ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В ОБРАЗОВАНИИ

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UNIVERSITY STUDENTS' EDUCATION BY MEANS OF ONLINE TECHNOLOGIES

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Abstract. *Introduction.* During the past ten years the important changes in educational programs of higher education point out the transition from the traditional live lecture form to the distance learning form (the online training format). Training for innovative engineering activities requires to involve students in the online training format and to explore its applicability.

The *aim* of the present article is to identify the areas of the effective use of the online training format in the educational process for high school institutions and the prospects of further development of the distance learning.

Methodology and research methods. In this article, an integration of theoretical and practical training of the innovative engineering with the methods of the analysis and synthesis, a pedagogical experiment and mathematical statistics were used.

Results. The areas of use of the online learning in the field of traditional and innovative formats of training have been identified. A subsystem of storage of the information on the course of educational activities is suggested. A high efficiency of the distance learning application is confirmed by the results of a pedagogical experiment within the unified programs for a wide audience of students and persons having the right to an individual work schedule.

Scientific novelty. The performed research contributes to identify the framework of the effective use of the online learning at higher education institutions. The suggested form of storage of the information on the education process events in a separate subsystem allow for processing and generalising the data with the use of the BigData and DataMining technologies.

Practical significance. Further development of the research presented in this article might be focused on the establishment of numerical relations when using various education formats within various disciplines providing the greatest effect when training students at higher education institutions.

Keywords: innovative engineering, online training format, distance learning, forms of education, training technologies.

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ОБУЧЕНИЕ СТУДЕНТОВ ВУЗОВ С ИСПОЛЬЗОВАНИЕМ ОНЛАЙН-ТЕХНОЛОГИЙ

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Аннотация. *Введение.* В последнее десятилетие наметилась серьезная тенденция перевода традиционной лекционной формы обучения в вузах в дистанционный режим. Подготовка к инновационной инженерной деятельности требует вовлечения студентов в онлайн-формат обучения, с одной стороны, и определения рамок применимости этого формата, с другой.

Цель статьи – определить области эффективного использования онлайн-формата в учебном процессе вузов и перспективы дальнейшего развития дистанционного обучения.

Материалы и методы. При написании статьи использовались интеграция опыта теоретического и практического обучения инновационной инженерной деятельности, методы анализа и синтеза, педагогический эксперимент.

Результаты. В работе определены рамки применимости онлайн-технологий в поле традиционных и инновационных форматов обучения. Предложена подсистема накопления информации о ходе учебного процесса. Высокая эффективность применения дистанционного обучения подтверждена результатами педагогического эксперимента с использованием унифицированных учебных программ для широкой аудитории обучающихся и для контингента, имеющего право на выбор индивидуального графика работы.

Научная новизна. Выполненные исследования позволяют определять рамки эффективного использования онлайн-формата обучения в вузах. Предложенная форма накопления информации о событиях учебного процесса в виде отдельной подсистемы дает возможность обобщать данные с использованием технологий Big Data и Data Mining.

Практическая значимость. Дальнейшим направлением исследования может стать установление численных соотношений при использовании разнообразных форм обучения по различным дисциплинам, которые дают максимальный эффект при обучении студентов в высших учебных заведениях.

Ключевые слова: инновационная инженерная деятельность, формы обучения, дистанционное обучение, онлайн-формат обучения, технологии обучения.

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Introduction

University students' preparation for the innovative activity is a pressing problem of the educational system, demanding the use of modern training technologies. Nowadays, a remote form of education, the so-called online format, is widely implemented into the higher education curricula. The authors of the article, analysing the first results of the efficiency of the transition of the educational process to the online format, note the need to establish the reasonable correlative proportions of implementation of different forms of education that provide the greatest effect in the educational process. According to them, the transition to the online format of training should not be overall. The expediency of the use of this format along with the traditional forms of education allows a teacher and students to keep face-to-face communication (when solving practical tasks, doing laboratory research, business games). The authors of the article claim that without real-life communication within the groups the students can lose dramatically their communication skills: the lexicon depletion, the difficulties in the accuracy of the utterance. The advantages of coeducation in groups are also lost, that is, the mutual assistance, the competitive spirit and the competition.

