

## Massive Open Online Courses as the Initial Stage of Development of a Digital University

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### Abstract

The purpose of this study is to identify the conditions (including pedagogical) for effective development and operation of MOOCs to meet the interests of all participants in the educational process and national innovation (educational) policy. The present paper is based on the classical methodology of scientific research, including a set of scientific methods such as a logical consideration of historical events, a dialectical way of studying the world around us, considering concepts in the interrelation of their contradictory aspects, identifying the causes and relations between phenomena, abstracting and specifying results, and the method of multiple thematic comparative research. The study uses the method of sociological surveys to collect empirical data. Further, it uses methods of statistical and graphic data processing. Other methods applied include analysis of relevant modern scientific literature and the synthesis of promising new directions for the development of universities using digital educational technologies. Relevant questionnaires were developed to interview students and teachers on the research topic set forth. In general, students have a positive attitude toward digital educational technologies and MOOCs. The main effects of MOOCs in the pedagogical process are as follows: The educational material becomes easier to perceive, more visual and diverse, the cognitive activity of students grows, the quality of information transmission and knowledge transfer to students improves, and the controllability of the acquired skills and abilities by students and teachers increases. To improve the effectiveness of MOOCs, it is necessary to reduce the academic load of teachers, simplify paper workflow, and increase the practical orientation of educational materials.

**Keywords:** *education, digital technologies, pedagogical methods and conditions, blended learning, innovation in the educational process.*

### Introduction

Current global trends in education suggest that modern education at universities is becoming digital, distance, remote, free, and networked. At the same time, there is a trend toward strengthening the most competitive digital education systems. Each university, acting in an open global digital space, strives to attract the best human resources, talented students and teachers, and financial and administrative resources. This trend in education systems methodologically

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corresponds to modern trends in the economy. Against the background of equal opportunities for the development of national economies in the global economic space, there is a return to the model of state protectionism, the return of capital to its homeland, the creation of conditions for the growth of the number of jobs, and the introduction of high customs duties on the import of foreign goods. Thus, an open digital economy is used exclusively to strengthen the monopoly power of the national economy. At the same time, domestic demand for new production is stimulated by high customs barriers for foreign, mainly Chinese, products and a ban on the export of American technologies and their use in general (for example, for the Chinese company Huawei). These trends in the global economy are reproduced in the education system. The scientific literature introduces the term “neo-colonialism,” which reveals the modern mechanism of the digital development of universities (Adam, 2019). With the help of digital technologies, modern universities are spreading their teaching methods and their scientific methodology, mainly Western, which leads to the destruction of local, indigenous knowledge systems in other countries.

The object of research in the present article is the Massive Open Online Course (MOOC). With the help of MOOCs, universities expand their interests to other countries, and gradually MOOCs become a source of formation of unique intellectual and financial resources of modern universities actively using digital technologies. Most of the leading universities have their own strategic plans for digital development and adaptation to digital changes (Guest et al., 2021; Kalimullina et al., 2021; Khalid et al., 2018; Sobral, 2021).

The development of modern society is characterized by certain dynamics, where the transition from the traditional era to the informational one takes place. This is manifested in the rapid development of virtual communications, which leads to dramatic changes in all spheres of society, affecting the field of education. Even businesses in such conditions are forced to actively use digital technologies to maintain their competitiveness (Benčić et al., 2020; Subedi & Subedi, 2020; Yemelyanov et al., 2020). This requires better information security of new education systems, which is being addressed simultaneously with the improvement of the digital infrastructure of universities, by the transfer of the educational function to a digital format (Evans-Amalu & Claravall, 2021; Gapsalamov, 2020).

Today, the educational process is structured in such a way that one is forced to constantly improve one's qualifications. The modern world is changing so quickly that a single profession is no longer enough. New technologies are constantly increasing the proportion of automated jobs. A valuable

specialist is one who is able to flexibly change under the influence of external changes and new information (Gibbs, 2020; Oguilve et al., 2021). The ability to continuously generate new knowledge in the digital economy is becoming important (Zmiyak et al., 2019).

Requirements for human competencies are changing. A competitive person should now have such character traits as mobility, sociability, the ability to use new technologies, and the desire to independently study new information. Digital education goes beyond the educational institution. The staff must constantly learn and acquire new competencies while working on their own (Danchenok et al., 2019).

Another trend in the transformation of the education system is the requirement to take into account the capabilities and needs of the student. A personality-oriented approach in the education system will allow taking into account various properties and qualities of a person. It is important that students have the opportunity to develop their natural inclinations and abilities. In particular, such results can be achieved when teaching on educational digital platforms, its vector of obtaining knowledge being adjusted by the listener. Education systems are following the path of integrating the possibilities of personification of educational materials and the accumulation of general educational resources, which is reflected in the growth of the number of MOOCs (Mu, 2020). Digital technologies are transforming all the traditional functions of the university, primarily its educational function. Researchers predict the emergence of new competencies in the work of teachers and a new profession: “digital-engineer-teacher” (Andryukhina et al., 2020).

The coronavirus pandemic and the massive transition to distance learning technologies has also made the present study relevant to improve the quality of teaching at the university (Gerasimova et al., 2018; Novikov, 2020). Furthermore, electronic educational sites and the MOOCs hosted by them are becoming the main factor in the digital transformation of the educational function of universities. The relevance of research studying the role and place of MOOCs in the modern digital educational space is currently considered high.

It is necessary to investigate the conditions for the effective development and operation of MOOCs in the pedagogical activity of a modern teacher at the university. The role of distance education is increasing. MOOCs are the most common distance education tool. It is necessary to use MOOCs in the traditional higher education system. It is also necessary to identify the most difficult problems and effective ways to solve them.

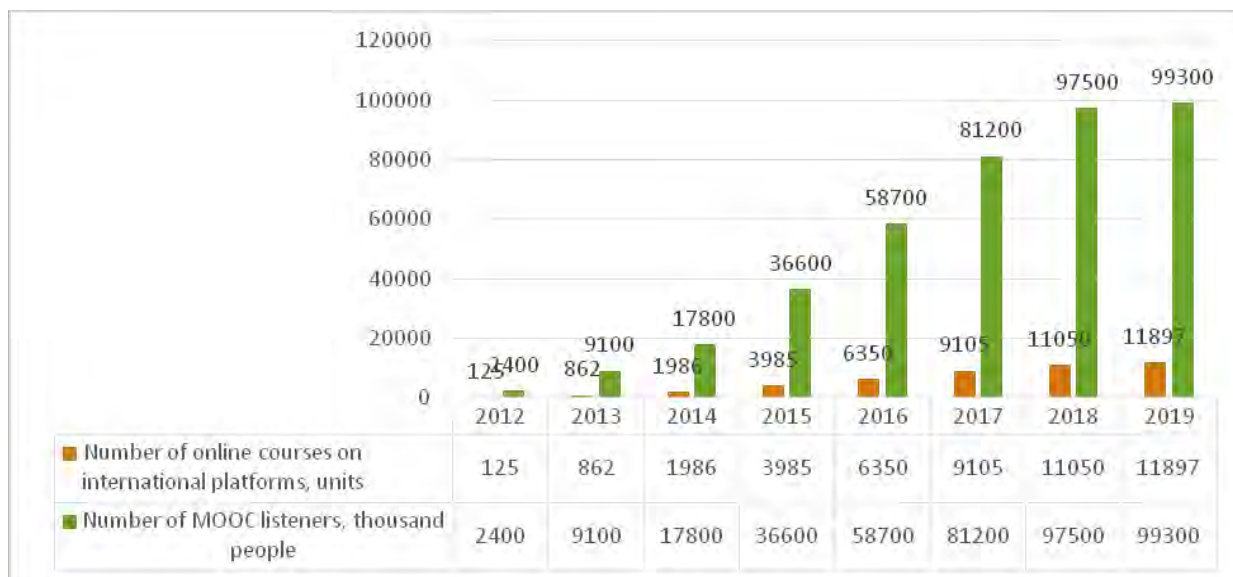
### Research Questions

In our study, we posed three research questions to guide the research procedure:

- 1) What are students' perceptions of MOOCs as the initial stage of development of a digital university?
- 2) How do students perceive the effects of MOOCs on teaching?
- 3) How do students perceive the effectiveness of MOOCs?

