Informatization of Education is a Mandatory Component of Engineering Education

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Abstract

The article highlights the problems of modern military education in Russia. Information technologies determine the training of competent military specialists. However, there are a number of contradictions that have arisen in military education. To resolve the contradictions, the authors propose to define what information competence of a military specialist is and consider the environment in which a graduate of a higher military education institution will be prepared. Attention is paid to the creation of modern electronic educational materials for students, simulators and simulators necessary for the training of competent future officers, graduate of a higher military education institution. Attention is paid to the creation of modern electronic educational materials for students, simulators and simulators necessary for the training of competent future officers. The authors attempt to define the Informatization of the Russian Armed Forces. To train competent military personnel, teachers are subject to increased requirements. They must know not only highly professional military tasks, but also meet the requirements imposed by the modern stage of Informatization of society to the formation of a professional qualification structure of military personnel. The article defines the factors that determine the relationship between the education system and Informatization of the Russian Armed Forces. It is assumed that electronic textbooks are the key to successful independent training of students. It is assumed that electronic textbooks are the key to successful independent training of students.

Keywords [1]

Military education. Informatization of education. Competence. Information society. Information processes in education. Computer facilities. Information environment.

1. Introduction

Higher military education is the basis for the development of the army and society, the basis for improving Russia and accelerating scientific and technological progress, achieving universal professionalization of society to meet the needs of individuals in differentiated professional educational services, which determines its priority in the state policy of the period of economic transformation in Russia. The ever-increasing pace of scientific and technological progress has led to

a significant increase in the role of information flows in the functioning of complex military-technical systems. The volume and intensity of collecting, processing, and transmitting military-technical information is becoming increasingly complex and stressful. The emergence of the concept of "information war" outlines the main trends in determining the role of the information factor in military Affairs. According to foreign sources, at present there is every reason to take into account at all stages of preparation and conduct of military operations such components of the confrontation process as "information warfare" and "information weapons".

The increased attention to the implementation of information technologies in the processes of managing troops can be explained, first of all, by the fact that now, when armies have weapons of mass destruction, precision weapons and mobile groups of troops, the price of risk for an incorrectly or untimely decision has significantly increased. This can have a decisive impact on the outcome of a battle, operation, or armed struggle as a whole. In connection with the modernization of the army and the introduction of new technologies, the requirements for graduates of higher military education institutions are growing. The competence of a future officer of a graduate of higher military education is determined both by the requirements of the army, and by the quality of education and personal characteristics of the subject of activity, as evidenced by the results of scientific research.

In the conditions of modern life, a graduate of a higher military education institution should be able to achieve this goal by mastering methods for solving a large class of military tasks. The competence of a graduate of higher military education is determined by the requirements of the army, as well as the quality of education and personal characteristics of the subject of activity, as evidenced by the results of scientific research.

Legislative and regulatory documents adopted in recent years (Order of February 2, 2018, № 59 on approval of the Informatization plan of the Ministry of Defense of the Russian Federation for the next fiscal year 2018 and the planning period 2019 and 2020), aim institutions of higher military education to develop students' skills and abilities adequate to modern forms and methods of military operations.

At the same time, due to the limited time for natural science training in institutions of higher military education, the problem of selecting pedagogical tools necessary and sufficient for the training of competent military specialists, their adaptation to the information society, where the collection, accumulation, processing, storage, transmission and use of information based on modern computer technology are becoming the dominant activities in the military sphere[1].

We proceed from the fact that the traditional system of higher military education does not fully meet the tasks of Informatization of the army, since it does not ensure the formation of future officers ' information competence - the ability to serve in dynamically changing professional circumstances, in the conditions of information processes in the army.

Professional training of military specialists in institutions of higher military education will ensure the formation of their competence if:

- the peculiarities of information processes in the Russian Armed Forces are taken into account;
- the information competence of a military specialist is taken as the result of information training of a training institution of higher military education;
- the essence and structure of the key concept «information competence of a military specialist» are revealed;
- an information educational environment has been created to ensure the formation of information competence of a military specialist;
- the system of formation of information competence of a military specialist in the information educational environment of higher military education institutions has been developed and tested.