It is clearly seen that students of the first degree (undergraduates) lose their communication skills in case of the transition to the online format combined with the development of individual working skills. Traditionally, the first-year students, jointly attending lectures, laboratory and practical classes, quickly get acquainted with each other. It is all-known that friendly group relationships create a harmoniously developed personality. But the lack of due contact with each other leads to the absence of interrelation and interconnection within the groups even among the first-year students [1].

It is also necessary to note that the first-year students are psychologically not ready for a transition from a usual resident secondary school instruction with a constant control over the educational process by teachers and parents, to the training in the computer environment where the self-checking role is especially important. The yesterday's secondary school students have a temptation to postpone studying the discipline up to the end of a term and then "storm" the new material. Thus, it is necessary to prepare the first-year students for distance learning, in order to obtain better final results.

It is noted that the last versions of the Federal State Educational Standard for Higher Education (FSES HE) provide for obligatory training of students for the innovative activity that cannot be carried out without corresponding communication skills. It is high time for discoveries made not by individuals,

but by teams. The identification of hidden problems when solving applied tasks in the field of the equipment and technologies, the development and the creation of new machines and mechanisms, testing and finishing the technical samples ready for implementation as new products are the result of the collaborative (team) work providing the efficiency and the competitiveness of the enterprises as well as the whole country. The statement that the innovation activity always served as an instrument of the development of the society was formulated [2–5], and the importance of the high school education of the personnel ready for the innovative engineering activity was noted. The analysis of the methodical systems of training of students in higher education institutions for the innovative engineering activity allows us to conclude:

1) The formation and the development of communication skills within the educational process can increase the efficiency of students' competence in the innovative engineering activity;

2) The integrated forms of education applied to the educational process should provide a necessary formation and development of communication skills among students.

The use of the online format should be equilibrated with other forms of the organisation of the educational process and play an auxiliary, supplementary role. In this regard, the purpose of this article is to justify the limits of the effective application of the remote form of education in the higher education system that reveals the advantages of the use of the Internet.

The term Engineering stands for an area of intellectual and practical activity, aimed to apply the achievements of science and technology to solve specific problems. The Innovative engineering involves the creation of a marketable new product at the executive level. Any product new to the market is a result of innovative engineering.

Literature Review

The problems of training of students in technical universities are widely discussed, both in this country and abroad, as a modern graduate should be ready for broad innovative activity in hard conditions of market economy. Thus, the last generations of the FSES HE standard comprise obligatory training of students for this kind of activity. It is supposed that after graduation from the university a specialist should be rather competent in a wide range of knowledge (competence in the engineering innovative activity). It is necessary for young people to gain competence sufficient for the engineering activity within the time limits determined by the programme of training [6]. And it is noted that in addition to temporary limits of training, learning activity should not go beyond certain psychological limits. The desire to provide students with a large amount of knowledge is, of course, understandable and laudable, but as training activity is limited in time, it is necessary to ensure the required speed of processing the obtained information, which could be sustained by a student without psychological discomfort. Thus, a question of the choice of suitable methods of training arises.

Foreign students were involved into the innovative activity training earlier than in Russia. For the innovative engineering activity training at the Massachusetts technological university the concept of Conceive – Design – Implement - Operate was implemented (to think up – to design – to implement – to work). A world-wide recognised project management specialist Russell D. Archibald [7] paid much attention to training, preparation and efficient education of project managers, functional managers and specialists. He described the requirements which any top manager should impose to the members of the team working on the project management in order to achieve maximum benefits from the implementation. These requirements should promote the formation of qualities of competitiveness of a team and develop the cooperation in the era of the Internet. Russell noted a successful work of virtual teams which have now an opportunity to conduct collaboration in real time irrespective of the geographical location. This opportunity is caused by a possibility of application of cheap Internet systems of audio, video and digital telecommunications.

Such training methods as training in a team, contextual training, training based on personal experience, problem-oriented training and cross-disciplinary approach in training are recognised [8] as the most used innovative methods of training in the UK, the USA, and Germany. These methods should promote the education of the young people capable to generate the ideas for a solution of professional tasks. In the UK a cross-disciplinary approach in training is revealed, for example, in the fact that initially, besides the skills of engineering design, the student should gain knowledge, the skills of industrial design [9] which considers the consumer demand of the population of the country. The future engineers, functional heads and specialists should have broad knowledge, considering a possible influence of products on ecology of the country and the whole world in general, and be able to minimise the risks.

