

The Formation of Students' Self-Organization Skills in a Technical University

*Tatyana N. Kochetova*¹, *Yanina G. Stelmakh*¹, and *Natalia Y. Tihanova*^{2*}

¹Samara State Technical University, Molodogvardeyskaya str., 244, Samara, 443100, Russia

²Bauman Moscow State Technical University, 2nd Baumanskaya str., 5/1, 105005, Moscow, Russia

Abstract. The main components of self-organization and its implementation stages are identified against the background of determining the importance of self-organization skills mastery by technical university graduates for the successful implementation of educational and future professional activities. Based on the social demands generated by the need to form general cultural and professional competencies in the learning process, the necessity to organize students' independent work in such a way that it motivates self-organization and, as a result, self-education is confirmed. It is proved that the transformation of students' independent work should be carried out regularly, taking into account the changes taking place in society, using modern information technologies as a kind of organizational resource. In order to reduce time expenditures in the process of updating the educational material for a particular discipline, it is proposed to establish the relationship between the components of the educational process by identifying intersubject communications, which are considered as a means of achieving the applied orientation of the discipline, at the stage of selecting the necessary information. The formation of students' self-organization skills has been carried out on the basis of data from a frequency analysis of the network information sources. The results of frequency analysis and statistical processing of experimental data show the ability to make a forecast about the weight of specific topics for future professional activities, which will allow to distribute study time correctly. The use of established intersubject communications of disciplines and the fulfillment of the selected conditions contribute to the development of students' educational activities self-organization.

1 Introduction

In modern society the educational process in higher education requires significant changes due to a reassessment of values and changes in socio-economic and political paradigms. The improvement of the educational process follows the line of changing its content - educational programs for training students, as well as forms and methods of educational activity and its control. In this regard, the scientific and methodological support of the educational process should be formed taking into account the transformation of the

* Corresponding author: tikhanov@bmstu.ru

student's position from the learning object to the conscious subject of educational activity. In the course of training, young specialists should develop not only knowledge and skills that will enable the graduate to be effective in the future profession, but also the ability to be familiar with the related areas of professional activity.

The education quality, revealing in its effectiveness and efficiency today, when a significant part of the work on educational information is transferred directly to the students themselves, depends on the level of students' self-organization of educational activities.

The analysis of psychological and pedagogical research allows us to state that the ability to organize educational work independently is one of the aspects of education self-management, as it makes it possible to plan and estimate rationally, correct timely and improve the process itself, as well as the results of educational activities. Moreover, the formation of skills to manage their own educational activities inevitably occurs against a background of increased activity in the student's behavior.

The relevance of the studied problem – the skills formation of students' educational activities self-organization during the training organization at a technical university is manifested in the fact that self-organization, as an essential component of the educational process organization system, provides an improvement in the education quality, reflecting the state-dictated requirements for its modernization on the innovative society formation.

The purpose of the study is to determine the importance of self-organization for the professional training of the students from a technical university on the basis of a multi-aspect consideration of the self-organization phenomenon, to establish factors that influence the process of self-organization skills formation and to make suggestions on developing the ability of students to organize their educational activities independently.

2 Main part

The professional formation of a future specialist is impossible without the formation of self-organization skills today.

The term "self-organization" first appeared in 1947 in the scientific publication by W.R. Ashby "Principles of the Self-Organizing Dynamic System". In 1970-1980s, it has been widely used in the physics of complex systems as a process of ordering elements of one level in the system due to internal factors without external special influence, as a result of which units of the next qualitative level arise. M.Ya. Basov became the first developer of a multilevel concept of organization of behavior, psychology of activity and personality psychology - the subject of such activity in Soviet psychology.

The phenomenon of self-organization is considered in application to various aspects of educational activity, from the formation of the skills of its rational management to the self-realization of a person in the educational process in numerous Russian and foreign studies. However, there is no well-established definition of the term "self-organization" in the psychological and pedagogical literature. Self-organization is defined both as a person's conscious work on himself to improve intellectual and emotional character traits, and as the ability to adopt the experience of previous generations in the field of rational organization of mental work, and as a process of conscious and purposeful construction of his personality. The versatile definitions of self-organization show that the authors focus on its features, which, in their judgment, seem more significant.

