

Transition of the Russian federation to new educational standard: independent work of students as a factor in the quality of educational process*

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Abstract. The paper is devoted to changes in the organization of independent work of students. These changes are associated with transition of the Russian Federation to new educational standards. In this regard, systemically-active approach to educational process, which is also called competence-based approach, comes to replace the knowledge-based model of education. Independent work of students as one of the main components of the competence-based approach is aimed not only at achieving of educational goals, but mainly on the formation of personal qualities of the future specialist - self-knowledge, self-development and self-realization. These qualities form a new competent person who meets the requirements of the labor market. The research includes consideration of issues such as organization, planning, monitoring methods of self-dependent student work taking into account the requirements of the educational standard.

Keywords: Educational standard; self-dependent student work; competence-based approach; modular method of teaching

1 Introduction

The ongoing reform of higher education in Russian Federation is associated with the transition from learning model to the education model. For the previous one the higher professional education in Russia was based on the model of knowledge, according to which creation of knowledge and skills is the overall objectives of education, where the main

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attention was devoted to the absorption of knowledge. Thus, according to this approach, students receive a huge knowledge base, but do not receive the necessary practical skills.

However, nowadays systemically-active approach to education, which is also called "competence-based approach", comes to replace this model. The main objective of professional education on the basis of this approach is the formation of a competent person, who able to use their knowledge, skills, aptitudes and personal qualities for the evaluation and analysis of the specific professional activity, and knows how to find the best ways and methods of solving the practical implementation of any professional objectives.

It is impossible to solve this problem only by the transfer of knowledge in finished form from a teacher to a student during the process of classroom instruction. Therefore, it is advisable to take most of the time for active independent work of students. Independent work contributes not only to the formation of professional competence, but also provides a methodical process of maturity and self-control of educational activity. This issue is particularly important because it suggests the formation of future specialist professional activity as a subject that capable of self-development, design and transformation of his actions, [1].

To show the importance of the problem under investigation let us consider in detail a robotics learning course. Looking at the robotics learning, one can see a several contradictions. For example, on the one hand the number of hours devoted to classroom work is reduced. On the other hand state standards require to increase the number of taught sections and to deepen their content taking into account individual specialties content. Moreover, students have to study the course of robotics in planned volume regardless of the number of hours devoted to its study in a classroom. In addition, basic training of the most students is poor, so some universities introduce specialized courses on higher mathematics, electrical engineering, mechanics, whose purpose is to fill gaps in some sections, which are necessary for complete study of professional education programs. A similar situation is typical for other disciplines.

There is no proper provision of methodical literature, which contains professionally oriented objectives with the interdisciplinary connections. Thus, in modern conditions of reforming of higher education the proportion of hours devoted to independent work of students must be clearly increased, and thereby some learning material has to be transferred for self-study. Therefore, methodically properly organized independent work of students becomes the actual problem from the first day of classes at the university.

Independent work of students is a system of interrelated technologies at the present stage conversion of high school. These technologies are aimed not only at achieving of educational goals, but mainly on the formation of personal qualities of the future specialist - self-knowledge, self-development, self-realization. These qualities form a new competent person who meets the requirements of the labor market.

Today, the independent work of students is not just a form of the educational process, but it becomes the basis [2]. Its implementation requires a sufficient level of consciousness, reflexivity, self-discipline and personal responsibility. It should deliver some satisfaction to the student as process of self-improvement and self-knowledge, [1,3].

At least half-time of learning is given to the extracurricular work in the modern standards of higher education. However, as international experience shows, the transfer of more hours on self-study is effective only when there exists effective control of the teacher for this kind of work. That is, teachers load should be planned for control of independent work.

Self-study is a type of active work, along with lectures, practical, laboratory and other types of learning sessions and represents one of the educational process forms. Moreover, it can be said that self-study is an essential part of education. Independent work has great educational potential, since it is not only the course of the academic content, but also its

expansion, the formation of the ability for work with different kinds of information, the development of analytical abilities, skills, control and planning of training time , [2]. Independent work of students is enough versatile and involves the following issues:

- Preparation for various occupations: lectures, practical and laboratory exercises, workshops, etc.
- Preparation for the different types of control (the current, a landmark, final et al.)
- Solution of problems and exercises of different difficulty levels outside and during classwork (performance tests, homework, course and diploma projects, etc.)
- Work with the various sources of information (paper and electronic textbooks, teaching aids, searching for information on the Internet, etc.)
- Preparation of essays and reports on a given topic, writing of summaries; preparation for the competitions and conferences, etc.