Now the elements of these training methods are used in all leading universities of our country according to the FSES HE standards, when applying the interactive forms of education during the educational process. Most often the interactive form is implemented under the form of business or role-play games developed for certain subjects within different disciplines. In Peter the Great St. Petersburg Polytechnic University in the Techno-sphere safety direction such business game as “Investigation of Life- and Work- Related Accidents” [10], which allows to use a teamwork training method, a method of training based on personal experience, a problem-oriented training and a cross-disciplinary approach, is successfully implemented.

The platforms for communication between the Internet users can become the instrument of interactive coeducation, a contrastive analysis of forums and wiki showed a possibility of use of these platforms for training courses [11]. The use of such form should be convenient and available; in work [12] the ways of improvement of usability of the educational websites are considered. The use of platforms for communication between the Internet users for students training purpose assumes their ability in information and communication technologies, which should be surveyed and motivated [13]. Playful forms of training allow enhancing this motivation, so, in [14] the authors give an example of a game on fire safety. In work [15] the author claims that professionally oriented video

games contribute to the development of necessary skills of students. But it must be kept in mind that first-year students need social adaptation in an Internet environment [16], that, in our opinion, should be undertaken by mentors-tutors.

To improve the quality of engineering education [17, 18], a set of training methods is offered, i. e. a combination of integrated training technology and a system of innovative engineering education. In the Ogarev Mordovia State University (MRSU) an attention is paid to the technologies of fast prototyping when training students. The authors of work [19] proved the expediency of integration of theoretical and practical training of engineering innovative activity and of a cross-disciplinary integration in the educational process.

The creation of a professional and psychological portrait of an engineer assumes the professional and creative self-development of students based on motivation for obtaining skills in innovative engineering activity [20]. Such motivation is enhanced by the system of training in which different methods and forms of education are effectively used. Besides, its maintenance is available in training of students timelessly. Actually, there are no recommendations about the observance of reasonable relations between different forms of education capable to give the greatest effect when mastering the core subjects and testing the necessary professional competences by students. Moreover, there are no means of automatic storage of information about the course and the events of educational process. In this regard, the purpose of the article is to develop the recommendations about holding practical and laboratory research, when lectures are organised in the online format, taking into consideration the use of mass open online courses [21].

Materials and Methods

The fundamental methodical approach in this article is the integrated approach (including theoretical and practical training of professional activity), based on an effective combination of different forms of education, including training by means of interactive tools. Special attention is paid to a role of interactive forms of education in the educational process when an online internet contact between the teacher and the student gives the advantage in the development of communication skills of the student. Being a modern training technology, the online format allows the use of a great number of possible technical training tools to be applied.

The experience of the application of distance learning by higher education institutions [22, 23] showed the undoubted advantage of this form of training for broad audience, and showed the possibilities of group discussions of certain questions at forums. Moreover, it has become obvious that the online format of training cannot replace live contact between the teacher and the students [1, 24], and between the students themselves.

Nowadays, the possibilities of distance learning are used to some extent practically by all leading higher education institutions of the country in the training of bachelors and undergraduates. Therefore, it is extremely important to make use of as much as possible accumulated experience in identification of both, positive and negative examples of application of this form of training. In

this case, the method of questioning of students and teachers, which is widely used in students teaching [25], can be useful in establishing of an effective combination of different forms of education on different disciplines.

Assume that objective information on mastering the core subjects by high school students at various rates of traditional and new forms of education will be provided by testing the residual knowledge. The use of the suggested subsystem of fixing main educational events will allow the possibilities of traditional methods of obtaining information to be expanded. It will create a base for the use of modern BigData and DataMining technologies.

Thus, the application of a remote format of training showed the relevance of the problem of its effective use related to traditional forms of education. In this regard, the methodic approaches and the pedagogical technologies need to be improved in order to create an integrated form of education combining different educational forms to maximise the effect of training.

Results

The research revealed the advantages and disadvantages of the remote form of education and allowed to draw out recommendations for its effective use. To work out the recommendations, we suggest including a subsystem of automatic information acquisition about the course of educational process in the system of remote learning. This subsystem is a relational database for the registration and the analysis of the different event characteristics of the educational process. The subsystem consists of four primary interconnected information sections:

- the event log;
- the data on the events of the educational process;
- the data on a training material;
- the information about the users.

According to the principles of development of relational databases, this information should be presented under the form of the interconnected entities (tables). A list of some entities is presented in Table 1.