One can also trace the inconsistency of ideas regarding the composition and structure of self-organization. From the view of the activity approach to the study of self-organization, the substrate-functional and structural-functional approaches may be distinguished. Adherents of the substrate-functional approach identify and analyze the individual components of the self-organization process, while proponents of the structural-functional approach study the relationships between the functional components of the self-

organization process. In a personal approach, researchers are focused on identifying the components that form organization as a mental quality of a person: intellectual abilities, attitudes and motives, value orientations, socio-psychological characteristics, etc.

In this study, self-organization will be understood as the activity of the subject of training, which is motivated by the goals of self-government and the improvement of the educational process and is aimed at the rational organization of educational work. As an indicator of a person's maturity, self-organization is determined by a combination of biological and personality traits acquired in society, embodied in the intellectual and volitional spheres of mental activity and realized in an independent organization of one's own life.

Self-organization is manifested in the student's ability to organize educational activities rationally and complete tasks gradually, to take into account intermediate results in order to carry out correction of educational activities and improve its organization on the basis of the conscious application of knowledge, skills and abilities. The educational activity itself is a specific kind of human behavior aimed at obtaining certain knowledge, abilities and skills as the basis of future professional activity, as well as the development of personal and professional qualities necessary for such an activity.

Based on the above-mentioned understanding of the self-organization of educational activity, six general skills, that are expressed in abilities, may be identified:

1) To set and realize educational goals during curriculum disciplines studying and to be recognize the ways to achieve the set goals - to be recognize the particularities of the learning process at the university, to determine the ultimate goal of learning and how to achieve it, to divide the final goal into intermediate goals, to determine the purpose of training in a separate lesson, to present ways to achieve the ultimate goal, as well as each intermediate goal and learning objectives in a separate lesson, to predict the results of self-organized educational activities;

2) To analyze the situation and to formulate a problem that must be solved in the process of one's own educational activity on the basis of analysis;

3) To draw up a plan to solve the problem and formulate the tasks - to highlight the structural components of the educational activity, design the phased implementation of the educational activity, formulate specific tasks, plan the time, taking into account the tasks with the need for personal development and relaxation;

4) To control activities in accordance with specific tasks and solutions;

5) Estimate the consequences and outcomes of solving problems and achieving goals - record the results of training activities and compare them with the intended goals, diagnosing difficulties and errors, analyze the causes of deviations from the planned result, determine ways to eliminate the identified shortcomings and consolidate the positive results;

6) The ability to adjust the implementation of educational activities and improve the organization - to change the components and (or) the content of educational activities in accordance with the current situation and own capabilities, to identify strengths in the independent organization of educational activities and to rely on them in the future, to identify weaknesses in self-organization and consistently eliminate them, carry out work to improve the process of organizing own educational activities, based on understanding and application knowledge and skills.

The general degree of self-organization skills of students' educational activities can be estimated on the basis of the degree of development of all components of self-organization in the complex.

A high level of self-organization indicates the student's ability to set goals consciously and independently, to analyze the current situation, to design work to achieve goals, to monitor and evaluate the implementation of the stated tasks, and also to adjust and improve

behavior, that is, to respond to any changes adequately and promptly. The level of self-organization affects the ability to master new activities and the degree of confidence in unfamiliar situations.

It is difficult to overestimate the importance of student's self-organization skills as an individual and as a future professional:

- significantly reduces the inherent resistance of all students to the pedagogical impact and increases susceptibility to pedagogical requirements,
- activates all types of activities, encouraging them to exert counter efforts for their learning and development;
- significantly facilitates the work of the lecturer, freeing him from the need to force and hurry;
- contributes to the pursuit of self-knowledge, self-determination and self-realization;
- develops sense of responsibility for one's own actions or inaction, contributing to a healthy socialization of the individual.

The formation of each component of self-organization of a future graduate can be considered as the basis for his personal development and achievement of success in the professional field. Here it is a transition to a qualitatively new level of behavior, based on a creative approach to the implementation of not only educational and future professional activities, but also self-education.