### Literature Review

The fundamental and final goal of all massive open online courses is to build a form of knowledge transfer with the educational process that is public and massive. In the literature, the MOOC is recognized as a revolutionary innovation in e-learning that changes the educational process for both the student and the teacher (Ahmad et al., 2020; Dagdilelis, 2018; Tadeu et al., 2019). Today, there is a wider choice of platforms for various MOOCs: Coursera, iTunes U, Stepik, Eduardo (Lectorium). The number of MOOCs located at these sites, as well as the number of students of these courses, is constantly growing (Figure 1).



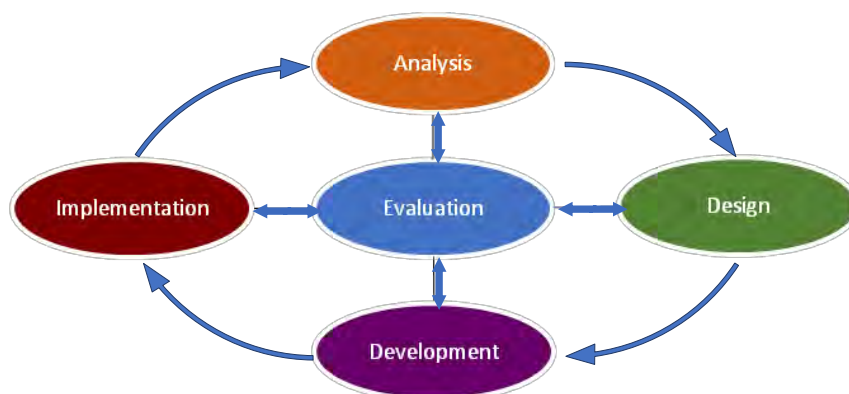
**Figure 1. Growth dynamics of distance education indicators in the world (compiled by the authors based on the analysis of multiple thematic comparative studies)**

The key features of massive open online courses include: (1) an accessible training format that is free for everyone; (2) the presence of educational video lectures; (3) practical work and test tasks, with the deadlines most often clearly spelled out; (4) the possibility of obtaining a certificate (including a paid one) upon successful completion of training; and (5) the emergence of new forms

of communication and knowledge acquisition, such as discussion forums (Almatrafi & Johri, 2019).

The literature describes parameters of massive open online courses that are worth paying attention to (Baez Zarabanda, 2019; Brigas, 2019; Ohlin, 2019). First, such a training format presupposes feedback and a system of various methods for assessing students' knowledge. At the same time, expanding the circle of communication of MOOC listeners through social networks increases the positive emotional state of the student (Anderson et al., 2020). Second, the possibility of forming an educational community for the interaction of students during the period of the online course needs attention. At the same time, special attention should be paid to a professional approach to the development and certification of the MOOC (Ansah et al., 2020). Third, the possibility of increasing interest in learning by introducing gamification elements is potential. This helps the active development of interactive educational technologies both in the humanities and in engineering (Barabanova et al., 2019). Fourth, it is possible to build an online course program based on a specific discipline in keeping with the number of credits and other results. At the same time, it is advisable to regulate the didactic parameters of the MOOC depending on the individual characteristics of the student (Baumol & Bockshecker, 2017). Fifth, flexibility of the online course is present. At the same time, an urgent task is to coordinate the conflicting requirements of the participants in the educational process: students, teachers, and university administration (Biedermann et al., 2019; Idika, 2020; Pogosyan, 2019). Sixth, there is formation of student independence, as there is an opportunity to study without direct interaction with the teacher. At the same time, it is noted that a more active use of MOOCS will increase the indicators of digital development of the universities in accordance with the priorities of the state policy of digitalization of the economy (Bogoviz et al., 2018).

The mechanism of creating an online course is rather laborious and associated with significant investment (Azami & Ibrahim, 2019). To optimize costs and increase the satisfaction of all parties when using MOOCS, the teaching practice uses the pedagogical design model ADDIE (analysis, design, development, implementation, evaluation). This model provides an opportunity to consider the main stages of developing a typical MOOC (Figure 2):



*Figure 2. Pedagogical design model ADDIE*

This model combines the most famous theories of pedagogical, psychological, and technical science. Based on the literature, a MOOC is a process of pedagogical activity using advanced digital technologies to organize and conduct distance learning, taking into account the individual characteristics of students and the dynamics of indicators of their group learning. The following is a brief review of the literature describing the stages of development of a modern MOOC in a digital university:

MOOCs indicate development of technical specifications. At this stage, the goals and objectives of the online course are formulated; the expected results are developed to be recommended for implementation during the educational process. It is necessary to take into account the specifics of the target audience for the formation of the initial level of training of the students. For example, there are approaches to the development of a MOOC depending on the age of potential students (Cedillo et al., 2019).

MOOCs can serve in preparing a pedagogical script for an online course. After the learning objectives have been set, it is necessary to determine the scope, content of the course, and its structure. During the work, a detailed course program is prepared. At the stage of the initial check of the material, the recommended time for studying the course is indicated and the electronic educational content is prepared. In this case, multimedia training tools can be actively used (Henukh et al., 2019).

In addition, MOOCs help course creation and testing. All materials of the online course are uploaded to the educational platform, tested, and checked for functionality. It is necessary to ensure

the improvement of learning outcomes using MOOCs compared to traditional forms of education (Sulistyo et al., 2019). The first stage is associated with the hosting of the massive open online course on the educational platform, its approbation, and testing. In some cases, the online course is uploaded to a cloud platform that provides network access to a large number of Internet users. At this stage, a number of researchers advise to expand the traditional functions of MOOCs and create a common digital educating environment for students and teachers (Holanda et al., 2020). Second, quality analysis of the online course is easy to control. In the process of distance learning using massive open online courses, it is important at each stage to receive feedback from students, make corrections, and adjust the course for its further modernization, taking into account the shortcomings found. This will identify students who make up groups with low efficiency of distance learning and who need advice and adjustments to the learning path (Wolff et al., 2014). All stages of the development of a typical massive open online course are lined up in a logical sequence and assume the feedback among the participants. This is necessary for the continuous improvement of MOOCs, supplementing with relevant materials, new structural elements, and new forms of student-teacher interaction (Zaporozhko & Parfyonov, 2017).

The key feature in the development of any high-quality massive open online course is building educational content in such a way that all the necessary information for the student is transmitted in an accessible and understandable form. The main task is a clear perception and subsequent practical application of the knowledge gained. For this, the researchers propose to evaluate the effectiveness of MOOC operation not only during the studies, but also by the results of the work of young specialists after several months of work in the real sector of the economy (Smith-Lickess et al., 2019).

The technology of pedagogical design is relatively simple, since it contains a certain algorithm already used as a basis for the online course being developed. The technology of pedagogical design can be most simply explained on the example of the use of marketing research in economics: It is important to understand the needs of the client (student) and ensure the transfer of the product (knowledge) in the most convenient, understandable and attractive way. Also important is the clarity and usefulness of the material being studied. The time factor in the positive acceptance of MOOCs as a new technology for training is also of importance (Hrabala et al., 2017; Prutchenkov & Pavlova, 2017; Teo & Dai, 2019).

Despite the fact that the effectiveness of distance learning is often questionable, it is still impossible to argue with the wide range of positive aspects of this form of education. With careful work on the quality of the online course, understanding the strengths and weaknesses will only allow improving educational content, taking into account the wishes of the students themselves (Kilinc et al., 2020; Williams et al., 2021). The process of improving the education system using MOOCs is not complete (Fadli et al., 2020).