The transition in higher education programmes from traditional lecture form to the online mode assumes a wide use of modern communication options [26] and a readiness of the universities to perform this type of activity. There is a whole complex of interconnected reasons, which stimulates the universities to develop and deploy remote courses: a growing size of academic groups along with the reduction of lecture hours within the academic course [18], a necessity to provide students with a large amount of information in compressed time limits, a change in staffing strategy in high school institutions.

Consider the advantages of the online training format and the conditions when it is reasonable:

1. A broad target audience worldwide.

The online learning is possible for any audience: large or not, but it is available only by means of a personal computer for each student with corresponding software (or an access to such a computer).

Table 1

Information about database of registration of learning process events

Таблица 1

Информация базы данных регистрации событий учебного процесса

Database Information				
Tables (entities)	Event Log	Information about events	Information about training material (TM)	Information about users
Fields (attributes)	Event ID	Event ID	TM ID	User ID
	User ID	Event type	TM type	Department
Fields (attributes)	Training material ID	Event title	TM title	Group
	Date and time	Event description	TM description	Name
	Comment	Comment	Comment	Comment

The online learning solves social problems of education availability to poorly protected categories of population: disabled people, workers in rural areas or in the rotational mode.

2. A possibility of modification of training programmes (change in regulatory documents, legislative bases) provided that the program of training should meet the requirements of the FSES HE.

3. A possibility of the student's individual scheduled work.

An online student defines himself the schedule of an Internet connection.

The remote mode allows selecting an individual speed of training.

There is an opportunity to catch up with the class in case of illnesses, business trips, work in the rotational mode, other unexpected events.

An intermediate certification is usually carried out also remotely in the test mode.

4. An opportunity of repeated reference to core subjects [23]: to video lectures, control questions, tests.

5. An opportunity of correspondence of the student with the teacher. In case of difficulties in the material mastering the student has an opportunity to put a question and ask for additional literature.

At some universities the positions of tutors (mentors) who help students with their study are introduced; they supervise the process of individual education.

6. An opportunity to undergo the on-the-job training, to attend several selected courses at the same time, to get another higher education.

A number of educational institutions will organise a vocational training (advanced training courses) for the employees in working hours. In this case the study does not interrupt the seniority.

7. When using the online training format there are no restrictions in literature (methodical materials); after registration on the website of the university the students receive the key to access to the university data base.

8. At distance learning the student is provided with free transport and free hotel accommodation.

9. The possibility of subjective appraisal of knowledge of students by the teacher is excluded.

10. The studies show that emotional stability of students is higher in case of the correspondence form of an examination than in the full-time study examination; moreover, the emotional stability of students in international educational groups when learning distantly is also higher [27].

The correspondence form of an examination is especially effective in international groups where the teacher should not face the cases of bad knowledge of the working language for a given training course. Besides, a foreign student has an opportunity to quietly translate difficult text elements and study in a comfortable ambience.

The primary benefits of the online format of training and the difficulties of transition of training to this format are presented in Table 2.

Table 2

Advantages and disadvantages of distance learning

Таблица 2

Преимущества и трудности онлайн-обучения

Advantages of distance learning	Disadvantages / difficulties / additional requirements of distance learning
1	2
Possibility of coverage of broad audience	High expenses for development of high quality programmes and software. Low performance of distance learning for small groups where a live contact with a teacher would be more effective
Potentiality of development of a unique high-quality universal programme for the discipline	Existence of the disciplines demanding a permanent updating of the core subjects, for example, because of change of regulatory documents. Existence of the disciplines related to the knowledge areas where disruptive innovation occur, opening new views and ideas regarding the subject of the research
Opportunities of individual scheduled work of the trainee with the choice of the personal speed of training	Requirement of high technical equipment of the university or having a computer with the necessary software. Requirement of motivation and responsibility of the trainee to self-checking when independently studying the discipline
An opportunity to undergo on-the-job training	Physical and psychological readiness for study after the working day
Providing with methodical material in any quantity	No

1	2
No	Lack of development of communication skills of students. At distance learning a live contact of students with each other and with teachers is limited
Low cost of distance learning	No
Possibility of training people: 1 – with limited opportunities of social or physical character (disabled); 2 – living in remote corners of the country	Problems of the user's identification at the computer. A potential risk of work under an assumed name

The performed analysis of the advantages and difficulties of the online training format reveals the disadvantages and limitations of the distance learning. One should not completely abandon traditional lectures and practical works, because it is there that students have a live contact with a teacher and with each other, developing their communication abilities. Only a reasonable combination of various training formats can result in a high educational level.