During the development of market relations and under the influence of scientific and technological progress, when the disclosure of the country's intellectual potential, the competent use and implementation of creative products in production are considered as the main condition for the innovative growth of any state and increase the level of well-being of the population, the special importance of creatively oriented behavior is the possibility and necessity implementation of scientific and technical activities. Scientific and technical activity is a special area of society, aimed at meeting its needs and expressed in the manifestation of human mental abilities, aimed at finding new knowledge. Scientific and technical activity can be expressed in creating new scientific results and technical innovations, introducing the results of new developments (organization of technological and production processes, conducting marketing research, etc.), alienating or transferring intellectual rights to the results of scientific and technical activities (conclusion of license agreements, franchising activities, etc.). The ability to organize economically justified activities of a scientific and technical nature competently depends on the ability to self-organize subjects of study, primarily technical universities. Therefore, the attention should be paid to the development of students' regulatory skills in future professional activities.

The stages of educational activity self-organization are divided in the literature on the base of the study of the psychological and pedagogical features of educational activities and self-organization: orientating-targeted, theoretically prognostic, design-constructing, technological, evaluative-reflective and corrective.

At the orientating-targeted stage the goal of educational activity is recognized and concretized, based on which the goal of self-organization is designated and its results are predicted. At the theoretically prognostic stage the state and conditions of the educational activity are analyzed, problems are diagnosed, and the dependence of the results of educational activity on the organization of its process is established. At the design-constructing stage, the planning process of the educational activity and the design of its self-organization is held. The technological stage consists of the actual implementation of a certain way of organized educational activity with constant monitoring of the progress and results by the student. The evaluative-reflective stage is characterized by evaluating the work done in terms of the student's reflective position. At the corrective stage, shortcomings in the academic work are eliminated, ways and methods of improving self-

organization on the basis of theoretical understanding and creative application of knowledge, skills are outlined.

Improving the education quality in the higher education is impossible to imagine without developing a system for acquiring students' skills in the independent organization of educational activities that will allow them, taking into account the person's individual characteristics, to spend their energy rationally and organize their life activities in the most optimal and most effective way purposefully. All this consists in the ability to goal-setting, competent planning of time for the future (short-term, medium-term and long-term).

Self-organization is focused on managing oneself during the achieving consciously set goals and objectives. As a mental quality of a person, self-discipline involves initiative, autonomy, perseverance, independence, responsibility and is a necessary element of professional functioning and self-education. In this regard the following signs of self-organization can be considered:

- independence and controllability,
- the coincidence of personal goals with the goals of the activity,
- compliance of the individual's internal qualities and the external conditions of the activity.

The process of mastering the skills of self-organization is based on the need to show persistence and will, based on the true belief that the independent organization of educational activities is an integral part of the educational process.

In this regard, it is impossible to ignore the problem of the cognitive needs' formation, and from it - the problem of motivation for self-organization of educational activity. The motivation formation should be carried out based on the characteristics of the educational process content in a particular university. The motive for self-organization of educational activities, in its turn, is determined by the internal motivation to carry out educational activities. Whatever extent the student will strive to be persistent in mastering the educational program, to what extent he will present himself as a self-organized successful person, capable to goal setting and competent actions planning within the educational process.

In psychological and pedagogical studies, touching upon the problem of motivation for educational activity by one or another way, the connection between the motivation of the subject of training and the level of skills mastering of independent organization of educational work has been confirmed repeatedly. At the same time, there are doctrinal developments to identify patterns of self-organization of personality, classification and separate consideration of cognitive and social motives, their psychological characteristics, etc.

One of the differences between the educational process in a university and the educational process in secondary school is the student's independent responsibility for organizing his educational activities. Therefore, he should be motivated to gain knowledge, skills, to develop competencies necessary for the implementation of professional functions.

The complexity of the motivation is explained by the fact that the student is encouraged to learn not by only one, but by a whole complex of motives. At the same time, lecturers of higher education often do not consider the formation of motivation and self-organization as an integral property of a person. Using existing recommendations, university lecturers should learn to convince the students to understand themselves as an independently programmable intelligent beings, capable of developing essential forces and achieving success.