2. Informatization of the Russian Armed Forces

Information technologies are being introduced into all spheres of military activity, creating the potential for multiple increases in the effectiveness of state defense; the mechanisms of functioning of various branches of the armed forces are changing.

The increasing flow of information affects the military sphere in full. The Russian armed Forces have an extreme need for proactive, competent military specialists in all branches of the armed forces

who are able to quickly respond to changing social and political conditions, process and apply information in various formats[3]. Thus, we come to the conclusion that Informatization should be understood as the process of creating optimal conditions for meeting the information needs of society and the Armed Forces of Russia using information resources. Thus, information processes that represent actions to create, preserve, and process information determined the acceleration of the scientific and technological revolution, radically changed the nature and structure of production, the place and functions of man in it, and led to an increase in the role of science in the development of all spheres of social reality[4].

3. Informatization of military education in Russia

Since the problem of Informatization is urgent, the Russian Armed Forces require students who receive training in institutions of higher military education to know the principles of operation of the main equipment, its purpose, the ability to work with high-tech equipment, monitor the operation of computerized mechanisms, and comply with the regulations on information protection.

The Russian Armed Forces have taken the first step towards the «information revolution». At the July meeting of the Presidium of the state Council, President Vladimir Putin himself stated that we hope that this step will really bring an understanding of the importance and necessity of implementing advanced information technologies in the military sphere, as well as an opportunity to fully realize the potential inherent in our combat systems and means.

Ensuring the national security of the state in the "information age" is becoming an increasingly complex and complex event that affects the fight against international terrorism and the prevention of regional conflicts in the world. Microelectronics opens up new opportunities for computerization of control of machines and equipment: electronic and computer technology penetrates into all areas of the Russian Armed Forces, which are set up by qualified specialists.

The main defining component of the Informatization process is intellectualization, which deals with the highest form of information - knowledge. It is the intellectual component of Informatization that is becoming today the most important tool of science in General and military science in particular in solving the most important and complex problems of systematization and multiplication of knowledge. This is well understood by our leading military experts. So, V.D. Ryabchuk among the priorities proclaimed in the military doctrine, proposes to include the following: "increasing and strengthening the intellectual potential of the military organization of the state as a whole and its bearer - officers, primarily military leaders, scientists and teachers; theoretical and practical development and implementation of information technologies, primarily in the field of intelligence and management...".

The ultimate goal of Informatization of military management is to ensure the proper quality of information support for management decisions. The upper, functional level of the "semantic gap" of software-implemented information technologies and systems for this purpose is usually called special software.

Come to the conclusion that the Informatization of the Armed forces of Russia in modern conditions is extremely actualizes the problem of information and education in institutions of higher military education, involving mass introduction in teaching practice methods and tools for the collection, processing, transmission and storage of information based on microprocessor technology and media, and teaching techniques based on these tools, with the aim of creating conditions for improving cognitive activity and enhance intellectual capacity of students.

4. Results and Discussion

Education, along with the problems of survival and development of the earth's civilization, ecology, energy, nutrition, has become one of the global problems of humanity. It is officially recognized that the fate of our civilization depends decisively on the fate of education: "We can say that the situation in the world as a whole is such that the fate of civilization depends on the development of education in the future, whether the expected reasonable order or rapidly approaching

chaos will prevail in the world" [8]. The only possible option for the survival of the earth's civilization was determined by the transition of the world community to the path of sustainable development of society [7]. In the context of the problem of survival, Informatization is defined "as an active process of increasingly complete acquisition of information as the most important resource for human development".

This resource is being prepared in the military education system, the main trend of which is the Informatization of education - the process of including modern information technologies in the education sphere, aimed at implementing the goals of professional training of future officers. It should be noted that this process accelerates the pace of improving the management mechanisms of the education system based on the use of computerized data banks of scientific and pedagogical information, information and methodological materials, and communication networks, which requires improving the methods of selecting content, methods and organizational forms of training, education, corresponding to the tasks of developing the student's personality in modern conditions of Informatization of society.

