



## Development of University Students' Motivation with the Help of E-learning

### E-ğitimi Sayesinde Öğrencilerin Motivasyonunun Geliştirilmesi

**Nickolay V. Kotryakhov**, Vyatka State University, Kirov, Russia, [n248kirov@gmail.com](mailto:n248kirov@gmail.com)

**Alfiya R. Masalimova**, Kazan (Volga region) Federal University, Kazan, Russia, [alfkazan@mail.ru](mailto:alfkazan@mail.ru). ORCID: 0000-0003-3711-2527

**Zhanna M. Sizova**, I.M. Sechenov First Moscow State Medical University, Moscow, Russia, [sizova-klinfarma@mail.ru](mailto:sizova-klinfarma@mail.ru) ORCID: 0000-0002-1242-7074

**Rashad A. Kurbanov**, Institute of Legislation and Comparative Law under the Government of the Russian Federation, Moscow, Russia, [mos-ssp@mail.ru](mailto:mos-ssp@mail.ru) ORCID: 0000-0002-2398-7181

**Abstract:** The urgency of the study is caused by the thrust of contemporary education models to develop a competitive creative personality having the need for continuous self-improvement and self-development. It is possible owing to the high level of students' learning motivation and accordingly, the motivation to acquire a future profession. It should be emphasized that e-learning technologies have considerable potential in terms of intensification and effectiveness of the system of education. This fact is very important in the context of the educational paradigm of lifelong learning (learning throughout life) within which blended-learning is widely used which assumes an optimum combination of face-to-face and distant (remote) form of interaction between teachers and students. This article is aimed at unlocking (defining) didactic potential of the means of e-learning to enhance motivation of technical specialties students to master the natural-sciences and mathematical disciplines and acquire a profession. The leading method of the study was activity-based approach which enabled us to analyze the problem from the standpoint of dialogue, subjectivity and individuality. In the process of the experimental work, methodologies and techniques were used that allowed to determine with a sufficient degree of reliability the level of students' motivation for e-learning, and later for professional training. Also, observation, interview, survey techniques were used. The article analyzes theoretical aspects of the use of e-learning to motivate university students to acquire natural science knowledge with the subsequent study of vocational disciplines. On the one hand, the article is a methodological basis for the engineering and technical personnel training system; on the other hand, it reveals some methodical issues dealing with the use of modern means of e-learning to increase the level of learning motivation in general. The article also presents the outcomes of a series of lessons aimed at developing students' motivation by means of e-learning. The materials of the article may be helpful to those who teach at higher education institutions.

**Keywords:** Motivation, motives of learning, students, development, e-learning, didactic potential of e-learning

**Öz.** Çağdaş eğitim modelleri sürekli kendini geliştirme ve kendini geliştirme gereksinimi olan rekabetçi bir yaratıcı kişilik geliştirmeye çalışmaktadır. Bu da, öğrencilerin yüksek düzey öğrenme motivasyonları ve buna bağlı olarak gelecekteki bir meslek edinme motivasyonları sayesinde mümkündür. E-öğrenme teknolojilerinin, eğitim sisteminin yoğunlaştırılması ve etkinliği açısından önemli bir potansiyele sahip olduğu vurgulanmaktadır. Bu gerçek, harmanlanmış öğrenmenin yaygın olarak kullanıldığı yaşam boyu öğrenme eğitim paradigması (yaşam boyu öğrenme) bağlamında çok önemlidir; bu da öğretmenler ile öğrenciler arasında yüz yüze ve uzak (uzak) etkileşim biçiminin optimum bir kombinasyonunu varsayar. Bu makalede, teknik uzmanlık öğrencilerinin doğa bilimleri ve matematiksel disiplinlere hakim olmaları ve bir meslek edinmeleri için motivasyonlarını artırmak için e-öğrenme araçlarının didaktik potansiyelinin kilidinin açılması (tanımlanması) amaçlanmaktadır. Çalışmanın önde gelen yöntemi, sorunu diyalog, öznellik ve bireysellik açısından analiz etmemizi sağlayan faaliyet tabanlı bir yaklaşımdır. Deneysel çalışma sürecinde, öğrencilerin e-öğrenme için motivasyon seviyesini ve daha sonra mesleki eğitim için yeterli bir güvenilirlik derecesini belirlemeye olanak veren metodoloji ve teknikler

kullanılmıştır. Ayrıca gözlem, görüşme, anket teknikleri kullanılmıştır. Makale, e-öğrenme kullanımının teorik yönlerini analiz eder ve daha sonra mesleki disiplinlerin incelenmesiyle, üniversite öğrencilerini doğal bilim bilgisi edinmeye teşvik eder. Bir yandan, makale mühendislik ve teknik personel eğitim sistemi için metodolojik bir temeldir; Öte yandan, genel olarak öğrenme motivasyon seviyesini artırmak için modern e-öğrenme araçlarının kullanımıyla ilgili bazı metodik konuları ortaya koymaktadır. Makale ayrıca, e-öğrenme yoluyla öğrencilerin motivasyonunu geliştirmeyi amaçlayan bir dizi dersin sonuçlarını da sunar. Makalenin materyalleri yükseköğretim kurumlarında ders verenlere yardımcı olabilir.

