# Can MOOC help to prepare a well-trained specialist for aerospace industry?

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**Abstract.** Digitalization of education is the main trend of modern society. The ideology of education "lifelong learning" invests the opportunity to improve skills and develop competencies without leaving home. The article discusses the possibility of using MOOC for training specialists in the aerospace industry. The analysis of the MOOC and specialized courses developed and followed in the TPU, as well as analyzed the education of students is done.

## 1 Introduction

Mass-open online courses (MOOCs) are named among the 30 most promising trends in the development of education until 2028. It is believed that they open up new opportunities in the field of distance education increasing the relevance of the topic of quality online courses [1]. The MOOC concept is based on the key principles of the new theory of learning – connectivity: diversity of models, approach to learning as a process of network formation and decision-making, learning and cognition as a dynamic process.

Features of MOOC:
• training is free of charge or conditionally paid (for the certificate) and voluntary;
• a large number of students on the course (hundreds and thousands);
• emphasis on independent work, self-control and mutual control;
• openness-MOOC is accessible through the Internet 24x7x365 without any restrictions;
• multimedia-MOOC use audio, video (including interactive), 3D-worlds and many other modern technologies.

Presentation of training information:
• theoretical material is represented by lectures (in the recording), which are divided into parts with a duration of 2 to 15 minutes. Lectures end with a test, quiz or control questions for checking understanding;
• workshops in the form of various tasks: solving mathematical problems, essays, discussions, creative projects, team projects, work in virtual laboratories, etc.

Organization of control:
• focus on independent work. Independent and cross (mutual) evaluation of each other's work is used to monitor the activity of students,
• the total final control measure for the certificate [2].

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## 2 Nowadays situation

Major American and British universities actively participate in the creation and dissemination of educational resources, including open online training courses, and are developing the market of electronic educational services. [3]

Some of the researches are sure that MOOCs provide free access to high-quality learning materials, offered by elite universities. They are conceptualized as online learning environments in which participants worldwide can create, research, and share open educational resources. However, the opponents consider them as a passing trend that might damage higher education, including research and accreditation.

Another debate relates to the way students learn and whether MOOCs can facilitate deep and meaningful learning. Mackness, Mak and Williams (2010) asserted that the more autonomous, diverse and open the MOOC is, the more the potential for students' learning to be limited by the lack of structure, support, and moderation which are normally associated with a regular course. [4]

One more series problem is lack of mechanisms for assessing the quality of e-learning and the MOOC by consumers.[5]

The analysis of the MOOCs, covering the issues of training specialists for the aerospace industry, showed the following. On two Russian platforms (Stepik and Universarium) there are five courses related to this field, on the foreign platforms 8 courses were detected.

## 3 TPU and MOOC

TPU has a positive experience of MOOC using. Since 2016, at TPU's own platform http://edx.tpu.ru students are trained with the MOOC using. MOOCs are used  within the framework of the disciplines "Professional English Training" and "Foreign Language". Students study "Introduction to petroleum engineering", "Myths and Facts About Rocks» [6]. 85 percent of TPU students who train in this discipline received a certificate for the successful completion of the course.

Teachers use MOOC as an additional material for the discipline, applying different technologies:

• technology "inverted class". Independent work of the student involves studying the video lectures of the course and performing evaluation activities. During the classroom work complex aspects of the course are worked out and practical assignments / laboratory works are performed;

• the organization of independent work only on the basis of the MOOC;
• formation of professional communication skills (English language) on the basis of the MOOC. A glossary (thematic dictionary) of the basic terms of the course in English is formed and developed. The work in the classroom is aimed at fixing professional terms in English, and in the course of independent work, the students carry out the tasks of the course.

Summative assessment of the discipline is organized at the discretion of the teacher:

1.    offset on the discipline on the basis of the final result at the rate;

2.    the final result at the rate is taken into account as a written part of the offset, and the oral part of the test involves the protection of the project in English within the framework of the course.

This experience can be passed on improving the quality of future engineers training, including the field of space engineering. The complexity of the material of engineering disciplines does not allow to limit examination by tests. Special types of tasks oriented on practicing practical skills required. The system of TPU MOOCs tasks contains tasks for

mutual verification, as well as practice-oriented tasks with automatic verification (including the checking of entrepreneurial competencies).

Here is an example of the course "Logistics for yourself. To develop entrepreneurial thinking is a popular science course, but also it helps to obtain specific skills (through a system of tasks / business cases). It lasts for 5 weeks and contains four practical calculation tasks, one laboratory work and analysis of four thematic business cases.