The creation and active use of universal educational massive open online courses focused on obtaining fundamental knowledge and practical skills requires very high developer qualification. Therefore, one of the tasks of a digital university is to increase the competence of students and teachers in the field of digital technologies. The solution to this problem is not sufficiently described in the existing scientific literature. The purpose of this study is to identify the most effective conditions for mastering digital competencies and pedagogical methods for the effective development of massive open online courses and their active use as an initial stage in the development of a modern digital university.

## **Methods**

### **Research Design**

The present study used a survey design to which a quantitative approach was applied to analyze data. The focus of this study was the use of MOOCs as the massive online system used in Kazan University, Russia. A comprehensive consideration of digital technologies in solving pedagogical problems is in the interest of the university in the process of its digital transformation and competition for resources (personnel, financial, technological) in the global educational environment. Statistical analysis using SPSS software was used as the tool of data analysis. This study was conducted at the Yelabuga Institute of the Kazan (Volga Region) Federal University. The study was conducted over three months from September to November 2020.

### **Instruments**

The questionnaire and inventory were developed by the authors of the study. In their work, the authors relied on previous research by scientists on digital education and MOOCs, presented in the literature review and bibliography in this article. The verification of the results obtained was based on comparison with the results of other studies, which is described in this article.

The following survey questionnaires were developed:

#### **Questionnaire 1: Items of the survey questionnaire for the students**



*The students' attitude to the organization of training using massive open online courses as an initial stage in the development of a digital university:*

1. Would you like to receive basic or additional education on digital platforms of massive open online courses?
2. How much time a day do you spend on the Internet?
3. Do you consider learning on digital educational platforms effective?
4. Do you know what digital educational resources are?
5. Have you gained knowledge through digital educational resources?
6. Are you familiar with such programs as Google Classroom, Coursera, or Stepik?
7. Which is more convenient for you: to acquire knowledge from a textbook or using the Internet?
8. Have you had experience with acquiring knowledge through multimedia presentations, electronic encyclopedias, or on online training platforms?
9. Would you like to have digital educational resources start to be widely used in your educational institution?
10. Do you find learning on digital educational platforms interesting?

**Questionnaire 2: Items of the survey questionnaire for the teachers**

*Teachers' attitude to the organization of training using massive open online courses as an initial stage in the development of a digital university*

Question formulation	Answer options
1. Your sex:	a) male b) female
2. Do you teach:	a) mathematical and natural science disciplines b) technical disciplines c) economic disciplines d) agricultural disciplines e) general educational humanitarian and socio-economic disciplines f) industrial training g) other
3. Are you familiar with the concept of massive open online courses?	a) yes b) no
4. Do you have experience with using elements of distance learning in pedagogical practice?	a) yes b) no
5. How do you feel about the introduction into educational practice of such an element of distance training as massive open online courses?	a) it is more interesting to study traditionally, since there is personal communication b) to organize training in a distance format is much more effective c) it is preferable to adhere to a blended training format, with both formats expressed equally d) other
6. What is the effectiveness of training using distance education forms, including online courses?	a) low b) medium c) high d) not sure
7. Do you think that massive open online courses provide an opportunity to study the discipline to the fullest?	a) yes b) no

8. Have you had any experience with developing massive open online courses?	a) yes b) no
9. If so, what difficulties arose during the development in the academic methodological aspect and during implementation?	a) lack of time b) difficulties in the speed of mastering new competencies c) overload of the documentation component d) difficulties in creating an online course for practice-oriented specialties e) other
10. What forms and means are most preferable for the implementation of distance training today?	a) email b) online conferences c) chat, forum d) educational platforms with online courses by discipline e) other
11. Do you support the idea of introducing distance training into the educational process of your educational institution, including massive open online courses?	a) yes b) no c) not sure

*Source: Developed by the authors*

To compile this questionnaire, interim surveys were carried out with clarification of possible questions in terms of their relevance and practical importance for the current state of the university, taking into account the task of its digital development and respecting the interests of both teachers, students, researchers, administration, and partners of the university and representatives of state and municipal authorities.

### **Data Collection**

To collect data, we used the e-mail addresses of students and teachers, presented on the official website of the Elabuga Institute of the Kazan (Volga Region) Federal University. Personal data were not violated. The answers to the questions were received with the consent of all respondents. The Google Forms information service was used to automate the data collection process. The responses received over the Internet were then exported from Google Forms to Microsoft Excel, where the data were analyzed further. Ninety-five percent of all teachers and students answered the questionnaire. Such a high percentage of answers received is due to the high motivation and interest of the respondents in solving the issues of digitalization of the university and the use of MOOCs that proved important for them.

The questions for the questionnaire were compiled based on the studied research and scientific articles on digital education and MOOC development. Students (2,000 people) and teachers (200 people) took part in the survey. Gender differences did not affect the quality of the study. The ratio of men and women in the number of respondents is equal. During the survey, no privacy or data confidentiality was violated. The error was not taken into account in the calculations, since the research methodology assumes a normal distribution by the number of respondents.

The research methodology is aimed at identifying the positive and negative effects of the introduction of MOOCs at the university as a whole for the entire community of respondents. Therefore, no research has been carried out on the contingent and quality of the respondents. The goal was not to identify differences in the perception of MOOCs by different contingents and qualities of respondents. In general, the aggregate of respondents is characterized by average indicators: in terms of the quality of preparedness of students, by academic performance, by the psychological qualities of receptivity to digital technologies. All interviewed teachers have higher pedagogical education.

### **Data Analysis**

To analyze the data obtained, statistical research methods were used: the calculation of absolute, relative and average values. For a more effective visual perception of the obtained statistical data, graphs were used. The graphs presented both absolute values and the percentage of the respondents' answers. All statistical calculations and graphs were made using licensed Microsoft Excel software.

### **Findings**

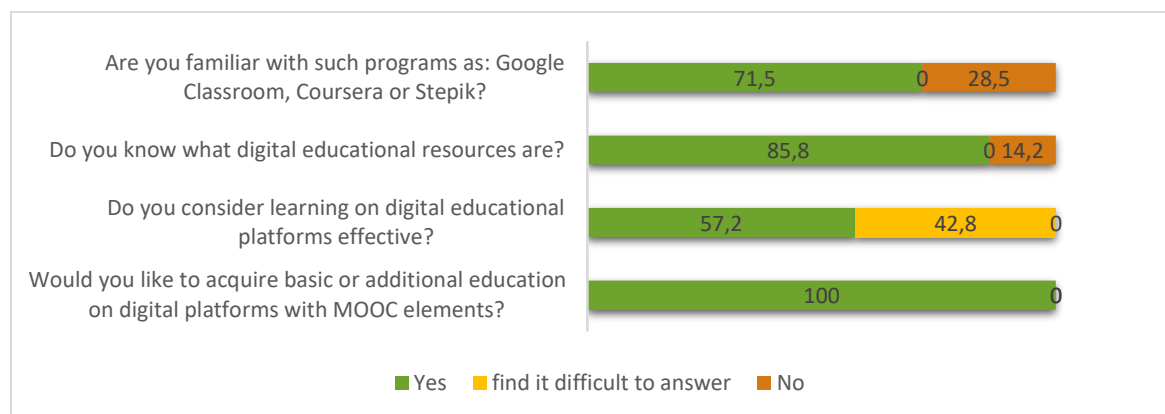
Let us structure the results of our research based on the previously formulated questions:

1) What are students' perceptions of MOOCs as an early stage in the development of a digital university?

#### **Students' Perceptions of MOOCs**

In this direction, the following results were obtained:

- 100% of the respondents would like to receive basic or additional education on digital platforms of massive open-online courses.
- 57.1% consider training on digital educational platforms as effective; 42.9% found it difficult to answer (were not sure).
- Before the introduction of the online course, 85.7% knew about the concept of digital educational resources; 14.3% were not aware.
- At the same time, 71.4% have an idea of Google Classroom, Coursera, or Stepik; 28.6% chose the "no" option.
- 100% of those who voted are inclined to believe that it is more convenient to acquire knowledge on the Internet and with the help of digital educational technologies and MOOCs (Figure 3).