**Anahtar Sözcükler:** Motivasyon, öğrenme amaçları, öğrenciler, gelişim, e-öğrenme, e-öğrenmenin didaktik potansiyeli

## INTRODUCTION

### The relevance of the study

The introduction and implementation of information and communication technologies in various spheres of modern society stipulated the expediency of updating the methods and forms of training competitive specialists. The didactic potential of e-learning enables to intensify the process of learning at the university. It becomes possible thanks to such properties of e-learning as interactivity, technological effectiveness, openness and mobility (Griban, 2011; Levina et al., 2017). Studying various capabilities of e-learning, scholars identify(define) the following: the development of students' motivation, intensification of cognitive learning activities, individualization of the learning process, etc. (Khodyreva, 2011; Chen et al., 2017; Khrulyova & Sakhieva, 2017; Konysheva & Ibragimova, 2017; Khafizova, 2017). The development of students' motivation is one of the priorities of the university educational environment. It is due to the fact that researchers of the problems of higher education in the structure of student readiness for professional activity consider motivation a key component (Diyachenko, 2006; Popova, Gumerov & Popova, 2017). Analyzing and summarizing various points of view, we come to the conclusion that readiness suggests that a prospective professional should have a certain set of knowledge, skills and abilities as well as developed motivational sphere for continuous self-improvement, advancement in terms of professional development and engagement. The specified position relates to the psychological concepts of learning, according to which, a leading indicator of achieving the goals of training is the level of development of cognitive, sensory and kinesthetic components as well as the level of motivation. In accordance with the provisions of activity-based approach to the educational process, the development of these components takes place directly in the activity, specifically in the student's independent cognitive learning activity. Its structure includes such interrelated substructures as psychological and physiological state of the subject; cognitive activity; attitudes and behavior in the process of obtaining a profession. All this confirms the expediency of the study of the impact of e-learning on these components and structures.

### The status of the problem

A. Maslow (1982), the founder of the theory of motivation, describes men as thinking organisms that seek to satisfy their needs in order to actualize their abilities and aptitudes completely. Taking his theory as a basis, many researchers considered conditions for personal development as a source of achieving management targets and a resource of effective implementation of given tasks.

Learning motivation is defined as a special kind of motivation included in the activities of teaching and learning. As any other kind of motivation, learning motivation is determined by a number of specific factors for this activity:

- firstly, it is determined by the education system, the educational institution where learning activities are carried out;
- secondly, it is determined by the organization of the educational process;

- thirdly, by the subjective features of the student (age, sex, intellectual development, abilities, level of aspirations, self-esteem, their interaction with other students, etc.);
- fourthly, by the subjective features of the teacher, and above all, by the system of their attitudes to the student and to the teaching process;
- fifthly, by the specificity of the subject (Volod'ko, 2016).

Learning motivation, as well as any other kind of motivation, is systemic. It is characterized by its orientation, steadiness and dynamism. In order to study the students' motivation development process, one should take into account the nature of the motives of students' cognitive learning activities. The researchers involved in this problem, point out extrinsic and intrinsic motives (Stolyarenko, 2002). Extrinsic motives include, in particular, reward and punishment, threat and requirement, material gain, peer pressure, expectation of future benefits as a result of professional activities. All of them are extrinsic motives in relation to the immediate goal of learning. Knowledge and skills are only means to achieve some other goals. Intrinsic motives are interest in knowledge, curiosity, the desire to raise one's cultural and professional level, the need for active and new information, i.e. everything that encourages people to learning. The above mentioned analysis enables us to argue that motives of learning are factors which cause manifestation of educational activity. In this respect, the works of C. Ames & J. Archer (1988), J. Archer (1994), V. V. Busato et al. (2000) are of utmost interest to us.

According to L. I. Bozhovich (1995), the objects of the external world, ideas, feelings and experiences can become the motives - in short, everything that can be embodied in the need. A number of Russian and foreign psychologists and teachers attach great importance to the study and development of intrinsic motivation. Among foreign psychologists, J. Bruner (1977) paid much attention to it. He spoke of such motives, as curiosity, the desire for competence (the pursuit of accumulation of experience, skills, abilities, expertise), which he connected with interest.

### **Motives of learning**

Motives of learning are the essential aspect of the learning process. They largely determine the orientation of the student's personality, their successes and failures. The motivation, aimed at knowledge, can be positive, neutral, negative or a combination of these aspects. The development of the motives of learning proceeds in two ways: either through assimilation by the students of the social value of learning; or through learning activity itself which should be of some interest to the learner. In pedagogy, there are quite a few specific conditions that generate student's interest in learning. For example, L. M. Meshkova (2016) proposes the following terms/conditions:

1. The method of presenting the learning material. The subject is usually presented to the students as a sequence of particular phenomena. The teacher explains each of the well-known phenomena and gives a prepared method of working with it. The child has nothing to do but remember it and act as it was shown. When the material is presented in this way there is a great danger of losing interest in it. Conversely, when the study of the subject goes through the revealing to the child of the essence, which is the fundamental part of all the actual phenomena, then, relying on this essence, the student himself deals with all the actual phenomena, his learning activity becomes creative and makes him get interested in the study of the subject. In this case, both the content and methods of work can motivate a positive attitude toward the study of virtually any subject. In the latter case, we mean the motivation by the learning process.

2. The organization of work on the subject in small groups. The principle of students' enrolment in forming small groups is of a great motivation value. If the children with neutral motivation to the subject are put together with the children who do not like the subject, after interaction, the first group has a significantly increased interest in the subject (Berg & Petersen, 2013). If we put the students with the neutral attitude to the subject with those who like the subject, we do not see any changes in the attitudes of the first group (Pintrich & Zusho, 2007).

