

## Approaches to the use of mass open online courses in the construction of adaptive trajectories in the information and communication educational space

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**Abstract.** The article is devoted to the problem of developing mass open online courses (MOOC) and their use in the system of general secondary and higher education. As part of the study, decomposition of the basic elements of the adaptive MOOC is presented, which includes a set of subsystems that form educational trajectories within the platform. As a pilot site, the portal of the methodical electronic educational center is presented, which allows to create high-quality electronic educational content for the system of general secondary education. The presented project allows to create Internet courses of new generation. This allows you to freely master the content of educational disciplines or subjects to a large number of students. The article presents a general description of the use of the IICC on the portal and the key moments of its use in the educational process and ways of integration of the unified information educational space of the university.

**Keywords:** open education, e-learning, online course, mass open online course, MOOC, electronic educational content

### 1 Introduction

In connection with the globalization of education, the problem arises of creating and developing new effective educational models. On this basis, universities, overcoming the boundaries of their closed self-sufficiency and uniqueness, strive to conquer and master not only their national educational space. The leading trend of the current stage of development of the world open education is the creation of the most accessible conditions (resources) for anyone who wants to receive a quality education.

### 2 Problem overview

At the moment, the leading Russian educational institutions are solving the important task of creating a single information space that will ensure the implementation of the

concept of lifelong education - from the preparation for the delivery of the OGE and the USE to the development of additional skills development programs in the online environment. Having identified the current level of development of e-learning in Russian universities and their level of willingness to participate in interuniversity projects, the Ministry of Education and Science of the Russian Federation continues to promote the development and improvement of the regulatory framework, methodology and technology in this area, taking appropriate organizational and coordination measures. The Presidium of the Presidential Council for Strategic Development and Priority Projects of October 25, 2016 announced the priority project "Modern digital educational environment in the Russian Federation in 2016-2021" [7]. In connection with this, leading universities are carrying out strategic work on combining accumulated resources and creating national educational platforms with the aim of locating mass open online courses that open the widest opportunities for different categories of the population for the implementation of individual educational paths (routes) with free choice of courses of different educational organizations.

Distinctive characteristics of mass open online courses are the following [3-6].

First, they are designed for significant target audiences. Typically, for each course is recorded from 1000 to 10,000 people. In some cases, these figures can be much larger.

Secondly, online courses are open or accessible, and in most cases free, for anyone without formal requirements to the basic level of education, regardless of place of residence, social and material situation, health status, language and cultural barriers.

Third, the concept of mass open online courses implies continuous online access of students to information in real time, at any convenient time and in any place. Considering the levels of user access to MOOK, we can distinguish the following [8]. The first level is directly the electronic educational content of the MOOK, developed by the author's team. The second level is the university's website with posted courses available to students on the campus network. The next, the third level, are specialized cloud IOOC-platforms provided by providers and providing the placement of courses of different educational organizations. The fourth level consists of the IOOK aggregators - portals with catalogs of the best and most popular courses of different providers.

Fourthly, the foundation of the IOOC is high-quality electronic content, which forms certain competences and has structured subject content that provides support for a specific educational program (video materials, interactive tests, assignments, etc.) and interaction of trainees (training forums, group projects, P.). The application of MOOC promotes the construction of the educational process, taking into account the individual age, psychological and physiological characteristics of the students, the formation of their readiness for self-development and the desire to learn all their lives, the development of an open social environment that ensures interaction between learners of different age groups, interests, educational needs and preferences.

Thus, mass open online courses can be formed for different levels of the education system, starting with the school bench. At the same time, in order to effectively plan an educational trajectory, it is necessary to develop an approach that allows adaptive response to the behavior of students in the information and communication environment.

In the framework of the study, we developed an approach that allows for the autonomous planning of an educational trajectory within a mass open online course. The introduction of adaptive technologies in MOOK makes sense if the number of students studying it exceeds a thousand people a year. When analyzing a smaller sample, it is difficult to build an appropriate model and develop a flexible algorithm for implementing the MOOK adaptivity. The next important condition for building a model is a clear structuring of electronic educational content and the allocation of educational facilities. Recall that in the MOOK educational facility is considered as a separate structural element of electronic educational content, corresponding to the specific goal of teaching and contributing to the achievement of the overall goal of the course. The number of possible routes for the implementation of adaptive educational technologies depends on the number of educational objects allocated. Further it is necessary to carry out measurements and collect analytical data on different parameters. Using the combination of various adaptive models of e-learning, as well as the means and methods of processing the received structured and unstructured data of huge volumes (BigData), you can get a variety of models of behavior of thousands of students and for each, respectively, determine the most optimal training route. Heuristic algorithms are used to construct individual learning trajectories for trainees. In order to correct the individual trajectory of learning, it is proposed to implement methods of data mining based on personal characteristics and preferences of the learner.

A schematically adaptive MOOK that takes into account all the characteristics and parameters of personalization of learning in the online environment can be represented in the form of decomposition of three interconnected subsystems.

Consider the basic set of subsystems and describe them in more detail.