**Figure 3. The results of the survey of students, in % of the total number of respondents**

Based on the survey data, an online course was developed as part of the practice in the discipline “Organizing a Team of Performers” at the Google Classroom site. Despite the fact that this training was of a mixed nature, all students voluntarily registered and actively completed the assignments provided in the course.

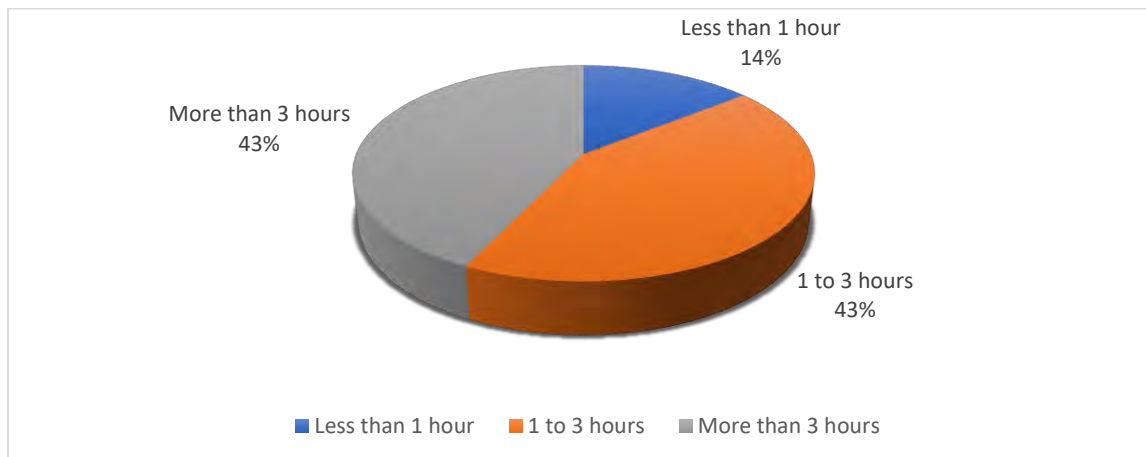
Analysis of the results of the development and implementation of elements of a massive open online course in the discipline “Organizing a Team of Performers” in the educational process indicates a high motivation of students to study at the sites of massive open online courses. The practice of implementing distance learning has shown that today, in order to enhance the motivation of students and increase control over the educational activities of students, a blended learning option is possible with the active improvement of MOOCs, finalizing digital educational content, and taking into account the feedback and wishes of students, their individual cognitive preferences, and digital portraits.

### **Students’ Perception of the Effects of MOOCs**

We proceed to the analysis of the results according to the second research question: 2) How do students perceive the effects of MOOCs in teaching as an early stage in the development of a digital university? In this direction, the following results were obtained:

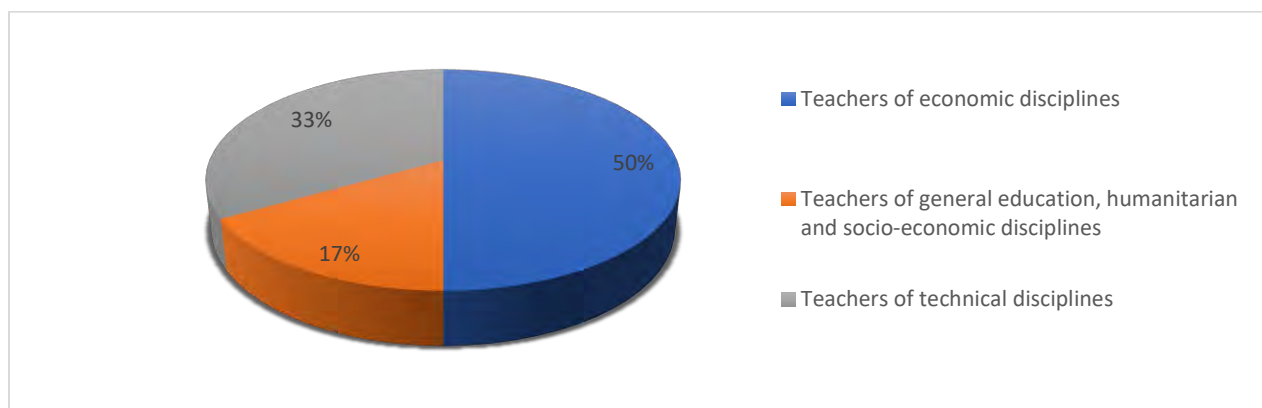
All of the students noted that the use of digital technologies and MOOCs in classrooms increased their motivation to learn and improved the quality of the educational process. The results of a survey of time engagement of students were obtained (Figure 4):

- 14.3% of students spend less than 1 hour on the Internet every day, 42.9% of students spend 1 to 3 hours a day on it, and 42.9% of respondents chose the answer “more than 3 hours.”



**Figure 4. Time spent by students on the Internet, in % of the total number of respondents**

The next stage of the research is associated with a survey of the teaching staff, based on which the corresponding conclusions were made. The structure and composition of the interviewed teachers is shown in Figure 5. The survey was attended by teachers of economics, general education, and technical disciplines.

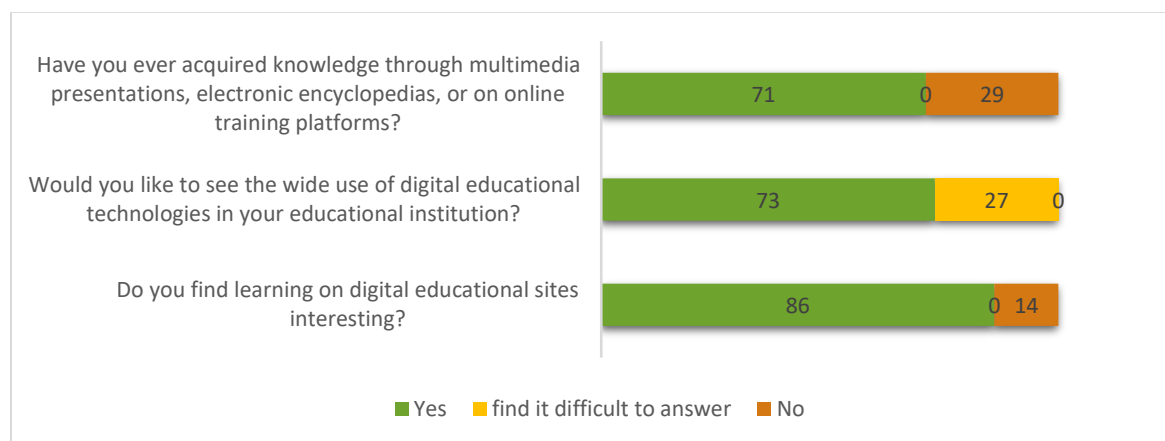


**Figure 5. The structure of teachers taking part in the survey, in % of the total number of respondents**

The most preferred forms and means for implementing distance learning today (a question with a choice of several answers at once) are chats and forums (16.7%), online conferences (33.3%), and educational platforms with online courses on disciplines (100%).

- 50% had experience developing massive open online courses; the other half of the respondents did not have such experience to date.
- 71% of students had a chance to acquire knowledge through multimedia presentations, electronic encyclopedias, or online training platforms; 29% of students were inclined toward a negative answer.

- When asked about their desire for active implementation and having classes using MOOCs, 73% of respondents answered in the affirmative; 27% of students found it difficult to answer. There were no negative results.
- 86% of respondents think that learning on the platforms of massive open online courses is interesting and exciting; 14% of students found it difficult to answer the question. There were no negative answers (Figure 6).