Improvement of technical means of human development and creation of new information technologies of training on their basis is the main goal of scientific and technical progress of society as a whole, conditioned by the principles of objectivity and scientific character [2, p.32].

It becomes quite obvious that there is a need to create new pedagogical technologies aimed at forming a different worldview of a person who operates in a modern, qualitatively new information environment, is aware of the essence of the ongoing information transformations and is able to effectively use the accumulated information resources.

An independent task in this case is to teach rational methods of working with information resources, including technology and algorithms for searching, selecting, analyzing and synthesizing information. It should be taken into account that the Informatization of military education is due to the rapid growth of information volumes, which gave rise to a well-known phenomenon characterized by the metaphor "information explosion", accompanied by an information crisis - one of the paradoxes of modern life: when there is an abundance of information in society as a whole, the individual has great difficulties in accessing it and has to overcome a number of obstacles due to the laws of dispersion and aging of information, terminological, language and other information barriers. We believe that overcoming these barriers is impossible without knowing the properties of information and information resources, distribution patterns and ways to access them. Therefore, already at the training stage, a future military specialist should receive information about information, or, to use the term introduced by Y.A. Schrader, meta-information. It becomes obvious that the traditional education system, based on the principles of classical science, cannot play the role of a means of human development of the world.

Thus, the problem of creating a promising system of military education that can prepare future officers for life in a completely new post-industrial civilization is being updated. It should be noted that the level of development and use of information technologies is mainly determined by the level of intellectualization of society, its ability to produce, assimilate and practically use new knowledge, devices and materials, as well as new technologies, i.e. new forms and methods of labor organization, which, in turn, is related to the level of education development.

According to international experts, information technology training can improve the effectiveness of practical and laboratory classes in natural science disciplines by at least 30%, and the objectivity of knowledge control of students by 20-25%. The speed of vocabulary accumulation with computer support for learning foreign languages increases by 2-3 times [8].

Information technologies in education make it possible to solve a number of fundamentally new didactic tasks, such as:

- study of phenomena and processes in the micro-and macro-worlds, inside complex technical systems based on the use of modeling;
- representation of various physical, chemical, biological, and social processes that actually occur at very high or too low speed on a convenient time scale.

Laboratory work using computer models does not require special equipment, which is sometimes unavailable to educational institutions. Telecommunications technologies have opened up completely

new opportunities for students and teachers. Observations of specialists have shown that working in computer networks actualizes the need for students to be members of a social community [5].

For training and objective assessment of students in real time in the disciplines of the military-professional cycle, simulators and computer simulators are used in individual departments. In the training center, under a single methodological guidance, training is aimed not only at mastering individual skills, but also at interdisciplinary training to perform complex tasks for further use. For example, when using automated control systems in the training process, specialists in tactics, engineering, medical support, etc. are involved in the design of combat scenarios. When conducting classes on tactical (fire) training with the use of simulation-modeling complexes, simulation equipment (simulators-dummies, a set of damage modules) is used to practice techniques and skills for first aid and evacuation of the wounded under enemy fire, i.e. the so-called tactical medicine of the battlefield. Options for interdisciplinary training using simulation technologies are developed depending on the training tasks for both students and students of refresher courses for military personnel from the armed forces [3]. Training tasks are adjusted in a timely manner based on the analysis of the experience of troops, their participation in exercises and performance of special tasks, thus meeting modern requirements.

To clarify the component composition in the structure of competence of a trained military educational institution, we turned to the analysis: the first clarification was carried out through the ratio of the concept of "competence" and " competent", the second - through the basic elements of the model of a competent future officer (knowledge and thinking, values, value orientations, methods of activity, personal qualities). As a result, we came to the conclusion that the competence of a graduate of a military educational institution should be understood as an integrative property of the future officer's personality, which allows achieving goals in rapidly changing military professional situations due to the possession of information technologies.

In the structure of a competent future officer, we will distinguish the following components: motivational-value, social-role, cognitive, personal-activity, and reflexive.