These works consider the specifics of the learning motivation development of the subjects of the educational process.

3. The relation between the motive and the purpose. The purpose set by the teacher, should be the student's purpose. In transforming the purpose into the motive the student's awareness of his success is very important.

4. Problem-based learning. At each stage of the lesson problem-solving tasks should be used. If teachers use this approach, the motivation of students is usually at a rather high level. It is important to note that it is cognitive (informative) by its content, in other words it is intrinsic (Vlasova, Kirilova & Curteva, 2016).

The appearance of incentives and motivation for getting education and preparing of the person to the process of learning is inextricably connected with the study of patterns of upbringing, teaching, and learning. Thus, under the patterns we understand the connection between artificially created and naturally formed conditions and outcomes. The study and generalization of pedagogical experience, conceptualization of different pedagogical theories enable us to reveal such approaches that can be used in teaching practice.

It should be emphasized that modern researchers also pay attention to the conditions that generate students' interest in learning. For example, E. A. Hodireva (2011), while considering the use of innovative technologies in the system of vocational education, argues that "goal-setting helps to identify/ determine and realize personal meaning of learning ..." (Hodireva, 2011, p. 40). A.B. Kulakova & D.V. Rozontova (2014), with the purpose of enhancing learning motivation, recommend using varied forms and working techniques: creative, group, individual and others. Varied forms of work strengthen the desire to acquire knowledge and form steady interest in the most of subject matters.

Thus, it can be argued that in relation to vocational education, motivational component characterizes the student's values, motives, and interests aimed at learning and mastering a future profession. It confirms student's willingness to independently set goals, seek to achieve them and make an effort to improve their own knowledge, skills, abilities and competences. It should be noted that under the influence of motivation there arise subjective emotional experiences that are mainly of negative connotation, until respective needs are met. The motivation sphere is the core of the individual. The leading motives among various social motives for learning are "I want to know more", "it is interesting at the lesson", and also "to please parents"

### **The factors of learning motivation development**

Verbal reinforcements, evaluation, which characterize student learning activities, play a significant role in the development of learning motives. According to B.C. Ilyin (1975), the main factors influencing the development of steady positive motivation for learning are: the content of teaching material; the organization of learning, which includes the three main stages: motivational, operational-educational, and reflective-evaluative; the cooperative forms of learning; the evaluation of learning activities; the style of teaching.

However, it should be noted that these factors are modified when used in the process of e-learning (Vlasova, 2014). For example, the use of e-learning technologies presents new requirements for the development and presentation of the educational content, methods of teaching, means and forms of organizing cognitive learning activities.

### **The reasons of negative attitude to learning**

Negative attitude towards learning can be caused by a number of reasons. There can be both subjective and objective reasons. For example, subjective reasons may be related to the traits of the students themselves: the lack of appropriate positive motivation (lack of educational, scientific, professional interests, impoverished ideals, predominance of personal material needs, etc.); the difficulty in implementing a positive motive (Serova, 2010).

In addition to subjective reasons, there may be objective reasons related to the teacher. For example, the educational material does not facilitate the maintenance of curiosity, does not correspond to the level of students' intellectual development, the level of existing knowledge;

the techniques and methods of work do not correspond to the children's needs to develop activity and independence. Accordingly, some means of encouragement can serve as the reasons for the formation of negative attitude toward learning. Teachers should know everything about it, so that the development of positive motivation in learning could be successful.

Cognitive interest is a strong intrinsic motive. G.I. Shchukina (1979) believes that cognitive interest occupies the central place among other motives of learning and is altruistic in nature. In order to generate the students' interest in learning, she recommends:

- to reveal the objective possibilities of interesting sides, phenomena of the surrounding life in the pedagogical process;
- to foster and constantly maintain a state of active interest in students (not indifference) in surrounding objects, moral, scientific values;
- the entire system of education and upbringing should be focused on forming an interest as a valuable property of a person, corresponding to their creative activity, their holistic development.

V.V. Davydov (1996), in his turn, notes, that the character of learning activities is of considerable importance for the development of theoretical educational interest. The development of cognitive interest goes through three main phases:

1. Situational, cognitive interest which arises under the conditions of novelty.
2. Continued interest in the certain content of the activity.
3. The inclusion of the cognitive interest in the general direction of the individual, in the system of their life goals and plans.

Undoubtedly, the development of cognitive interest in learning and future profession is facilitated by new and emerging information and communication technologies which opened up opportunities for introducing diverse types of integrated training for university students. When educational Internet resources are used in the educational process, learning motivation significantly enhances, students' cognitive interest is stimulated, the effectiveness of independent work increases, all the individual's potentials are realized: cognitive, moral, creative, communicative and aesthetic.

The foregoing enabled us to define the stages in the development of motivation of the subjects of the educational process, taking into account the specifics in the application of e-learning technologies. In particular, we have identified the following stages: motivational, operational-cognitive, and reflexive-evaluative.