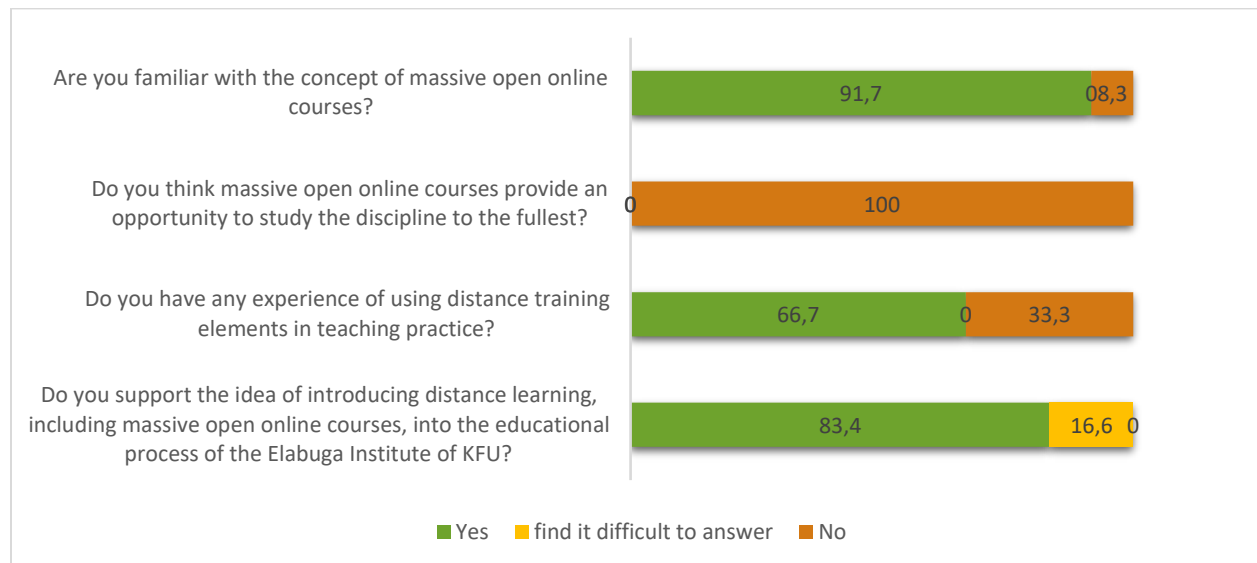
**Figure 6. Results of students' survey, in % of the total number of respondents**

Thus, both teachers and students note the high importance of using MOOCs in the pedagogical process at the university. However, the quality of the presented MOOCs and the effectiveness of their use for solving pedagogical problems in the context of the digital transformation of the university allow us to talk about the existing problems in this field. The task of the present study is to determine ways of solving the identified problems.

### **Effectiveness of MOOCs**

Consider the results for the third research question: 3) How do students perceive the effectiveness of MOOCs in teaching as an early stage in the development of a digital university? In this direction, the following results were obtained:

The topics of the questions relate to distance training and, in particular, concern the development of massive open online courses in an educational institution (Figure 7).

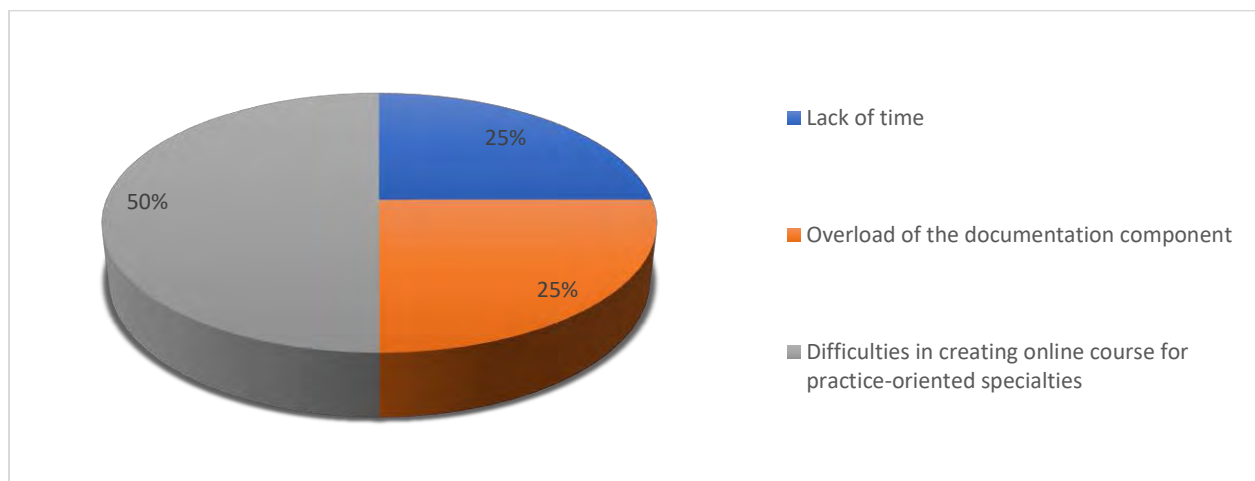


**Figure 7. The result of a survey of teachers of the Elabuga Institute of the Kazan (Volga Region) Federal University, in % of the total number of respondents**

- 91.6% are familiar with the concept of massive open online courses; 8.4% are not.
- When asked if they had experience using distance training elements in their teaching practice, 66.7% answered yes and 33.3% answered no.
- When asked about the introduction into educational practice of such an element of distance training as massive open online courses, all (100%) answered that it is preferable to adhere to blended training with both formats expressed equally (the ratio of traditional and distance learning).
- To the question “Do you think that massive open online courses provide an opportunity to study the discipline to the fullest?” 100% chose no.
- To the final question “Do you support the idea of introducing distance learning into educational training, including massive open online courses?” 83.3% answered positively; 16.7% found it difficult to answer.

Thus, we see that the effectiveness of the implementation of MOOCs is high. This is confirmed by surveys of both students and teachers. However, there are a number of problems reducing the effectiveness of the implementation and use of MOOCs. Let us dwell on this point in more detail. The difficulties of mastering digital educational technologies were investigated. When asked about the difficulties in developing MOOCs (where it was possible to choose several answers), one of the main reasons was highlighted: lack of time (25%), overload of the documentation component

(25%), and the most popular answer, difficulties in creating online course for practice-oriented specialties (50%). The results are as follows (Figure 8):



*Figure 8. Difficulties encountered by teachers in the process of developing massive open online courses, in % of the total number of respondents*

Our research results show that at the Elabuga Institute of the Kazan (Volga Region) Federal University, it is possible to study using online courses with a forecast of positive dynamics. Due to the high orientation toward the practical component in the implemented specialties, today it is possible to combine traditional and innovative forms of education (Zelentsova & Tikhonov, 2020). A blended training model will allow building a well-structured process of transferring knowledge to students. The presence of rich experience in teaching and the desire to study and implement new educational trends allow for favorable forecasts for the further development of the studied educational institution on its way to the model of a modern digital university.

### Discussion

According to the research results, both teachers and students noted the positive effects of using MOOCs in the educational process. After the application of digital (remote) technologies in the educational process, there is an increase in the cognitive activity of students and their academic performance increases. Despite the many negative effects of excessive use of Internet technologies and virtual reality, the educational process using MOOCs allows one to gain additional knowledge in a more attractive form. The process of introducing MOOCs at the Yelabuga Institute of KFU is at an early stage. Various difficulties will arise along the way. There is a need for a step-by-step improvement in the implementation of MOOCs, which includes new digital technologies and disruptive pedagogical methods.



Digital technologies are radically changing the economy, education, and life as a whole (Korableva et al., 2019; Kozlova, 2019; Vijayavalsalan, 2018). This study does not reveal the mechanism of the influence of digital technologies on the economy, education, and life. In our study, the assessment of the level of MOOC operation at the university has shown a direct relationship between the quality of digital technology application in the economy and the demand for specialists with digital competencies.