When measuring the level of competence of students of military schools were taken into account dynamics of development of motivational-value component of the specific military-professional activity of future officers in terms of information processes in the army (the inclusion of information processes in the Arsenal of professional values; interest to include algorithmic operations with use of the media; the need for professional growth). To determine the level of the motivational and value component, the following methods were used: conversation, questionnaires, and self-assessment. The criteria for the formation of this component are: motives for personal and professional improvement; a positive attitude to military service; awareness of life and professional values.

Low indicators of the motivational and value component of the competence of students of military universities at the beginning of the experiment are due to: the spontaneity of the choice of a military specialty; the lack of a dominant reference point in targeted military professional education.

To develop interest in the chosen military specialty, the need for self-realization in military professional activities, awareness and acceptance of personal and professional values in the military University, in addition to training sessions, extracurricular work was conducted: meetings with former graduates of the University, military unit commanders, combat veterans, participants of the Great Patriotic War.

The growth of the average indicator of the motivational-value component during the experiment was observed over the course of three years of training. The level of competence in the experimental group increased from unsatisfactory to high (from 0.23 to 0.95), in the control group - from unsatisfactory to average (from 0.17 to 0.65), due to the use of information technology in training; studying the course "Information technology in production", working in virtual laboratories, simulators and simulators, passing industrial practice. In the experimental group, a positive attitude to the integrated course "Electrical Engineering" + "Computer Science" led to increased educational motivation in training and the need for professional self-realization. Thus, in the process of information training for the formation of students ' competence, it is necessary to introduce an integrated special course "Special Discipline" + " Computer Science " into the training process, which contributes to the expansion of professional values (Fig. 1).

The socio-role component is an indicator of the quality of military professional training of students and reflects: ability to perform official functions in innovative conditions of military service; product of interaction with colleagues in the course of military service. The tendency of the component development in the structure of students ' competence based on longitudinal research materials was expressed in increasing its level in the experimental group from 0.22-unsatisfactory to 0.79-high, and in the control group from 0.16 - unsatisfactory to 0.58 - average. Thus, the study confirmed the productivity of information training of students, which is expressed by personality traits that ensure productive interaction with colleagues.
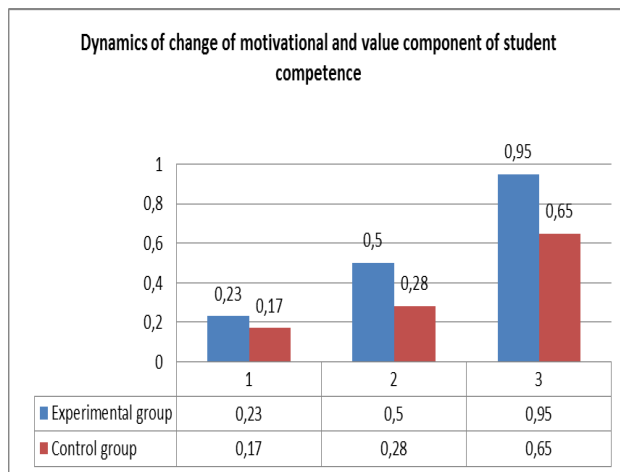

Dynamics of change of motivational and value component of student competence			
	1	2	3
Experimental group	0,23	0,5	0,95
Control group	0,17	0,28	0,65

Dynamics of change of socio-role component of student competence			
	1	2	3
Experimental group	0,22	0,45	0,79
Control group	0,16	0,35	0,58