### **The development of professional activity motives**

The important step in the acquisition of the professional activity is its "acceptance", i.e. the extent to which understanding of the profession correlates with the human needs (Shadrikov 2013). Projecting their motivation structures to the structures of professional activity factors, people strive to satisfy their needs. The richer the person's needs are, the greater demands they impose on the activities, but at the same time they can get satisfaction from work. V. D. Shadrikov (2013) identifies three groups of needs: material (physical), spiritual, social. He believes that there are synthetic needs formed from the needs of the listed groups, for example, the need for labor. The adoption (acceptance) of the profession "creates a desire to perform it in a certain way, gives rise to a certain determinative trend and is the starting point of the formation of the system of psychological activities." The development and transformation of the motivational structure of the subject's activity takes place in two ways: firstly, the development and transformation of the common motives of the person into labor motives takes place; secondly, the system of professional motives changes together with the level of professional development. In the course of getting professional education, the needs of the individual are met in activities, in this way the formation of the structure of professional motivation and awareness is carried out. As a result of this process the personal meaning of the activity and the need for its transformation are identified. In the course of the professional activity a further change in the motivational sphere takes place: the appearance of new motives, the involution of the old ones, the change of the absolute and relative importance of some motives, the change in the structure of motives. The enrichment of the motivation sphere of the person causes the labor satisfaction,

which contributes to the manifestation of the personal initiative, self-expression and self-actualization in the activity. Thus, on the whole way of a person's professional development, there are significant changes in the motivational sphere. Acceptance of the profession and defining the personal meaning of activity are the critical moments in the genesis of motivation. Various motives become leading at different stages of professional development. Motivation contributes to the person's holistic professional behavior, increase of labor activity, and has a significant influence on the formation of goals and the choice of the ways of achieving them.

### **E-learning tools in the development of university students' motivation**

Integration of e-learning into the international education practice resulted in the orientation of the leading universities to the active use of e-learning technologies and the development of open e-learning courses. The examples are: MOOC (Massive Open Online Course), Coursera, Universarium and others.

Searching for more effective methods and means of learning is one of the leading ways to improve educational sphere in general and specialists training in particular. The use of information and communication technologies, distance learning technologies and e-learning technologies can intensify the learning process, contributes to its differentiation and individualization. The structures of students' motivation that have been discussed earlier, as well as the specifics of its development in vocational education, have enabled us to determine the impact of e-learning on the development of motivation. One should focus on the fact that this effect is due to the didactic potential of e-learning. As A.I. Yakovleva (2001) pointed out, the introduction of information and communication technologies, "significantly accelerates transmission of knowledge gained by technological and social experience of the mankind, not only from generation to generation, but also from one person to another". A number of authors, in addition, emphasize increasing of the efficiency of the learning process by means of flexibility and multimedia technologies, openness and individualization of the educational process, the changing nature of the activities of both students and teachers. For example, I.G. Zakharova (2010) focuses on the intensification and actualization of the educational process by using information technologies. According to the author, they provide solving the following problems: identification and use of incentives to enhance the cognitive activity; deepening of interdisciplinary ties in solving problems from various subject areas; the active participation of students in creating projects and further implementation of their educational path. In addition, thanks to such properties of e-learning as virtuality, multimedia and openness, we can present educational information in a multimodal series: sound, graphics, and multimedia images, text format, etc. It facilitates the process of perception, decreases mental stress, and enhances motivation to learning. A.L. Sirotyuk (2001) argues that the intensity of learning is enhanced when not only the students' individual abilities to perceive information are taken into account but also those of the teacher. It is confirmed that presentation of educational information, taking into consideration the functional specialization of the cerebral hemispheres is one of the pedagogical conditions of differentiation and individualization of education, which positively affects the creation of favorable atmosphere for teaching students. Identical is the position of I.N. Frolov (2009). Studying the effects of educational technology on the process of perception and understanding, he comes to the conclusion that new technologies not only contribute to the intensification of the learning process, but also have a significant impact on the generation and assimilation of concepts and reasoning, as well as development of positive motivation to learning. The above mentioned facts enabled us to determine the pedagogical potential of e-learning in the development of students' motivation. The e-learning means are:

- interactive forms of students learning activity (chats, forums, webinars, etc.) allowing to integrate methods of interaction of the subjects of the learning process;
- creation of "the situation of success" in learning using e-learning technologies which help adapt the university learning process to the students' traits and provide the atmosphere of cooperation and dialogue interaction;

- building of an individual educational path, which provides the student with the right to select "the complexity" of learning. As a rule, it enables to intensify the students' educational and cognitive activities by means of providing professional orientation of learning, the use of e-learning technologies; providing feedback, ensuring continuous pedagogical support of in-class and out-of-class work of students.

### **Functions of e-learning**

We identified and substantiated the following e-learning functions: informative-educational, organizational-stimulating, diagnostic-corrective and communicative-managerial (Konysheva, 2016). The informative-educational function is expressed in the operative "delivery" of information both to teachers and students, the opportunity to work with automated data sets. The organizational and stimulating function is aimed at the coordination of the learning process, as well as the formation of individual educational paths.

Pedagogical value of individual educational trajectories in the process of development of students' motivation is determined by the opportunity of the students to choose their own individual trajectories. In psycho-pedagogical studies there are two leading directions – horizontal and vertical. The horizontal direction implies the choice of content and forms of organization of educational activities. The vertical direction provides a choice of achieving optimal level of education. S.I. Osipova & T.V. Solovyova (2013) emphasize that choice is an action that gives the entire activity purposefulness. It enables not only to take into account the students' personality traits but also to provide "the situation of success. Achieving the "situation of success" significantly increases the attractiveness of professional education.