The first subsystem is the "Profile of the trainee", which is responsible for the detailed collection of the following data:

- A1 - gender (male, female);
- A2 - age group (up to 20 years, 21-39 years, 40-59 years, after 60 years);
- A3 - interests in the subject area (input questioning: learn new, pass test / examination, broaden horizons, personal development);
- A4 - the purpose of training (low level - initial acquaintance with the subject area, medium - in-depth study of the discipline, high - retraining or advanced training);
- A5 - features of perception and memorization of information (visual, audial, kinesthetic, digital).

The second subsystem is the "Progress of the learner", designed to collect constantly changing data about the student's academic achievements:

- B1 - points for each evaluated educational facility (for example, 50-70% - low, 71-89% - medium, 90-100% - high);
- B2 - achievements in the study of other courses (received scores on completion of the course, assessment for the final exam);
- B3 - level of preparedness of the student (entrance testing in points: low, medium, high);
- B4 - the number of attempts to perform tasks;
- B5 - the time spent on the tasks;

B6 - the level of complexity of the task, formed by the feedback of the learner (simple, normal, complex);

B7 - the level of complexity of the material according to the learner's reviews (simple, normal, complex).

The third subsystem is "Personalization of content", which, based on the analysis, evaluation and synthesis of the data obtained for each individual student, creates the optimal learning strategy and provides a unique setting of the parameters, in particular the presentation format and the level of complexity, of the proposed electronic educational content. The main idea underlying the development of this subsystem is the following: a qualitative adaptive training program in the MOOK should be extremely personalized. Unlike the standard MOOK, the adaptive course lacks the usual menu for the students "Course content", it is impossible to move consistently at the rate, choosing educational objects at your own discretion, in the course of the student's progress, his success is noted, and points are not awarded. Thus, this subsystem generates a set of individual learning paths C1 ... Cz.

Experimental approbation and development of adaptive MOOO was started in 2016. One of the first stages was the formation of a quality electronic educational content for the system of general secondary education. For this purpose, the portal of the Methodical Electronic Educational Center (MEOTS) was created by the team of researchers of the Faculty of Mathematics and Information Technologies of the Orenburg State University with the support of the Government of the Orenburg Region and close cooperation with the Ministry of Education of the region.

The peculiarity of the MEOC (<http://www.56bit.ru>) is the presentation of open access to educational materials (video lessons, presentations, etc.) developed by the leading teachers of the region and who underwent a mandatory multistage preliminary examination at the Regional Center for the Development of Education and recommended by the Ministry of Education of the Orenburg region.

All materials are structured according to subjects, years of study, sections and topics. Open access to electronic educational materials expands the ways of ensuring the independent work of schoolchildren, opens the possibility of using active-activity and personality-oriented forms of learning in class.

For the convenience of users, a search is organized for the title of the lesson theme, allowing you to find the required material without specifying the subject and class. Advanced search allows you to refine the criteria and set the type of methodological material, subject, class.

To date, more than 5,000 lessons and 10,500 materials on 12 general education subjects have been posted on the IEC website. Methodical electronic educational center was visited by about 20,000 unique users, including 8660 from the Orenburg region.

An important special feature of the IEC is the provision of remote access to educational institutions of Orenburg region, implemented by Internet channels, to virtual desktops with pre-installed licensed software required for specific school lessons. For this purpose, the web-interface is available on the website of the IEOC, allowing teachers to form an application for sharing access to the necessary software systems and products on demand or at a pre-specified training schedule.

The next strategic stage of the MEOC development is to attract leading teachers of the Orenburg region to develop full-fledged IOOCs for preparing schoolchildren for olympiads, final state certification in various subjects, admission to higher educational institutions. In addition, it is planned pre-profile online preparation of students for in-depth study of subjects whose training programs go beyond the standard school curriculum, for example, "Live English", "Web Programming and Site Building", "3D Modeling and Animation", etc. that the region's teachers will be able to use the author's MOOK when teaching schoolchildren to different subjects in the "inverted class" format. In this case, schoolchildren watch short video lessons at home on a computer or any mobile device, and during class work learn to apply the knowledge gained in practical activities, which is the basis for forming key competencies through living situations, solving problems, reflecting experience. MOOK extends the boundaries of accessibility of education and communication for students with disabilities, children who are often ill and skipping classes or studying for other reasons under an individual home-based plan. MOOK can provide the conditions for continuing education of schoolchildren during long-term quarantine, when they should receive theoretical material and pass the teacher's homework assignments for examination.

Soon, the Methodical Electronic Education Center will be a cloud platform providing the third level of user access to the MOOK and providing the maximum opportunities for organizing effective e-learning: complex qualitative electronic educational resources, joint access on the basis of cloud technologies to the necessary licensed program providing, interactive means of interaction between the subjects of the educational process a. The main goal of creating and developing the IEC is information-methodological and educational support of the educational community of the Orenburg region. The Methodical Electronic Educational Center should become a comprehensive, open tool for the accumulation and use of mass open online courses, an effective means of forming the image of the innovative work of the educational system of the Orenburg region.

### **3 Conclusion**

Thus, the implementation by the Government of the Russian Federation of a priority program for the development of e-education is a key factor in the targeted emergence and wide dissemination of mass open online courses that provide one of the most important components of the innovative development of the educational system. The implementation of the IOOC on the basis of the Methodological Electronic Educational Center of the Ministry of Education of the Orenburg region and the Orenburg State University will have a significant social effect - it will provide access for teachers and students of all schools in the region to the use of wide opportunities for open online learning in the educational process.

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