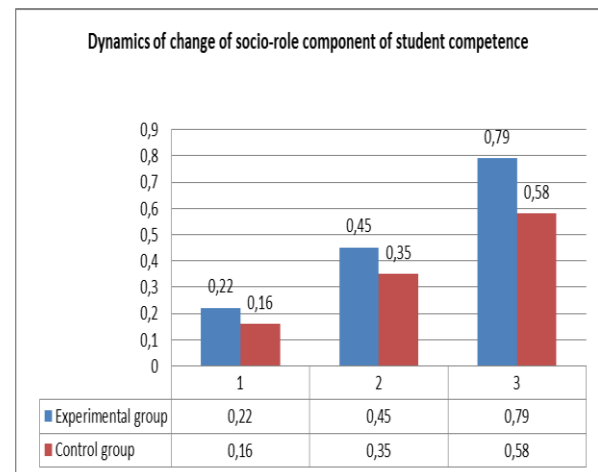**Figure 1:** Dynamics of change of motivational and value component of student competence

Figure 2: Dynamics of change of socio-role component of student competence

Taking into account the results of the study, various methods were used in the educational process to increase the level of social and role-playing component: dialogue and game methods were used; individual work was organized by the teaching staff of the University with students; extracurricular forms of leisure activities were directed to the development of strong-willed personality traits and adequate self-esteem (sports events). The criteria for the formation of the social-role component were: personal and professional stereotypes (reflection of the prestige of military service, translation of its social influence). So, the development of the social-role component in the process of information training contributes to the readiness of students to work in the conditions of Informatization of the army, to the realization of their personal capabilities and successful interaction with colleagues (Fig. 2).

When measuring the level of competence was taken into account dynamics of development of cognitive component, which reflects the level of information of students to military-professional tasks in terms of information processes. To determine the level of the cognitive component, various diagnostic methods were used: observation, conversation, questioning, ranking, testing of students. The criteria for the formation of the component are: special knowledge; the degree of manifestation of positive thinking.

Low indicators of the cognitive component at the beginning of the experiment are explained by the low level of school knowledge of General subjects, insufficient information training of students in secondary school.

In the course of the study, an increase in the indicators of the cognitive component was observed over the course of three years of training. The level of competence of students in the experimental group changed from low to high (from 0.32 to 0.85), in the control group - from unsatisfactory to average (from 0.15 to 0.68), due to the use of information technologies in the educational process (study of the course "Information technology in professional activities", integrated training course "Electrical Engineering" + "Computer science", as well as in extracurricular leisure activities classes in the elective course "Computer science and we", participation in Olympiads in programming and Informatics) (Fig. 3).

Low values of indicators of the personal-activity component at the beginning of the study indicate the lack of experience of military service in future officers; the lack of skills to identify the features of performing military practical tasks using information technology and organize the process of mastering modern means of professional activity.

To determine the level of the personal and activity component of the competence of future officers, various diagnostic methods were used: observation, conversation, questioning, training, and self-diagnosis. The criterion of formation of the personal-activity component was expressed by indicators of professional culture (creativity, purposefulness, mobility, patriotism); independence; readiness for cooperation, communication, interpersonal interaction; individual style of activity in solving military professional tasks (Fig. 4).
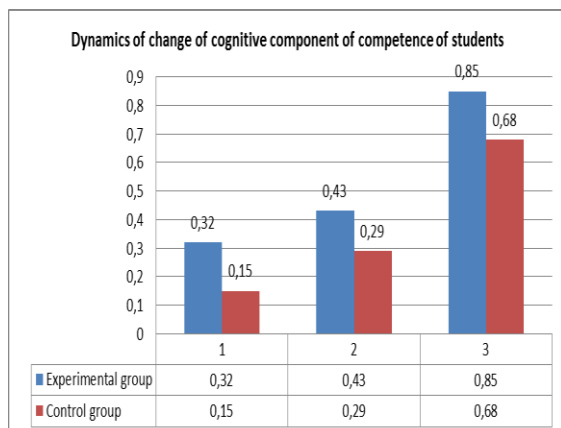