Task № 1 Determination of the required number of days of additional insurance reserve for the enterprise. In Task № 2 Student need to choose a store in which it is more profitable to buy products for the preparation of a particular dish, and to calculate the minimum cost of this dish. Task № 3 devoted to determination of more profitable warehouse: own or hired, and to calculation of the cost of the selected type of warehouse and the point of indifference of cargo turnover. Task № 4 poses to calculate and form a template in the program MS Excel, which can then be used to make decisions to optimize the real business processes of the company.

- virtual laboratory work "Choice of warehouse ownership" is implemented in the format of interactive video – contains elements of active influence of the viewer on the reproduced video and allows to organize a non-linear scheme of viewing video to simulate live communication of the teacher and the student, the organization of an interactive dialogue between the viewer and the lecturer.
- the average percentage of people who have successfully completed MOOC depends on a number of factors:
- on the direction to which the course belongs (art, Humanities, business and management, computer technology, biological Sciences, psychology, physics, mathematics and logic, engineering Sciences, etc.),
- on the support of the course by teachers/curators (frequency of answers to questions, the presence/absence of a thematic community within the course, the atmosphere in the course, etc.),
- on the purpose of the course (education, educational – in such courses % of successfully completed training will be less than in courses that are aimed at practicing some practical aspects (PC courses, retraining, etc.),
- career guidance (bonuses for successful completion of the course, for example, extra balls on admission, self-determination and ect.).

As a rule, students already come with a request for certain points (practicing skills, obtaining a certificate, bonuses, their self-determination, etc.). They are already motivated to pass, because it will either "pump them", or they will receive some bonuses for themselves.

Here is a comparison of two most wide used on-line technologies MOOC and Moodle (Table 1.)

**Table 1.** Distinctive features of MOOC and Moodle.

| Parameter | MOOC | Moodle |
|---|---|---|
| Course name and audience focus | Original and attractive name | As a part of the educational program, as a rule, coincide with the modules or parts of the discipline |
| Quantity of students | Massive participation (more then 1000, otherwise the will not be opened) | From 1 person, the course holder decides (in accordance with the curriculum) |
| Structure of the course | Information block<br>Training and Practical Unit<br>The control unit<br>Organizational unit | Availability of large quantity of material<br>Temporary access to materials after compulsory course units |

| | Communication block<br>Dosed temporary access to materials after compulsory course units | (subject to curriculum restrictions) |
|---|---|---|
| Verification materials<br>Interactive assignments | Ability to assess competencies<br>Inclusion of simulators for assessing professional activity | Problem-oriented learning, gaming, social networks, web 2.0, virtual laboratories, the creation of educational content (teacher + student), peer-to-peer peer evaluation mechanisms, etc. |
| Period of passage | 3-6 weeks | From one week till one semester |
| Time resources for development | Till 100 hours per week | The ability to reduce time costs by copying elements |
| Individuality and competences of the teacher | Demand for charisma, professionalism, literate speech, ability to keep and switch the attention of the audience<br>Ability to communicate with the course team<br>Possibility to connect an assistant | Not of importance<br>Possibility to connect an assistant |
| The design of the course | Nonstandard | Standard with elements |

## 4 Common signs of all MOOCs

The list of students who have higher education depends on a number of points: from the direction to which the course belongs (art, humanities, business and management, computer technologies, biological sciences, psychology, physics, mathematics and logic, engineering sciences, etc.), from the purpose of the course (enlightenment / education, career guidance, specific skills, training, retraining, etc.), from the necessary preliminary training (if any special knowledge that you need to have for the course / prerequisite training course). Also, the same course on different platforms can have different target audiences. In courses aimed at career guidance, training, retraining, practical tasks should be more than, in popular science courses. Practical tasks are a more effective way to check the achievement of the results announced in the course (working out practical skills, checking understanding of the organization of processes, getting feedback on the chosen option, etc.). In popular science courses it is possible to organize a test at the expense of a system of tests (verification of theory assimilation), although practical assignments in such courses are perceived positively by listeners.

Common problems of MOOC using:

- the difference in the level of students' training, inadequacy of peer-to-peer evaluation;
- the problem of identification of the student;
- the inaccessibility of teacher in large numbers in groups;
- lack of binding knowledge to a specific country, its needs and features;
- ensuring a minimum level of language training;
- the need for prior focus group courses;
- unlimited access to online course content after the course ends;
- the need of adapting teaching methods to the digital culture of generations (generations Y-Z);
- the need of including courses directly in the educational programs of universities (as well as in the evaluation system as a whole;

- the difficulty of including the business community and professional communities as experts to assess the quality of online courses and post-course learning outcomes;
- addressing financial issues related to the use of courses.

## Conclusion

The course analysis was conducted. The peculiarities and problems of development and implementation of online courses were revealed.

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