Analysis of theoretical studies regarding to the results of surveys among students studying in Russian universities suggests that students experience great difficulties in self-organization of independent work. Difficulties in self-organization may be associated with the inability to "force" oneself to sit down at work and not be distracted from it, as well as

the choice of information sources. At the same time, the exactingness of the lecturer and the strictness in assessing knowledge, abilities and skills always change the students' attitude to independent work, developing discipline for the better, but without affecting the formation of self-organization skills significantly in our opinion.

The education of students in any field of training (specialty) involves the formation of certain competencies (general cultural, professional, etc.), which determine the most effective implementation of future professional activities according to the federal state educational standards of higher professional education (FSES HPE). In addition to knowledge, abilities and skills, the content of competencies includes personal qualities that also contribute to the quality implementation of professional functions, which, in their turn, are determined by the goals, objectives and requirements of the corresponding production sphere. For example, the discipline "Mathematics", included in the number of compulsory disciplines of the Federal State Educational Standard of Higher Professional Education in numerous areas of training (specialties), is a necessary tool in most areas of professional activity. In relation to the training program 131000 (Oil and Gas Engineering), the goal of studying the discipline "Mathematics" for students is to master the mathematical apparatus in order to analyze, model and solve applied tasks. At the same time, the formation of competencies (general cultural and professional) necessary for the implementation of the production and technological, organizational, managerial, experimental research and design activities of the future graduate is envisaged. Such competencies, in particular, may include:

- the ability to generalize, analyze and perceive information;
- the ability to acquire new knowledge independently using modern educational and information technologies;
- the ability to set a goal and choose ways to achieve it in the conditions of formation and development of the information society;
- the ability to master the methods of constructing the simplest mathematical models of typical professional tasks;
- the ability to apply a systematic approach and mathematical methods in formalizing the solution of applied tasks;
- the ability to use the mathematical apparatus for solving computational and analytical problems arising during professional activity.

As it can be seen from the example of mathematical training, readiness for a competent professional activity implies the formation of motivation for its effective implementation, the creative solution of tasks, which convinces us in the importance of acquiring self-organization skills, first of all, educational activities once again.

All this leads to the conclusion that students' independent work must be organized in such a way that it forms a cognitive need, the purpose of which is to develop motivation for self-organization and self-education, the desire for competent and creative use of information during solving professional problems.

Taken into account that the development of self-organization processes is significantly affected by the transformations in society, it is necessary to review and transform independent work for the organization of students' activities in the study of educational programs, viewing modern changes in society. Educational programs optimized in this way should be updated for each new academic year, with consideration to the development of engineering, technology, science and economics. The success of this kind of activity directly depends on the professionalism and motivation of the lecturer-developer, which confirms the need to create in each university a working mechanism for managing the growth in the quality of educational services [1,2,3], including expanding the intellectual infrastructure of the university [4] and creating conditions for teachers to master intercultural communication skills in their professional activities [5].

Socio-economic changes led to the emergence of a specific organizational resource associated with the use of information technology and aimed at improving the efficiency of the educational process [6]. Everywhere, being introduced into the system of professional training, information technologies are aimed at forming professionally and socially competent person [7], including one possessing the skills of creative manifestation and self-organization in various types of activities [8,9]. With regard to the development of the ability to organize educational activities independently, it is difficult to overestimate the importance of information technology in terms of ensuring the visibility and accessibility of teaching material [10,11], as well as interaction and productive communication of the student and the lecturer [12].

The introduction of information technology and the growing demand of society for the continuous provision of modern information have led to the emergence of an information space that contains a large number of useful resources that can assist in obtaining new competencies [13]. The modern information space is a multidimensional structure, which is characterized by an increase in the interested audience, which must be correctly used when updating educational programs. The Internet provides large amounts of information [14] on the profile of the technical departments of the university. Updating of the educational material in disciplines requires considerable time, therefore, during the necessary material selection, we establish relationships between the components of the educational process, distinguished by the basis of their correspondence to the academic discipline using statistical methods for the quantitative assessment of text material. We will establish the relationship through interdisciplinary connections that allow the interaction between a methodologically competent combination of several different programs and combine it into a single whole and determine the integrity of such a basic characteristic of education as the content [15]. Thus, the interdisciplinary communications will act as a means of achieving the applied orientation of the discipline, and to identify them as a means of quantitative assessment, you can use frequency analysis to determine not only quantitative, but also qualitative relationships that will reveal the meaning of the studied concepts and disciplines [16].