The communicative and management function is connected with the above-described function. It facilitates the implementation of various forms of interaction between the subjects in the e-didactic environment and enables to provide feedback and continual educational support of in-class and out-of-class students' work.

### **The hypothesis of the study**

The analysis of the psycho-pedagogical and methodological literature, as well as of the experience of studying the problem showed that the issue of e-learning opportunities should be clarified and needs further development. It is primarily due to the change in the educational paradigm, the updating of methods, the requirements for the level of training of university graduates, etc. At the same time, methodological support for the use of e-learning technologies in modern educational practice is not sufficiently developed. The above mentioned let us formulate the hypothesis of the study of the problem: the learning process at higher educational institution will be more effective if e-learning tools and guidance on their application are developed and used in the educational process. (For example, in our work, we use such e-learning resources as multimedia tutorials, online learning resources, and didactic simulators).

Let us take the example of the development of students' motivation to study natural sciences which provide a kind of "Foundation" for future engineers' professional training and significantly increase the level of motivation to learn a trade in general.

## **METHODS**

In our study we consider the problem of development of university students' motivation for studying natural sciences. The significance of natural science training of students in professional development of future engineers is determined by its fundamental importance in the study of special disciplines. This is due to the following factors: quantitative-qualitative language to describe models of reality, the strict causal connections and relationships, the validity of the general laws and theorems, evidence and validity of scientific statements and theories, experimental confirmation of truth. The experimental procedures were aimed at improving the training of future engineers and technicians. The analysis of legal documents (in particular, the Federal State Educational Standards - FSES) analytical, psycho-educational research enabled us to identify the main provisions that determine the value of the natural science training in the professional development of engineering and technical personnel. Firstly, the entrance (profile)

examinations in the subjects, included in the educational field of "Engineering, technology, technical sciences", are carried out in mathematics and natural sciences. Secondly, and most importantly, mathematics and natural sciences are prerequisites for the study of professional disciplines and, as mentioned earlier, act as a kind of basis, "Foundation" for the direct study of technical disciplines. Another reason, that determined this attention to the mathematical training of future engineers at the university, is its methodological potential and capabilities in professional formation of engineering and technical personnel. The study of natural sciences contributes to the development of logical thinking of future engineers, their spatial imagination, algorithmic culture, formation of abilities to establish cause-and-effect relationships, to model a situation, to the development of intellectual abilities.

Thereby, the analysis of educational research allowed us to conclude that natural science training in the professional development of future engineers performs cognitive, applied and integrative functions. These functions involve general didactic and specific principles of organization of natural science training for engineers and technicians at the University. These principles include: the principle of fundamentality, the principle of practical orientation, the principle of informatization, the principle of ecologization (greening), the principle of economization.

It should be emphasized that on the one hand, it is a methodological basis for the system of training; on the other hand, it provides the use of natural science knowledge in the study of professional disciplines. Taking into account the specifics of engineers' future professional activities and the difficulties in studying the natural sciences, we organized systematic work on the development of university students' motivation by means of e-learning.

To determine the level of students' motivation, the following methods were used: the method "Studying the motives of students' learning". To collect experimental data, the method "Learning motivation in higher education", proposed by E. P. Ilyin (2001), was used. The purpose of the methodology is to diagnose the students' motivational sphere. In the study, it is used to identify the leading motives of learning and professional activities and to assess the level of the formation of the motivational component. Evaluation is made on three scales: "Acquisition of knowledge" (the desire to acquire knowledge, curiosity); "Mastering the profession" (the desire to master professional expertise and to develop professionally important qualities); "Getting a diploma" (the desire to get a diploma with formal learning, the desire to find workarounds in passing exams and tests) (Ilyin, 2001). Description and the results of the experiment are presented below.

## RESULTS

### The description of the experimental procedures

The experimental procedures were organized and conducted on the basis of Vyatka State University and Kazan (Volga region) Federal University. There were 225 students in the control group, and 204 students in the experimental group. In general, 21 groups of students participated in the study. That is, on average, there were about 20-21 students in each group. We developed a series of lessons of studying natural sciences, allowing us to use e-learning means to the full extent.

The module "The intellectual puzzle" involves the following tasks: identifying the level of students' motivation for studying natural sciences and for the acquisition of future profession; determining the initial level of natural science training; identifying "barrier" mechanisms in the study of natural sciences, diagnosing the development of self-organization skills, self-control and reflection.

This module is aimed to develop the analytical skills analyzing information in order to solve practice-based tasks; formation of the conception of natural sciences as "a method" to describe the phenomena of the world and the processes related to future professional activities; techniques and methods of correct expression and reasoned justification of the point of view;

forecasting possible consequences; forming algorithms of actions related to the computational operations in mathematical disciplines.

The content of the module is represented by: webinars – (“I want to be an engineer – I want to be taught!”, “Information crystals” (effective information processing techniques), “Time Management Secrets”, “Kaleidoscope of discoveries”, “Jolly mathematics”; chats – “The engineer of the third millennium – the engineer of the future, who is he?”; “Physics, Chemistry for Engineers: Myth and Reality”; the round table – “The heritage of the past” (about great scientists, inventions and discoveries), “The constellation – the Engineer” the tree of wishes; five fingers; “The fish-born”, “thick” and “thin matters”.