Self-dependent work of students can be divided into two main types:

- Self-dependent work during the classroom (lectures, workshops, laboratory works, etc.)
- Extracurricular independent work of students in the performance of tasks and challenges of different character and complexity

Thus, independent work of students is a collection of independent activity in the classroom and outside of it, which takes place under the supervision of a teacher, and without his direct involvement. It should be noted, if there is no direct involvement of the teacher, it does not mean that the process of self-study reduces to the form, when self-education of students is organized according to their own will. This process is a systematic and controlled, and therefore, planning, organization and monitoring of students independent work results is an important task of the learning process.

Taking into account the requirements of the federal state standard (third generation) for a successful and effective organization of independent student work a certain number of conditions have to be performed. It should be noted that all the changes described below were used in the robotics course of ITMO University.

2 Management of self-dependent student work using modular method of teaching

The essence of modular training lies on the way students can organize own self-depending work targeted on proposed individual trajectory. The trajectory includes a targeted program of actions, bank of information and guidance for achieving its didactic purposes. Module education has the following advantages:

- Almost all students work independently (some of them with the help of the teacher) and as a result achieve a particular purpose of learning and cognitive activity for knowledge consolidation on a particular subject
- During independent work students increase own level of self-organization, self-control and self-esteem. It gives them the opportunity to determine for themselves the knowledge and skills level, to see the gaps and eliminate them
- During the execution of the module, students usually do not get distracted by extraneous things

Using of modules introduced in high school practice learning can be upgraded with traditional teaching methods. In particular, the following tasks of education are solving:

- Identifying, updating and using of personal experience of students
- Development of student individual cognitive abilities
- Inclusion of each student into the work, which corresponds to the area of its

strongest qualities

- Determination of an individual learning program
- Creation of conditions for self-knowledge, self-determination and self-

realization

- Differentiation of the learning process
- Parity relationship between teacher and student
- Free choice of tasks
- Ensuring of positive results in training and education
- Formation of ability of tasks navigation
- Formation of self-esteem (their capabilities and abilities, strengths and

limitations)

However, it should be noted that a number of the advantages of this kind of learning (reduced training time due to the enlargement of blocks of information, independent research work of students, which forms the skills of self-education, self-organization and self-esteem, differentiated learning, etc.) does not negate some problems that may face the teacher. The biggest difficulty is replication of material, because each student must get their own module. Another problem is that the structuring of educational information requires a huge effort. First, a lot of standard materials and teaching aids have to be revised. Using of interactive presentations is indispensable condition. The next problem is psychological. It is quite difficult for the teacher to move away from the reproductive method of material feeding and from the "do as I do, and not otherwise" principle. It is difficult to present themselves not a "dictator", but a mentor who is always ready to help. Another detail: the use of this method is limited by the type of material - emotionally-shaped or descriptive material is unsuitable.

The practice shows promising of module education, which is characterized by advancing study of theoretical material with the help of the integrated block-modules, algorithmization of training activities, completeness and consistency cycles of knowledge. Tiered individualization and differentiation of educational activity of teacher and students means the situation of choice and provides the possibility of further self-education and professional growth for graduates.

The positive effect of this training is associated with its dynamism, namely, with variation of module elements and content. Objectives inherent for this type of learning are formulated in terms of operation methods, techniques and procedures, and are divided into cycles of knowledge and cycles of other activities. Module education is differed by problematic approach and creative attitude of students to the teaching. Its flexibility is associated with differentiation and individualization of learning through many times repeating diagnostics for determination of the knowledge level, needs, individual learning pace of student activity.

One of the main objectives of module education is a formation of student's skill of self-learning. Therefore, the whole process is based on a conscious goal-setting and decision-making with the hierarchy of the close (knowledge, skills), medium (interdisciplinary skills) and future (development of the individual abilities) goals. Awareness of learning activities means translation of the teachers work from the information mode to the mode of counseling and management. The teacher is released from a purely informational functions, and delegates some management functions to the modular program, which become self-control functions, [7].

The main tool of module education is a modular program consisting of separate modules. The quality of education in general depends on quality of these modules. The modular program is based on the logic of the new knowledge development. The modular program is

a system of means and receptions, which help to achieve the development of independent student's cognitive activity. The logical connection is built in a modular program in accordance with the laws of the assimilation of new knowledge, [4]. Modular programs are built in accordance with the following general principles (Fig. 1):