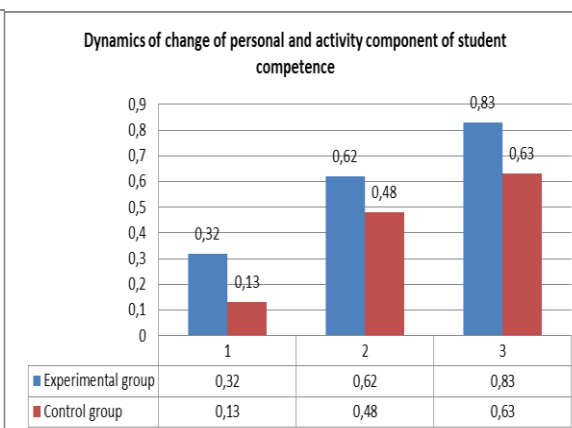**Figure 3:** Dynamics of change of cognitive component of competence of students

Figure 4: Dynamics of change of personal and activity component of student competence

When determining the level of competence of future officers, the dynamics of the development of indicators of the reflexive component, reflecting the ability to analyze the results of their own activities and colleagues in the information educational environment, was taken into account. For this purpose, various diagnostic methods were used: observation, conversation, questioning, analysis of the results of productive military professional activities, self-diagnosis [6]. The criteria for the formation of the reflexive component were: self-assessment of cultural and social activities; awareness of one's own identity and activity stereotypes, knowledge of ways to correct interpersonal interaction; reflexive self-regulation.

Low indicators of the reflexive component at the beginning of the experiment are due to: inability to analyze military service; anticipate possible difficulties, identify erroneous actions; make objective conclusions and summarize the work done.

The development of reflexive abilities of students was facilitated by tasks for self-analysis, adjustment of their professional actions and drawing up a program of self-development using information technologies.

The growth of indicators of the reflexive component of students ' competence was observed over the course of three years of training. The level of competence formation of future officers in the experimental group changed from unsatisfactory to high (from 0.19 to 0.89), in the control group - from unsatisfactory to average (from 0.12 to 0.65), which can be explained by the inclusion of students in the process of mastering the optional course "Fundamentals of officer personality formation", in which theoretical classes are combined with practical exercises for self-diagnosis (Fig. 5).
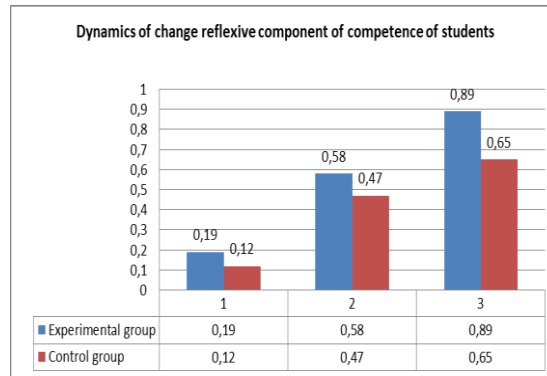
Figure 5: Dynamics of change reflexive component of competence of students

High values of indicators of all components of competitiveness are proved by a hypothetical assumption about the high performance of information training of future officers in the institution of higher military education.

5. Conclusion

The main characteristic of the education system is its dual temporal orientation - both in the past and in the future, which is facilitated by scientific and technological progress, which has a direct impact on the goals, content and methods of education. As a result, the task of modern higher military education is updated - preparing future officers for real military life by eliminating the gap between theoretical knowledge and practical skills, forming their competence and readiness to adapt to the difficult conditions of the modern army. In the conditions of Informatization of the army, and especially the army of the future, the content and nature of the activities of the military are dynamic.

Military activity due to the Informatization of the Russian Armed Forces and new information technologies requires a high level of information culture. In our opinion, it is necessary to create electronic methodological complexes focused on the development of the intellectual potential of the student, on the development of skills to independently acquire knowledge, carry out information and educational activities, various types of independent work on information processing, the use of computer testing, diagnostic methods for monitoring and evaluating the level of knowledge of students.

The results of sudden inspections of troops and the experience of their use have shown the need to strengthen the practical orientation of training, the introduction of a training regime for students and cadets that is as close as possible to the conditions of military service in the troops.

Thus, the development and introduction of new technologies becomes a pattern of social production, and the information society begins to make high demands on the military specialist, his General education and professional level, general theoretical and practical training. As a result, higher military education, as a means of professional development of the individual, is an important factor of intensive development in the Armed Forces of Russia.

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