Achieving the goal was carried out through the use of pedagogical potential of e-learning: the situations of success were created, the atmosphere of cooperation of students and teachers was created, immediate feedback between the subjects was provided, and the integration of the content of mathematics, natural sciences with elements of professional knowledge through interdisciplinary connections was made. To ensure these conditions, we developed and used multi-level tasks corresponding to the professional content. They were used in such forms of interaction of the subjects of the educational process as a forum, webinar, chat, which enabled us to obtain operational feedback on the status of assimilation of the educational material by the students and to identify corresponding challenges in passing the stages of the educational route.

We will focus on specific capabilities of e-learning, implemented with the aim of developing students' motivation. First of all, we should note that e-learning technologies enable us to take into consideration the students' perceptual modalities. This condition is necessary for the development of the subjects' motivation. The optimal way of perception by students was carried out by various ways of presenting educational information and its perception in different combinations: audio and visual with digital. However, we emphasize that, in practice, it is not recommended to use all the channels of perception of information by the students to avoid their psychological and information overload. Secondly, e-learning technologies contribute to the concentration of students' attention. This is possible through the use of animated, audiovisual effects, photos, diagrams, images maintaining interest in the studied material. Thirdly, the process of memorizing educational information is the most optimal and has a positive effect on the development of students' motivation. It is achieved by the following techniques: efficient highlighting of information, and the use of structural and structural-logical schemes.

The first technique - an effective highlighting of information enables to highlight formulas or symbols by using font or color, which for obvious reasons promotes better acquisition of the most important material. The second technique - the use of structural and structural-logical schemes for the provision of information enables us to overcome the difficulties associated with the handling of symbolic images, and also with high level of abstraction (abstractness) of the studied concepts. Reliance on diagrams enhances the effectiveness of perception and memorizing information. It is achieved largely through the implementation of the principle of cognitive visualization. The visualization process is rolling of virtual meaningful elements into visual images that can be deployed and acts as a support for subsequent thought and action. Fourthly, e-learning technologies provide the state of the intellectual comfort for the subjects of the educational process by creating “situation of success”. The latter is a purposeful, organized combination of conditions enabling students to achieve significant results in the activity. “Success in learning is the only source of inner energy, giving birth to energy to overcome difficulties and a desire to learn” (Shafikov, 2002). Psycho-pedagogical studies point out that “the situation of success” promotes the development of cognitive interest, corrects certain negative personality traits, such as anxiety, self-doubt, also generates adequate self-esteem. Additionally, creating “situations of success” for students enables one to maintain a favorable psychological climate in the educational process and, most importantly, substantially enhances learning motivation.

### **The results of the experimental procedures**

The efficiency of the experimental procedures was analyzed by assessing the level of development of students' motivational component in the structure of readiness for professional

activity. To ensure internal validity, multi-function Fisher test was used to confirm the homogeneity of the control and experimental groups. To ensure external validity, we used a technique of diagnostics of learning motivation orientation (Dubovitskaya, 2002) and the methodology of T.I. Ilyina (2002). The motivation component is characterized by the presence of value orientations, motives and interests of future engineers aimed to, study the natural sciences. It reveals the students' readiness to set and achieve goals, as well as the orientation to improve their knowledge, skills, abilities, and competencies. To carry out the experiment and test the hypothesis, we developed experimental and control group of participants.

At the forming stage of the experiment, we developed and implemented a series of classes, namely the previously presented cycle "Intellectual puzzle", which was implemented by means of e-learning. In pilot work, we used various forms of organization of students' cognitive learning activities by means of e-learning: webinars, forums, chat rooms. The focus and content of webinars were summarized earlier. In the framework of forums and chats, in addition to discussing the issues under study, we organized academic discussions and reflexive methods. All the procedures specified earlier were conducted only in the experimental group. The control group studied in the usual mode. This enabled us to determine the students' emotional-value characteristics (affective experiences), to assess the level of cognitive activity in the study of the Natural Sciences, and therefore to determine the level of motivation more correctly. In addition, we studied and analyzed the data dealing with the students' progress, test results, continuously monitored the current learning activities and student performance.

At the summative stage of the experimental procedures the majority of students showed the low and average level of formedness of the motivational component (Table 1). At the formative stage of the experiment a series of lessons was introduced and implemented by means of e-learning. Table 1 shows the distribution of the students of the experimental and control groups according to the levels of the formedness of the motivation components.

**Table 1.** Distribution of students by the level of motivational component at different stages of the experiment

Participants of the experiment			Motivation levels		
			High	Average	Low
Start	Experimental group	Student	38	121	45
		Percent	18,6	59,3	22,1
	Control group	Student	30	109	86
		Percent	13,4	48,4	38,2
Finish	Experimental group	Student	74	98	32
		Percent	36,3	48	15,7
	Control group	Student	36	122	67
		Percent	16	54,2	29,8

Interpretation of the obtained data enables us to draw a conclusion about significant differences in the percentage of students in the experimental and control groups with average and high level of the motivation component formation.

Analysis of the research results enables us to conclude that there is a significant positive dynamic in the experimental group, which manifests itself in a heightened interest and awareness by the students of the role and importance of the Natural Sciences for future occupation. As a result of the experimental procedures, the number of students with low level of motivational component decreased (from 22,1% to 15,7%.) which confirms, in general, the effectiveness of the proposed use of e-learning. Accordingly, the number of students with an average level (from 59,3% to 48%) also decreased somewhat. but with a high level of motivational component (from 18,6% to 36,3%) increased.