The distance learning is fast-pacing in Russia, and the comparative results of the efficiency of different forms of education still should be estimated. There is a question how to increase the motivation of students to good study and to achieve the regularity of their studying in the online format, as the number of responsible students is limited.

One of practical examples of a combination of different forms of education is a teaching discipline "Health and Safety" at Peter the Great St. Petersburg Polytechnic University. The discipline is taught for the first-year students as follows:

1. In the full-time learning format the introductory lecture is given.

2. The theoretical part of the discipline (lecture) divided by topics is learned online. Each topic results in a test connected with a subsequent access to other topics. The final test is provided where the result of mastering the discipline is estimated by points or in percentage.

3. Practical training or laboratory works are performed by students in a presence mode, the laboratory work for engineering specialties, and the exercises for humanitarians, with the interactive elements of a business game.

Note the ambiguous attitude of teachers to distance learning. The teachers supervising an online course note, on the one hand, a significant increase in time spent by students over the Internet (peculiar computer dependence arises, a visual load increases, a physical inactivity and a sleep disorder develops). On the other hand, the communication from a home computer gives a certain freedom in working time management.

The authors believe that distance lectures are most effective for broad audience, and the content of training materials should be modified, corrected or updated if necessary. For small audiences, the traditional internal practical and laboratory classes should be enhanced by an interactive component [28, 29]. The feedback from students and graduates will indicate the direction of updating the developed courses [30].

Analysing the results of the first-year students studying the discipline "Health and Safety", the authors of article note a special role of an introductory lecture which is given by the teacher internally with a flow of students before starting a work in the remote mode.

At the introductory lecture the following is clearly explained to the students:

1. Rules of the access to the portal of distance learning.
2. Need of consistent and regular study of material.
3. Rules of the evaluation fund, Role of the final test, Terms of completion of tasks.
4. Rules of the integrated assessment of a course on the final testing of the theoretical and practical parts of the discipline (laboratory works or exercises).

A "National Open Education Platform" (hereafter the Platform) was created on the basis of the leading high schools such as MSU, SPbSTU, SPbU, NRU MISIS, HSE, MIPT, UrFU and IFMO, containing free online courses on basic disciplines with a certificate at the end of training. Opportunities offered by the Platform can be a tool for improving the efficiency of universities in achieving competitive advantages in the international higher education market [31].

When choosing a proportion between different forms of education for the studied discipline the pedagogical experiment will allow: to determine, to validate theoretically and to test experimentally the conditions for the development of effective professional competences [32], the use of electronic educational resources in the required amount [32], to combine live and computer educational tools [33, 34] and to form the professional activity competences [35, 36].

Experimental education

The pedagogical experiment, aimed to test the effective implementation of distance education, was based on an integrated approach including the following types of experiments:

– *stating* – testing the experimental and control groups formed for a divergent type study in order to identify the indicators of the efficiency of the distance learning;

– *forming* – a practical implementation of the distance learning programme in control and expert groups at the Higher School of Technosphere Security at Peter the Great St. Petersburg Polytechnic University;

– *control* – verification of the results of the formative experiment.

During the experiment, the criteria were validated, the parameters and the methodic for their measurement were determined.

To assess the "intellectual culture" criterion the overall intellectual development of students was evaluated, using the methodology "assessment of the intelligence structure".

For the "technical ability" criterion the test "assessment of technical ability" was used.

For the "professional competence" criterion the results of academic results, the rating of scientific work and the level of professional communication were used.

The students participated in the experiment during the whole time they studied at St. Petersburg Polytechnic University (SPbPU) at the Higher School of Technosphere Safety. The choice of control and experimental groups was random. It turned out that the academic performance in natural science disciplines was higher in the control groups (68% rated by "4" and "5" where 5 is the highest mark), while in the experimental groups it was lower (52% rated by "4" and "5").

In the course of the experimental work, the characteristics of the participants of the experiment were changed, and a professional motivation for the choice of a further professional direction, a profile and an educational institution was formed. So, 63% of the students of the experimental groups have "4" and "5" in the natural science disciplines, and they all have chosen to continue their education. In the control groups, the learning outcomes remained the same (64% have "4" and "5" in these disciplines).