The experience of introducing distance learning in the educational process shows that the wide use of digital technologies in general depends on the rate of their dissemination in the external environment, on the rate of their mastery by all participants in the educational process, and on the correct perception and use for the good of the case (Akhmetzhanova & Yuriev, 2018). This study did not consider the characteristics of increasing digital literacy between different participants in the educational process. In our study, the analysis of the teaching staff of the university and the student body has shown the need to increase the overall level of digital competence simultaneously and in a balanced way for all participants in the educational process.

How does the use of MOOCs affect the quality of training sessions and the motivation of students to master the educational material? The researchers are of the opinion that the effectiveness of MOOCs will increase with their gradual adaptation to the individual characteristics of a student. For this, deep learning technologies using artificial intelligence are applied (Katasev, 2019; Mustafin, 2015).

This study does not consider the prerequisites for the formation of a digital individual educational trajectory. Our study shows that to increase the effectiveness of MOOCs, it is necessary to take into account individual characteristics of a student and indicators of the dynamics of knowledge assimilation in a group of students.

In the process of developing MOOCs, it is necessary to take into account the language characteristics of students to develop educational and methodological support. Then the created MOOC will gain a competitive advantage over others and will increase the financial security of the university and preserve jobs and the quality of the local education system (Idrissi Jouicha et al., 2020). This study does not fully disclose the conditions for increasing students' motivation to learn. In our study, the results obtained indicate the need to increase students' cognitive interest in MOOCs. It is only possible on the basis of high-quality didactic and methodological elaboration of educational materials, taking into account cultural and linguistic characteristics of the listeners.

It is necessary to avoid the risks arising in the context of digitalization by ensuring the improvement of the education system toward sustainable and balanced development (Ahel & Lingenau, 2020). Digital technologies are being introduced deeper and wider into the educational space. Much research in the literature is associated with the capture of traditional areas of educational activity, not only humanitarian, but also purely technical, by digital technologies (Shleymovich et al., 2018). This study does not assess the risks of a sharp transition from traditional to distance learning. Our study has shown that students and teachers prefer blended learning. The abrupt abandonment of traditional forms of education and an unprepared transition to distance learning are characterized by high risks.

How do teachers feel about the use of MOOCs in classrooms? The development of MOOCs gives a new impetus to international cooperation and the internationalization of educational systems (Snegurenko et al., 2019). This study does not show the benefits of using MOOCs at a regional university for solving local problems. In our study, as the respondents note, the main advantage of MOOCs is the ability to learn from anywhere and constantly update the information and knowledge.

The temporary transition to distance education will make it possible to assess how effective this format is for all areas, both humanitarian and technical (Ashilova et al., 2019). This study does not consider the peculiarities of the use of MOOCs in training specialists in the humanities or technical sciences. In our study, the results show that MOOCs and distance learning in general are more in demand in the humanities and less in technics. This is due to the need for physical experiments and material laboratory work, which students can only do in specialized conditions at the university. On the other hand, in our study, all students of both humanitarian and technical specialties confirmed their positive attitude toward MOOCs. The fact is that the effectiveness of MOOCs, as other studies show, depends on the quality of the preparation of educational materials posted on a digital platform (Novikova et al., 2017).

According to experts, the broader the analysis base for designing digital transformation processes, the more efficiently educational activities will be formed in the new format (Ashmarina et al., 2020). This study does not assess the impact of MOOCs on the digital transformation of the university. In accordance with the analytics and the identified patterns, in our research the formulated recommendations will make it possible to create a MOOC complex as an initial stage in the development of a digital university. In our opinion, a digital university is an educational

organization that has passed the stage of digital manageability and entered the stage of digital transformation. MOOCs are a means to transform traditional educational activities into a new format, implemented in the digital environment through digital technologies (Kokoreva et al., 2021).

What can be done to make the process of using MOOCs more effective in the context of training future specialists for the digital economy? Step-by-step development and effective feedback enable the creation of a well-functioning and structured MOOC (Alalwan, 2019). This study does not reveal the specifics of feedback making it possible to increase the effectiveness of the use of MOOCs for solving pedagogical problems at the university.

In addition to the conclusions known in the literature, the present study has allowed the authors to formulate their own recommendations. It is necessary to launch MOOCs in advance as a test option to ensure compliance with the curriculum and didactic and methodological recommendations. MOOCs should be properly structured and developed according to the theory of practically oriented education. For the successful launch of MOOCs, it is important to ensure the joint work of a teacher, methodologist, videographer, and other experts competent in this matter.

The literature mentions problems in the implementation and use of MOOCs associated with personnel resistance (Stackhouse et al., 2020). They highlight the reasons associated with the general rejection of everything new and the lack of demonstrated effectiveness. The literature also describes the problems associated with the increasing complexity of control of the acquired knowledge by students with the help of MOOCs. In our study, similar results were obtained. However, this problem can be solved by better preparation of funds of assessment means based on feedback from students (Pesoshin et al., 2016).

This study does not describe all the problems that arise in the design and implementation of MOOCs. Our research has updated and supplemented the list of problems presented in the literature. The study has revealed such problems of MOOC operation as lack of time, paperwork overload, and difficulties in distance learning for technical specialties. To reduce the risks of staff resistance, it is necessary to demonstrate success stories related to using MOOCs. It is advisable to monitor and discuss the classes held using MOOCs at the first stages of the introduction of digital technologies at the university. This will help to correct the digital university formation process, to interest participants in the educational process, to remove contradictions in the requirements for the educational process, and make MOOCs a more effective tool for everyone.

### **Implementations and Recommendations**

The following results were obtained according to the research questions. First, the attitude of students toward MOOCs is generally positive. Second, after the introduction of MOOCs, the cognitive motivation and academic performance of students increase. Third, teachers positively assess the processes of introducing MOOCs and actively use digital technologies and pedagogical methods. Fourth, in order to improve the processes of introducing MOOCs, it is necessary to create special conditions: to reduce the burden on teachers, eliminate unnecessary paperwork, and improve the practical orientation of MOOCs.

### **Conclusion**

This research has shown the high relevance of distance learning technologies for the teaching staff and for the student environment. In the context of the COVID-19 pandemic, the transition to distance learning was the way out of this situation. Along with the transition to distance educational technologies, some problems emerged: lack of time, higher paper documentation workload, difficulties in transferring to a distance learning format for technical specialties, and staff resistance to new technologies and changes. MOOCs should be considered the first stage of digital transformation of the educational activities of the university as it moves toward the digital university model. The following can be considered as effective conditions for the creation and implementation of MOOCs at the university: (1) Ensuring a balanced growth of digital competencies for both teachers and students of the university; (2) Development and improvement of MOOCs according to the theory of educational design (ADDIE); (3) Participation in MOOC development by a wide range of specialists (teacher, methodologist, videographer, system administrator); (4) Carrying out a program of activities to disseminate success stories related to the use of MOOCs; and (5) Launching and testing pilot MOOCs and arranging feedback from listeners. These recommendations will improve the quality of the distance learning format and bring Russian universities closer to the model of an advanced digital university with a high level of global competitiveness.