Quantitative results are presented in the table. As to qualitative results, the instructors noted a number of positive aspects of increase of students' learning motivation in the study of natural sciences by means of e-learning. These include, primarily: the increased level of activity

and independence of students; more complete and accurate assimilation of information due to the visual presentation of data; increase of their information literacy. In addition, students had an opportunity of virtually full individualization of instruction; visualization of the obtained information in various ways. Instructors, in their turn, had an opportunity: to use various options for presenting educational information; to diversify learning tasks; to control the process of doing assignments by each student. Thus, the qualitative and quantitative assessment of the results showed that the experimental procedures carried out to develop motivation of university students by means of e-learning provided a stable positive dynamics of the level of formation of the motivational component. In the course of the study, we also succeeded in revealing a noticeable tendency in the change of students' attitudes toward the study of natural sciences. At the stating experiment stage most of the students did not perceive these disciplines as professionally important, they also did not see their potential in solving applied problems, but at the forming (formative) experiment stage there was a significant growth of understanding of the importance and significance of such disciplines as Mathematics, Physics, Chemistry as core disciplines for vocational training of engineering and technical personnel. The interpretation of the data enabled us to make conclusions on the significant differences in percentage shares of the students with medium and high levels (of the formedness) of the motivation component in the experimental and control groups. We should note that the qualitative and quantitative evaluation of the results showed that the implemented experimental procedures on the development of university students' motivation by means of e-learning fostered learning environments for the positive dynamics of the level (of the formedness) of the motivation component.

#### **DISCUSSION and CONCLUSION**

The traditional system of education does not contribute adequately to the intellectual development and formation of the students' positive learning motivation (Sudutkina, 2015) Taking into consideration the unity of the cognitive and motivational spheres of an individual, we can conclude that one of the means of developing learning motivation can be specially organized long-term remedial work on the development of mental skills based on the application of e-learning tools. In our opinion, the most important is the impact on the motivation sphere, carried out by optimizing the "student-teacher" relations and the change of the student's self-attitude.

The implementation of remedial work not only increases the level of students' intellectual development, but also indirectly affects the students' motivation sphere, which results in significant changes in the structure and hierarchy of motives and foregrounding of the cognitive motives. But we must pay attention to the fact that the effectiveness of pedagogical assistance is provided by the adequacy of its content and means to the logics of learning motivation development, the character of motivation crises and difficulties, as well as the focus on the individual paths of students' development.

Summarizing the study results, we can state, that the goal is achieved, the problems are solved, and the theoretical and experimental data support the hypothesis of the study. Confirmation of the hypothesis of the study is supported by the experimental study, the validity of using statistical criteria for assessing the increase in the level of motivation of engineering students in the process of studying natural sciences. In particular, as a result of the multifunctional Fisher test, the level of reliability of results was 0,95. It enabled us to draw the following conclusions. There are critical periods in the development of natural science students' learning motivation: adaptation, development of cognitive motives, choosing a career, displacement of learning motives by pragmatic ones.

Having identified these critical periods we can develop a model of students' learning motivation by means of e-learning, in which this process is presented as a gradual transition from the dominance of the uncertain learning motivation and motives of avoidance to a combination of cognitive motives with motives of personal and professional self-improvement, social responsibility and co-operation, which is carried out in overcoming the difficulties of the critical periods by the students and actual and advanced pedagogical assistance.

In the study, the use of e-learning means is substantiated as a condition for the positive dynamics of the level of formation of the student's motivation component. E-learning provides the implementation of organizational and stimulating, informative, training, diagnostic and corrective and communicative management functions in the interaction of the subjects of the learning process when students master educational programs.

### ACKNOWLEDGEMENTS

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University. The publication has been supported by the 'Russian Academic Excellence Project 5 - 100' of the I M Sechenov First Moscow State Medical University (Sechenov University).