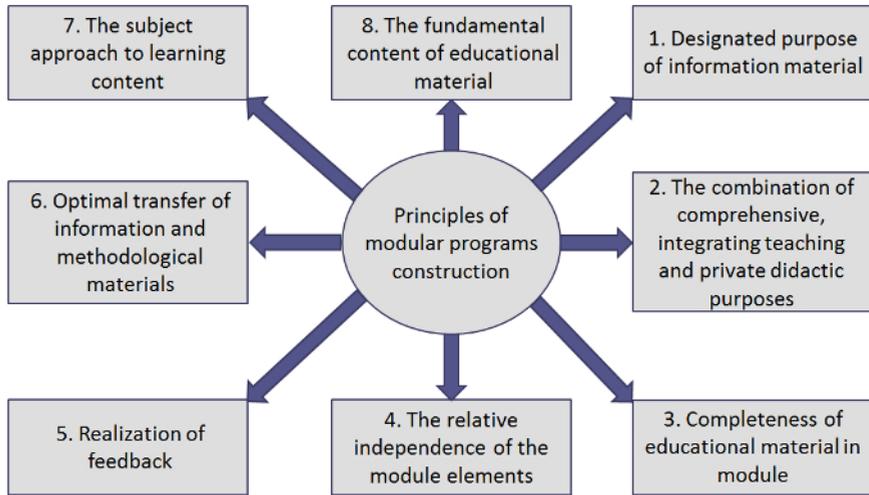


Fig. 1. Construction principles of modular system

3 Improving of organizational and methodical work

Study programs should be made taking into account requirements of learning professional orientation. Selection and presentation of the material have to ensure the achievement of the objectives appropriate to the federal state educational standard for each individual specialty. In formulating of the professional orientation of the educational process problem the proportion of hours devoted to independent work of students should be increased. Particular, attention should be paid to the control of the organization, performance and progress of students' independent work and actions to encourage its qualitative performance. Moreover, the effectiveness of self-study and learning is largely dependent on the active planned and systematic management. The following traditional methods of control retain their importance:

- Input control of knowledge and skills of students, which is usually held at the initial stage of training. For example, it shows the level of basic knowledge level obtained before study at the university
- Monitoring is a systematic check of assimilation level of the being studied material
- Intermediate control, which is usually held after studying a specific section of the course
- Students self-control, which is carried out by students in preparation for the various types of control. Creation of teaching materials to assist students in preparation for the planned test points, a series of training tests on various sections of robotics can be an example. Tests can be given as in paper so in electronic form
- The final control (exam, test, etc.)
- Control of residual knowledge

Test control of knowledge and skills of students are successfully applied, implemented and constantly improved. Test control is quite effective in applying a rating system of evaluation of knowledge and skills. Such a system is introduced and successfully implemented in the learning process at the ITMO University. Rating is an individual cumulative system for assessing of learning achievement of each student. A final exam is carried out after learning course. The exam is taken "automatic" in the case of a certain number of points for effective work throughout the semester. Current control, interim control, final control, etc., as well as checking the results of current progress can be easily implemented in the framework of the rating system. In addition, the organization of test-rating system helps to minimize the time spent on the traditional exam.

Students usually have a positive attitude to the rating system of learning, noting uniform load distribution throughout the semester and removal of "stress-session", which usually occurs during the preparation and during the traditional exam. Thus, such management system contributes to the systematic work of students throughout the academic time and significantly enhances their independent work.

4 Improving the scientific and methodological base

The main purpose of a robotics course in ITMO University is preparation of specialists capable to solve a wide range of professional objectives. Therefore, close interdisciplinary connection is necessary since the first classes in high school. As a rule, if students' knowledge does not fixed by sustained motivation related to future professional activity, students quickly forget them. Thus, a convincing demonstration of the "usefulness" of educational material during lectures, workshops, laboratory classes, independent work of students, as well as methodological guidelines and textbooks for these classes are needed. For example, if a student knows that a particular section of robotics will be useful in everyday work, we can expect a change in attitude to the study of robotics as a subject, and therefore increasing of the quality of their work in the classroom as well as independent work of students. Thus, it is necessary to develop a more thorough and complete training manuals and professionally oriented problem books and implement them into the learning process. First, it is necessary to create problems book in various sections of the object with the distribution of professionally oriented tasks by type and level of complexity. Simple tasks and tasks of medium and high difficulty should be kept in the problems book, that allows to take into account the different levels of preparation of students and individualize work with them. Secondly, it is necessary to create guidelines and to develop techniques for solving such problems and, thirdly, it is necessary to expand the existing database of tasks. Professionally directed tasks can be divided on three levels in developing of such benefits , [5]. Level 1: task-examples of profile courses on knowledge of basic robotics concepts. Such problems are widely used in presenting of the lecture material. Level 2: tasks that require construction and research of the simplest models of robots. Level 3: Research types of problems.

