture 32. Moodle default setup | 94% |
| Lecture 33. Assigning Roles in Moodle | 87% |
| Lecture 34. Registration in the Moodle 3 system | 89% |
| Lecture 35. Bulk user upload and grouping | 89% |
| Lecture 36. How to work on ftp in Moodle version 3 | 91% |
| Lecture 37. Backup in Moodle 3 | 94% |
| Lecture 38. Moodle notifications | 92% |
| Lecture 39. Activity and resource default setup in Moodle | 89% |
| Lecture 40. Mass upload of courses | 89% |
| Lecture 41. Moodle and YandexDisk | 87% |
| Lecture 42. Moodle and Google Drive | 79% |
| Lecture 43. Moodle and SkyDrive | 80% |
| Lecture 44. Literature on Moodle | 91% |

## III. CONCLUSION

Taking the above into account, the development of a massive online open course includes the creation of an information-intensive educational environment containing the following models:

- content presentation model;
- collaborative learning model;
- pedagogical interaction model;
- student reflection model;
- pedagogical design model.

*The content presentation model* is for shaping the structure and content of educational video. This model is based on the didactic and semantic content design. Ideally, the content is presented as intellectual complex information that encourages deep thinking on the part of the students and represents the equality between the teacher and the student.

*The collaborative learning model* involves interaction between students at the MOOC. Foreign researchers studies emphasize that interaction can lead to better learning, creating learning community, sharing ideas and developing critical thinking skills. In the early forms of distance learning, unfortunately, no attention was paid to creating learning communities. In modern online education, the role of the network community is constantly increasing. Creating a community in an online course can transfer teacher's management to helping students in developing a socially constructed project that requires mutual relations [5].

*The pedagogical interaction model* describes the interaction between the student and the teacher. The interaction between the teacher and the students at the MOOC can be presented in the form of informal e-mail messages, chats, forums, comments, or in a more formal style of recorded video or audio conferencing. Regardless of the form of communication, the value of this interaction is determined by feedback for sharing opinions, checking works, providing technical and pedagogical support [5].

*The student reflection model* follows from one of the main characteristics of using MOOC which is the development of reflective writing. Reflection should include students' assessments for their participation in learning and joint activities. Reflection allows them to evaluate their activities. It also gives the teacher evaluation of the developed course, that can be included in the overall final assessment of the course. Moreover, such tools allow the MOOC teacher-developer to put his course into perspective, critically interpret its content and improve its quality.

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