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## References

- Adam, T. (2019). Digital neocolonialism and massive open online courses (MOOCs): Colonial pasts and neoliberal futures. *Learning, Media and Technology*, 44(3), 365-380. doi:10.1080/17439884.2019.1640740
- Ahel, O., & Lingenau, K. (2020). Opportunities and challenges of digitalization to improve access to education for sustainable development in higher education. *World Sustainability Series*, 341-356. doi:10.1007/978-3-030-15604-6\_21
- Ahmad, M. A., Hussin, A. R. C., Dahlan, H. M., & Mahmood, J. (2020). Challenges of teaching in massive open online course. *Paper presented at the Journal of Physics: Conference Series*, 1500(1). doi:10.1088/1742-6596/1500/1/012096
- Akhmetzhanova, G. V., & Yuriev, A. V. (2018). Digital technologies in education. *Baltic Humanitarian Journal*, 7(3(24)), 334-336.
- Alalwan, N. (2019). Students used a massive open online courses (MOOCs) in higher education of Arab countries (AC). *International Journal of Recent Technology and Engineering*, 8(3), 3795-3800. doi:10.35940/ijrte.C5441.098319
- Almatrafi, O., & Johri, A. (2019). Systematic review of discussion forums in massive open online courses (MOOCs). *IEEE Transactions on Learning Technologies*, 12(3), 413-428. doi:10.1109/TLT.2018.2859304
- Anderson, V., Gifford, J., & Wildman, J. (2020). An evaluation of social learning and learner outcomes in a massive open online course (MOOC): A healthcare sector case study. *Human Resource Development International*, 23(3), 208-237. doi:10.1080/13678868.2020.1721982
- Andryukhina, L. M., Sadovnikova, N. O., Utkina, S. N., & Mirzaahmedov, A. M. (2020). Digitalisation of professional education: Prospects and invisible barriers. *Obrazovanie i Nauka*, 22(3), 116-147. doi:10.17853/1994-5639-2020-3-116-147
- Ansah, R. H., Ezeh, O. V., Teck, T. S., & Sorooshian, S. (2020). The disruptive power of massive open online course (MOOC). *International Journal of Information and Education Technology*, 10(1), 42-47. doi:10.18178/ijiet.2020.10.1.1337
- Ashilova, M. S., Begalinov, A. S., & Begalinova, K. K. (2019). About the impact of digitalization of society on education in Kazakhstan. *Science for Education Today*, 9(6), 40-51. doi:10.15293/2658-6762.1906.03
- Ashmarina, S. I., Kandrashina, E. A., Izmailov, A. M., & Mirzayev, N. G. (2020). Gaps in the system of higher education in Russia in terms of digitalization. *Advances in Intelligent Systems and Computing*, 908, 437-443. doi:10.1007/978-3-030-11367-4\_43

- Azami, H. H. R., & Ibrahim, R. (2019). Development and evaluation of massive open online course (MOOC) as a supplementary learning tool: An initial study. *International Journal of Advanced Computer Science and Applications*, 10(7), 532-537. doi:10.14569/ijacsa.2019.0100773
- Baez Zarabanda, D. (2019). ICT and its purpose in the pedagogical practice. *Research in Social Sciences and Technology*, 4(2), 83-95. <https://doi.org/10.46303/ressat.04.02.6>
- Barabanova, S. V., Kaybiyaynen, A. A., & Kraysman, N. V. (2019). Digitalization of education in the global context. *Vysshee Obrazovanie v Rossii*, 28(1), 94-103. doi:10.31992/0869-3617-2019-28-1-94-103
- Baumol, U., & Bockshecker, A. (2017). Evolutionary change of higher education driven by digitalization. *Paper presented at the 2017 16th International Conference on Information Technology Based Higher Education and Training, ITHET 2017*. doi:10.1109/ITHET.2017.8067811
- Benčič, S., Kitsay, Y. A., Karbekova, A. B., & Giyazov, A. (2020). Specifics of building the digital economy in developed and developing countries. *Lecture Notes in Networks and Systems*, 87, 39-48. doi:10.1007/978-3-030-29586-8\_5
- Biedermann, D., Kalbfell, L., Schneider, J., & Drachsler, H. (2019). Stakeholder attitudes toward digitalization in higher education institutions. *Paper presented at the Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft Fur Informatik (GI)*, 297, 57-66. doi:10.18420/delfi2019\_332
- Bogoviz, A. V., Gimelshteyn, A. V., Shvakov, E. E., Maslova, E. V., & Kolosova, A. A. (2018). Digitalization of the Russian education system: Opportunities and perspectives. *Quality - Access to Success*, 19(S2), 27-32.
- Brigas, C. (2019). Modeling and simulation in an educational context: Teaching and learning sciences. *Research in Social Sciences and Technology*, 4(2), 1-12. <https://doi.org/10.46303/ressat.04.02.1>
- Cedillo, P., Bermeo, A., Beltran, P., Rodriguez, P., & Serrano, F. (2019). A method for building massive open online courses for elderly people MOOCEP: From the user perceptions. *Paper presented at the Proceedings - Frontiers in Education Conference, FIE, 2018-October*. doi:10.1109/FIE.2018.8658587
- Dagdilelis, V. (2018). Preparing teachers for the use of digital technologies in their teaching practice. *Research in Social Sciences and Technology*, 3(1), 109-121. <https://doi.org/10.46303/ressat.03.01.7>
- Danchenok, L. A., Zaitseva, A. S., & Komleva, N. V. (2019). Transformation of the model of additional education in the digital economy. *Open Education*, 1. Retrieved from:

<https://cyberleninka.ru/article/n/transformatsiya-modeli-dopolnitelnogo-obrazovaniya-v-usloviyah-tsifrovoy-ekonomiki>

- Evans-Amalu, K., & Claravall, E. (2021). Inclusive online teaching and digital learning: Lessons learned in the time of pandemic and beyond. *Journal of Curriculum Studies Research*, 3(1), i-iii. <https://doi.org/10.46303/jcsr.2021.4>
- Fadli, M., Maharani, D. P., & Liemanto, A. (2020). A new paradigm of regulation for massive open online courses (MOOCs) in higher education in Indonesia: From disruptive innovation to sustaining innovation. *International Journal of Innovation, Creativity and Change*, (6), 442-457.
- Gapsalamov, A. R., Akhmetshin, E. M., Sharipov, R. R., Vasilev, V. L., & Bochkareva, T. N. (2020). Approaches to information security in educational processes in the context of digitalization. *TEM Journal*, 9(2), 708-715. doi:10.18421/TEM92-38
- Gerasimova, V. G., Melamud, M. R., Tutaeva, D. R., Romanova, Y. D., & Zhenova, N. A. (2018). The adoption of e-learning technology at the faculty of distance learning of Plekhanov Russian University of Economics. *Journal of Social Studies Education Research*, 9(2), 172-188. doi:10.17499/jsser.20153
- Gibbs, B. (2020). Critical teaching in classrooms of healing: Struggles and testimonies. *Journal of Curriculum Studies Research*, 2(1), 95-111. <https://doi.org/10.46303/jcsr.02.01.6>
- Guest, C., Wainwright, P., Herbert, M., & Smith, I. M. (2021). Driving quality improvement with a massive open online course (MOOC). *BMJ Open Quality*, 10(1). doi:10.1136/bmjoq-2019-000781
- Henukh, A., Nikat, R. F., Simbolon, M., Nuryadin, C., & Baso, Y. S. (2019). Multimedia development based on web connected massive open online courses (cMOOCs) on the basic physics material. *Paper presented at the IOP Conference Series: Earth and Environmental Science*, 343(1). doi:10.1088/1755-1315/343/1/012160
- Holanda, A. C. A., Tedesco, P. A., Oliveira, E. H. T., & Gomes, T. C. S. (2020). MOOCOLAB - A customized collaboration framework in massive open online courses. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 12149 LNCS, 125-131. doi:10.1007/978-3-030-49663-0\_16
- Hrabala, M., Opletalová, M., & Tuček, D. (2017). Teaching business process management: Improving the process of process modelling course. *Journal of Applied Engineering Science*, 15(2), 113-121.
- Idika, E. (2020). Students' and teachers' factors hindering effective teaching and learning of economics in secondary schools in the Nsukka Local Government Area of Enugu State. *Journal of Culture and Values in Education*. <https://doi.org/10.46303/jcve.2020.4>