At the first educational stage of the stating experiment, a pedagogical monitoring was developed and tested, its technological map was developed, and the ensemble of participants was determined. The obtained learning outcomes (the academic results and personal achievements) of the SPbPU students participating in the experiment allowed us to confirm the efficiency of experimental teaching methods and their influence on the further development of personal and professional qualities. According to the feedback, the bachelor graduates having followed the experimental methods, when entering in a new masters studies environment, have not worsen their academic results and demonstrated the initiative in the scientific community (Table 3).

Table 3

Results of education of the students

Таблица 3

Результаты обучения студентов

Students	Academic performance in control and experimental groups	General opinion of teachers (characteristic)
2017	Control groups 16% remained at the same level. Experimental groups 84% increased their performance	have the self-organisation skills, have difficulty at personal communication, self-education skills
2018	Control groups 23% remained at the same level. Experimental groups 77% increased their performance	have the self-organisation skills, self-education skills – fear of public speaking
2019	Control groups 25% remained at the same level. Experimental groups 75% increased their performance	have the self-organisation skills, self-education skills – have difficulty at professional communication

The main hypothesis of the experiment is presented in the framework of the task of statistical hypotheses testing:

H_0 is the effectiveness of the distance learning use.

H_1 – the required level is not achieved.

The Student consent t-criterion is considered as a statistical criterion for the compliance of hypotheses:

$$|t| = \frac{\left|\Delta_i^j\right|}{\sqrt{\frac{1}{m}\left(\left|\Delta_1^j\right| + \left|\Delta_2^j\right| + \ldots + \left|\Delta_m^j\right|\right)^2}},$$

where $\Delta_j^i = \xi_i^j - \xi_{i_k}^j$.

In our study, the statistical significance level α = 0.05 was adopted, allowing to ensure the confidence level of the conclusion obtained as ρ = 0.95.

Based on these values, the numerical value of the hypothesis acceptance criterion was chosen to be t = 2.056. Then the decision rule for all nominals can be reduced to the expression:

$$\begin{cases} H_0 \div t \geq 2{,}056 \\ H_1 \div t \leq 2{,}056 \end{cases}.$$

The hypothesis is confirmed that the use of distance learning and its implementation in the educational process will contribute to the improvement of the quality of training of graduates of the Higher School of Technosphere Safety of Peter the Great St. Petersburg Polytechnic University. This is confirmed by the results of the experimental teaching. However, note that eliminating the traditional learning forms by the distance ones can result in the fact that graduates will not possess a communication culture.

Discussion and Conclusions

Thus, identifying the area of the effective use of the online format in the educational process for higher education institutions and prospects of further development of distance learning is an important tool of the increase in overall performance of the universities in general and will ensure the competitive advantage of higher education institution in the market of the higher education.

In this work, we suggest to combine the traditional system of remote learning with a subsystem of automatic acquisition of information about the course of educational process. The suggested subsystem is presented under the form of a relational database. It will allow to fix and to accumulate data on different events of the educational process:

- the frequency of the appeal to different units of a training material;
- the individual trends of training;
- the questions which caused the greatest difficulties, etc.

The saved-up data processed by means of the DataMining methods will form a basis for the development of methods of remote learning.

Analysing the experience of remote learning with students in higher education institutions during the past five years, the authors faced the fact that some students negatively perceive this form of education; this question was brought up also in works [37, 38]. The solution of this problem seems to be in a certain preliminary adaptation work with students, in high quality remote courses and in a reasonable combination of different forms of education in different disciplines.

In conclusion, it is possible to draw up the following outputs:

1. Under the conditions of reduced academic hours for studying disciplines at the universities, the use of distance learning advantages can promote the maintenance of a high level education in our country.

2. The use of the online format is most efficient when training according to universal programmes. It is reasonable to combine, within the studied discipline, the distance form of education with the full-time one: along with the remote courses it is necessary to give the students an opportunity of individual communication with the teacher (within practical and laboratory classes) and with each other (business games and other interactive forms of training) that will provide a necessary development of communication skills of the trainee. No "total" transition to online education format should occur.

3. When developing the online courses, the possibility of timely mobile updating the material should be provided.

4. Further development of a remote system requires a deep analysis of the current information about the course of the educational process. The accumulation of this information is possible only when using the corresponding subsystem and the application of modern methods of analysis of big data volumes: BigData and DataMining.

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