However, the introduction of professional objectives in the course raises the following difficulties:

- The need to study the teacher to specialized disciplines
- The need for sufficient students material possessions in specialized disciplines
- The need for careful selection and adaptation of problems to the learning objectives in the discipline and on a specific lesson
- The need for additional time to solve the problems.

5 Participation of students in creative, research and methodical work

Engaging students to such work should be started with the first course, but rather, from the first semester of study at the university. For example, at ITMO University students are attracted to employment in robotic design office, participate in research projects, participate at various robotic and automatic control competitions, etc., [8, 9 and 10]. However, at the initial stage the engaging can be based on preparation of material for lectures, workshops, laboratory work, teaching aids. For example, it may be a search and compilation of a certain type of professional orientation tasks. In addition to writing essays and reports, which are already included in the independent work of students in the rating system, it is possible to introduce such creative and research tasks, as the creation of educational films, presentations and slide projects on specific topics. This type of work requires a certain perseverance and creativity from students, because in order to create an informative and entertaining film it is necessary to analyze a sufficient number of sources of information (manuals, textbooks, academic journals, and various related sites, etc.) and build logically studied material. Such work should be assessed, for example, in the rating system. Moreover, students must have an alternative: writing an essay or more creative work, which estimated a higher score. One student or a group of several people can be involved in such work in accordance with their desire.

6 Increased consulting and methodological role of the teacher

Students often have questions during preparation for the current, final control or other forms of self-study on different difficulty levels. For solving of this problem it is necessary to enable each student to receive timely advice of the teacher, which will help to intensify the process of learning and exclude non-compliance tasks. For this purpose auditorium and office hours for consulting work of each teacher must be provided. Moreover, note that the consultations should not be compulsory for each student. It is clear that there is no need to come to office hours for students who do not have problems. In addition, teacher can involve "excellent students" to the consulting work, giving them the status of "student-advisors". This issue is supported by the fact gifted students often help and advise their "lagging" classmates. To increase the motivation of gifted students for this kind of work the following items should be executed:

- Providing of instructional assistance
- Encouraging them by "bonus" rating points

So, summarizing the above, we can make the following conclusions. Self-study as a form of organization of educational process plays an important role in modern conditions of reforming of higher education. In this case, the planning, organization and methods of monitoring results have always paid special significance. And it is important to note that the effectiveness of students' independent work as a whole affects the work carried out during the preparatory phase: the development of training and educational materials containing different content and level of complexity of the assignment, guidelines, rational allocation of resources learning activities throughout the school time, the inclusion of creative and research work, application of active control, etc. An important role in the organization of independent work belongs to the teacher, who must at every level explain the purpose of the work, monitor understanding of these goals and the execution of tasks.

Knowledge, not backed by self-employed, can't become a true human heritage. Furthermore, independent work has educational value: it forms the independence not only as a set of skills, but also as a character trait that plays a significant role in the personality structure of modern highly qualified specialists.

During using of e-learning in an interactive learning system of the students a significant progress is marked. Points for the final test is higher on average by 15-20% in comparison with last year, when students have not been trained on this system.

E-course contains a set of software and technical and educational means for promoting individual learning activities of students: a glossary, video tutorials, a sufficient amount of theoretical material disposed within the divisions in an interactive form (which is much easier to find necessary information), tests for each section of the course, assignments for practical work. The success of the e-learning use consists of the maximum degree of individualization of the educational process, permanent monitoring and effective student management. Elements and setting of a course motivate students for self-dependent study of discipline.

Thus, to solve the above problems it is necessary:

- Wide implementation and use of modern educational technologies, which enable the teacher to obtain the most complete picture of the individual abilities of each student, and thus increase their effectiveness in shaping the personality of the future specialist
- Increasing of the students motivation for involvement in the learning process, due to the fact that cognitive motivation encourages students to develop their skills in the design and impacts on the disclosure of its creative potential, the formation of personal qualities. The development of cognitive-target component contributes to the reorientation of interests, activating abilities of students, creating the preconditions for the successful implementation of the project activity, which is directly connected with the organization of independent work
- Improvement of the efficiency of individual work with students, allowing to identify the actual level of knowledge and at the same time teaching them to work independently, use of educational and scientific literature. This issue provides free navigation in the information space that is a major component of education
- Paying attention to the development of young people, from school, independent work skills, the ability to use educational and scientific literature, to freely navigate the information space.

7 Conclusion

The paper describes changes in the organization of independent work of students. These changes are associated with transition of the Russian Federation to new educational standards. All innovations presented in the study were tested in practice in ITMO University in the course of robotics. The results have showed improvement of student performance on average by 8.7%. Moreover, the interest of students to the course is significantly increased. In the future we plan to expand the obtained results for the whole educational system in ITMO University.

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