### REFERENCES

- Ames, C. & Archer, J. (1988). Achievement Goals in the Classroom: Student's Learning Strategies and Motivation Process. *Journal of Educational Psychology*, 80(3), 260–267.
- Archer, J. (1994). Achievement Goals as a Measure of Motivation in University Students. *Contemporary Educational Psychology*, 19(4), 430–446.
- Berg, M. A. & Petersen, S. A. (2013). Exploiting Psychological Needs to Increase Motivation for Learning. International Conference on Serious Games Development and Applications. SGDA 2013: *Serious Games Development and Applications, LNCS 8101*. Springer-Verlag Berlin Heidelberg, 260-265.
- Bozhovich, L. I. (1995). Problems of formation of personality: Selected psychological works. Moscow: Voronezh Institute of Applied Psychology.
- Bruner, J. (1977). Psychology of cognition. Moscow: Progress.
- Busato, V. V., Prins F. J., Elshout, J. J. & Hamaker, C. (2000). Intellectual Ability, Learning Style, Personality, Achievement Motivation and Academic Success of Psychology Students in Higher Education. *Personality and Individual Differences*, 29(6), 1057--1068.
- Chen, F., Gorbunova, N. V., Masalimova, A. R. & Внговб, J. (2017). Formation of ICT-Competence of Future University School Teachers. *EURASIA Journal of Mathematics, Science and Technology Education*, 13(8), 4765-4777.
- Davydov, V. V. (1996). The theory of developmental education. Moscow: Progress.
- Diyachenko, M. I. (2006). Psychology of higher educational institutions. Moscow: Harvest.
- Dubovitskaya, T. D. (2002). Diagnostic methodology of learning motivation orientation. *Psychological Science and Education*, 2, 42-46.
- Frolov, I. N. (2009) E-learning as a form of organization of the educational process in the 21st century. *Informatics and education*, 2, 109-110.
- Griban, O. N. (2011). Computer-based technologies as a means to develop information competency of a modern teacher. Multimedia technologies in education: a way to freedom. Yekaterinburg: Ural.
- Hodireva, E. A. (2011). Information technologies of professional education: competency, independence, creativity. Kirov: Publishing House of Vyatka State Humanities University.
- Ilyin, B. C. (1975). Formation of the pursuit of knowledge, learning motivation among pupils. Moscow: Academia.
- Ilyin, E. P. (2001). Motivation and motives. Saint Petersburg: Piter.
- Ilyina, T. I. (2002). The study of learning motivation at higher education institution. *Psychological Science and Education*, 2, 42-46.
- Khafizova, A.A. (2017). Creation of a favorable motivation environment for training foreign languages in technical higher education. *Vestnik NTSBGD*, 4(34), 59-62.
- Khodyreva, E. A. (2011). Information technologies of professional education: competency, independence, creativity. Kirov: Publishing House of Vyatka State Humanities University.
- Khrulyova, A. A. & Sakhieva, R. G. (2017). Forming of Informational Culture as a Necessary Condition of the Level Raising of Higher Education. *Man In India*, 97(15), 211-225.
- Konysheva, A. V. & Ibragimova, E. N. (2017). Training of Engineers in Mathematics at University on the Basis of the Information Cybernetic Approach. *EURASIA Journal of Mathematics, Science and Technology Education*, 13(8), 4379-4391.
- Konysheva, A. V. (2016). Webinar as a network form of organization of students' learning. *Scientific-*

- methodical electronic journal "Concept", S1, 86-90. URL: <http://e-koncept.ru/2016/76018.htm>.*
- Kulakova, A. B. & Rozontova, D. V. (2014). Psychological aspect of the students' learning motivation in the educational process. *Problems and prospects of modern science, 2*, 113-117.
- Levina, E. Y., Masalimova, A. R., Kryukova, N. I., Grebennikov, V. V., Marchuk, N. N., Shirev, D. A., Renglikh, K. A. & Shagieva, R. V. (2017). Structure and Content of e-Learning Information Environment Based on Geo-Information Technologies. *EURASIA Journal of Mathematics, Science and Technology Education, 13(8)*, 5019-5031.
- Maslow, A (1982). *Self-actualization: Personality Psychology*. Moscow: Progress.
- Meshkova, L. M. (2016). Formation of positive motivation of university students. *Modern trends in the development of science and technology, 7-9*, 76-80.
- Osipova, S. I. & Solovyova, T. V. (2013). Designing individual educational trajectory by the student in the conditions of informatization of education. Moscow: INFRA. M. K.
- Pintrich, P. R. & Zusho, A. (2007). Student Motivation and Self-Regulated Learning in the College Classroom. In: Perry R.P., Smart J.C. (eds). *The Scholarship of Teaching and Learning in Higher Education: An Evidence-Based Perspective*. Springer, Dordrecht, 731-810.
- Popova, N.V., Gumerov, A.V. & Popova, E.V. (2017) Education of students in Russian universities: the motivational aspect. *Vestnik NTSBGD, 2(32)*, 64-70
- Serova, N. A. (2010). Formation of positive learning motivation in orphans in family-type children's homes. *Electronic scientific journal Information and communication technologies in pedagogical education, 03(07)*. <http://infed.ru/articles/31/>
- Shadrikov, V. D. (2013). *Psychology of professional activity*. Moscow: Publishing house of the "The Institute of Psychology, Russian Academy of Sciences".
- Shafikov, M. T. (2002). Potential: the essence and structure. *Socio-humanitarian expertise, 1*, 236-245.
- Shchukina, G. I. (1979). *Activation of cognitive activity of students in the learning process: a book for university students*. Moscow: Education.
- Sirotyuk, A. L. (2001) *Teaching children considering psychophysiology: practical manual for teachers and parents*. Moscow: Sphere.
- Stolyarenko, L. D. (2002). *Foundations of Psychology*. Rostov-on-Don: "Phenix".
- Sudutkina, I. A. (2015). Learning motivation of students of Secondary Vocational Institutions. Saransk: Saransk State Industrial and Economic College. <http://sgpek.ru/files/lsep/motiv.pdf>.
- Vlasova, E. Z. (2014). E-learning in the modern University: problems, prospects and experience. *Universum: Vestnik of Herzen University, 1*. Available at: <http://cyberleninka.ru/article/n/elektronnoe-obuchenie-v-sovremennom-vuze-problemy-perspektivy-i-opyt-ispolzovaniya>.
- Vlasova, V. K., Kirilova, G. I. & Curteva, O. V. (2016). Matrix Classification of Information Environment Algorithms Application in the Educational Process. *IEJME-Mathematics Education, 11(1)*, 165-171.
- Volod'ko, K. A. (2016). The organization of learning at higher education institutions, based on psychophysiological characteristics of student's age. VIII International Student Electronic Research Conference "Student Research Forum" - 2016." <http://www.scienceforum.ru/2016/2150/16532>
- Yakovleva, A. I. (2001). Information and communication technologies in education. *Information Society, 2*, 32-37.
- Zakharova, I. G. (2010). *Information technologies in education: a book for students*. Moscow: Publishing Center "Academy".