- Idrissi Jouicha, A., Berrada, K., Bendaoud, R., Machwate, S., Miraoui, A., & Burgos, D. (2020). Starting MOOCs in African university: The experience of Cadi Ayyad University, process, review, recommendations, and prospects. *IEEE Access*, 8, 17477-17488. doi:10.1109/ACCESS.2020.2966762
- Katasev, A. S. (2019). Neuro-fuzzy model of fuzzy rules formation for objects state evaluation in conditions of uncertainty. *Computer Research and Modeling*, 11(3), 477-492. doi:10.20537/2076-7633-2019-11-3-477-492
- Kalimullina, O., Tarman, B., & Stepanova, I. (2021). Education in the context of digitalization and culture: Evolution of the teacher's role, pre-pandemic overview. *Journal of Ethnic and Cultural Studies*, 8(1), 226-238. DOI: <http://dx.doi.org/10.29333/ejecs/629>
- Khalid, J., Ram, B. R., Soliman, M., Ali, A. J., Khaleel, M., & Islam, M. S. (2018). Promising digital university: A pivotal need for higher education transformation. *International Journal of Management in Education*, 12(3), 264-275. doi:10.1504/IJMIE.2018.092868
- Kilinc, E., Tarman, B., & Aydin, H. (2018). Examining Turkish social studies teachers' beliefs about barriers to technology integration. *TechTrends*, 62, 221-223. <https://doi.org/10.1007/s11528-018-0280-y>
- Kokoreva, N. V., Orlova, M. V., & Silina, S. A. (2021). Trends in the formation of the digital educational environment of universities. *Studies in Systems, Decision and Control*, 314, 747-755. doi:10.1007/978-3-030-56433-9\_79
- Korableva, O., Durand, T., Kalimullina, O., & Stepanova, I. (2019). Studying user satisfaction with MOOC platform interfaces using the example of Coursera and open education platforms. *Paper presented at the ACM International Conference Proceeding Series*, 26-30. doi:10.1145/3322134.3322139
- Kozlova, N. Sh. (2019). Digital technologies in education. *Bulletin of the Maikop State Technological University, 1*. Retrieved from: <https://cyberleninka.ru/article/n/tsifrovye-tehnologii-v-obrazovanii>
- Mu, S. (2020). The construction of learning support service system of distance open education based on sharing theory. *Paper presented at the IOP Conference Series: Materials Science and Engineering*, 750(1). doi:10.1088/1757-899X/750/1/012032
- Mustafin, A. (2015). Coupling-induced oscillations in two intrinsically quiescent populations. *Communications in Nonlinear Science and Numerical Simulation*, 29(1-3), 391-399. doi:10.1016/j.cnsns.2015.05.019
- Novikov, P. (2020). Impact of COVID-19 emergency transition to on-line learning on international students' perceptions of educational process at Russian university. *Journal of Social Studies Education Research*, 11(3), 270-302.



- Novikova, S. V., Sosnovsky, S. A., Yakhina, R. R., Valitova, N. L., & Kremleva, E. S. (2017). The specific aspects of designing computer-based tutors for future engineers in numerical methods studying. *Integration of Education*, 21(2), 322-343.
- Oguilve, V., Wen, W., Bowen, E., Abourehab, Y., Bermudez, A., Gaxiola, E., & Castek, J. (2021). Community making: An expansive view of curriculum. *Journal of Curriculum Studies Research*, 3(1), 69-100. <https://doi.org/10.46303/jcsr.2021.8>
- Ohlin, C. (2019). Information and communication technology in a global world. *Research in Social Sciences and Technology*, 4(2), 41-57. <https://doi.org/10.46303/ressat.04.02.4>
- Pesoshin, V. A., Kuznetsov, V. M., & Shirshova, D. V. (2016). Generators of the equiprobable pseudorandom nonmaximal-length sequences based on linear-feedback shift registers. *Automation and Remote Control*, 77(9), 1622-1632.
- Pogosyan, V. (2019). Change and variability of phenomena in complex social systems. *Wisdom*, 13(2), 95-103. doi:10.24234/WISDOM.V13I2.276
- Prutchenkov, A. S., & Pavlova, S. A. (2017). Technology for assessing supra-professional skills (key competencies) of schoolchildren within the framework of the juniorskills profile shift. *School Technology*, 5, 76-88.
- Shleymovich, M. P., Dagaeva, M. V., Katasev, A. S., Lyasheva, S. A., & Medvedev, M. V. (2018). The analysis of images in control systems of unmanned automobiles on the base of energy features model. *Computer Research and Modeling*, 10(3), 369-376.
- Smith-Lickess, S. K., Woodhead, T., Burhouse, A., & Vasilakis, C. (2019). Study design and protocol for a comprehensive evaluation of a UK massive open online course (MOOC) on quality improvement in healthcare. *BMJ Open*, 9(12). doi:10.1136/bmjopen-2019-031973
- Snegurenko, A. P., Sosnovsky, S. A., Novikova, S. V., Yakhina, R. R., Valitova, N. L., & Kremleva, E. Sh. (2019). Using e-learning tools to enhance students-mathematicians' competences in the context of international academic mobility programmes. *Integration of Education*, 23(1), 8-22. doi: 10.15507/1991-9468.094.023.201901.008-022
- Sobral, S. R. (2021). Massive open online courses: A bibliometric review. *International Journal of Information and Education Technology*, 11(5), 205-211. doi:10.18178/ijiet.2021.11.5.1513
- Stackhouse, M., Falkenberg, L., Drake, C., & Mahdavamazdeh, H. (2020). Why massive open online courses (MOOCs) have been resisted: A qualitative study and resistance typology. *Innovations in Education and Teaching International*, 57(4), 450-459.
- Subedi, D., & Subedi, R. (2020). Practicing self learning of ICT for resilience amidst the COVID-19 outbreak: Experiences from Kathmandu Valley. *Research in Educational Policy and Management*, 2(2), 78-96. <https://doi.org/10.46303/repam.2020.5>

- Sulistyo, W. D., Nafiáh, U., & Idris. (2019). The development of E-PAS based on massive open online courses (MOOC) on local history materials. *International Journal of Emerging Technologies in Learning*, 14(9), 119-129. doi:10.3991/IJET.V14I09.10143
- Tadeu, P., Fernandez Batanero, J., & Tarman, B. (2019). ICT in a global world. *Research in Social Sciences and Technology*, 4(2), i-ii. <https://doi.org/10.46303/ressat.04.02.ed>
- Teo, T., & Dai, H. M. (2019). The role of time in the acceptance of MOOCs among Chinese university students. *Interactive Learning Environments*. doi:10.1080/10494820.2019.1674889
- Vijayavalsalan, B. (2018). Students' impressions on the effectiveness of online discussion forums. *Research in Social Sciences and Technology*, 3(1), 86-108. <https://doi.org/10.46303/ressat.03.01.6>
- Williams, T., McIntosh, R., & Russell, W. (2021). Equity in distance education during COVID-19. *Research in Social Sciences and Technology*, 6(1), 1-24. <https://doi.org/10.46303/ressat.2021.1>
- Wolff, A., Zdrahal, Z., Herrmannova, D., Kuzilek, J., & Hlosta, M. (2014). Developing predictive models for early detection of at-risk students on distance learning modules. *Paper presented at the CEUR Workshop Proceedings*, 1137.
- Yemelyanov, V. A., Yemelyanova, N. Y., Shved, E. V., Nedelkin, A. A., & Fatkulin, A. R. (2020). Modeling of the multilayer perceptrons for image recognition of the steel microstructures. *Paper presented at the Proceedings of the 2020 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering, EIconRus 2020*, 952-955.
- Yigit, M. F. (2017). Value priorities of public and private university students. *Research in Social Sciences and Technology*, 2(1), 1-17.
- Zaporozhko, V. V., & Parfyonov, D. I. (2017). Development of a structural model of massive open online courses based on modern cloud educational platforms. *Modern Science-Intensive Technologies*, 3, 12-17. Retrieved from: <http://top-technologies.ru/ru/article/view?id=36608>
- Zelentsova, L., & Tikhonov, A. (2020). A methodology for assessing the innovative potential of a high-tech organization under the economy digitalization impact. *Quality - Access to Success*, 21(174), 7-13.
- Zmiyak, S. S., Ugnich, E. A., & Krasnokutskiy, P. A. (2019). Generation and commercialization of knowledge in the innovational ecosystem of regional university in the conditions of information economy establishment in Russia. *Advances in Intelligent Systems and Computing*, 726, 23-31. doi:10.1007/978-3-319-90835-9\_3