It is convenient to carry out updating the curriculum and selecting the necessary training material for organizing independent work according to the plan and developing students' self-education skills on the base of a frequency analysis data of network information sources for the studied profile. In this case, it is necessary to take into account the frequency and repeatability of the basic concepts and terms of the discipline for which the program is prepared in scientific and technical texts, and their use in the professional field. The results of the frequency distribution of special terms and concepts in the analyzed information sources allow us to make conclusion about the presence or absence of intersubject communications.

Based on the results of frequency analysis and statistical processing of experimental data, there is an objective opportunity to make a forecast about the weight of specific topics for future professional activities and will allow to distribute study time correctly. The proposed technology for calculating the volume of disciplines intersubject communications includes a number of interconnected elements: information retrieval (the choice of network sources of information significant for the discipline); expert (the formation of a thesaurus of the studied discipline); process (frequency analysis of information sources); reflective-productive (processing of experimental results, forecast) [17].

At the information retrieval stage, ordering and selection of information sources by discipline profile is carried out. To conduct a frequency analysis, we need electronic educational and research texts. The increase in the volume of analyzed information sources makes the forecast more accurate in terms of the significance of topics and sections of the studied course and discipline for future professional activities, which today can be done

using Internet resources. For the selection of Internet resources, firstly, one need to pay attention to the repositories of the university, which presents electronic archives of publications and full texts of publications of lecturers engaged in educational and scientific activities on a given topic. Secondly, to examine the sites and Internet portals that represent the most significant resources (the list is presented in the literature section of each program). Thirdly, to analyze the sites of specialized periodicals, where the journal electronic versions can be found. The second stage is the definition of a thesaurus with a complete list of the basic concepts and terms of the discipline (the thesaurus may include not only individual words, but also stable phrases that reflect their belonging to sections of the course or studied discipline). The third step is to use programs for the text frequency analysis, which are freely available or write a program for this purpose by yourself and conduct a text frequency analysis. As a result of the analysis it will be possible to obtain experimental data on the frequency of mentioning words from the thesaurus of the discipline in the information array of the studied industry sources of information selected at the first stage. At the last stage, the statistical processing of experimental data is recommended. It is aimed at constructing a mathematical model that allows to perform substantive analysis and quantitative characteristics will be able to establish intersubject communications of the studied disciplines. The obtained results make it possible to make a forecast about the need to include a particular topic in independent work, taking into account its' weight in future professional activities, which will contribute to the holistic professional development of a specialist in the context of a movement towards a knowledge society [18].

The success of solving the task of developing self-organization skills also depends on the pedagogical conditions that will be applied during the organization of the educational process.

For the formation of self-organization skills, it is necessary to create the following pedagogical conditions:

- focus students on the application of the topic in the curriculum disciplines of the chosen training program;
- to use professionally-oriented tasks and tasks, in which it is necessary to set a goal, to identify problems, to draw up a plan for solving the identified problem and to summarize the goal achievement, during lectures and practical exercises;
- to maximize individualization of training, based on gender differences in students' thinking [19,20] and their professional self-determination [21,22].
- to organize the independent work in such a way that, based on the theoretical material and independently acquired information, a project for participation in a scientific conference may be created.

The student's development in this regard should be a phased movement under the guidance of a teacher to self-directed learning, and from it – to self-education [23].

The proposed technology for calculating the volume of intersubject communications has been tested at Samara State Technical University at the Department of Higher Mathematics and Applied Informatics. The statistical processing of the frequency analysis results made it possible to determine the most significant topics and sections for the students future professional activity - future engineers of the studied industry, which made it possible to make adjustments to the students' independent work.

For the examination of independent work and self-organization of students, an experimental study has been conducted. Students of two groups in the amount of 54 people take part in it. In order to find out the degree of students' preparedness for studying at the university, the testing has been carried out according to the program of the school course in mathematics. According to the test results, it has been found that both groups (control and experimental) at the same level include students with higher and lower knowledge and

skills in the subject. This fact indicates the equality of the selected groups. Further, in the experimental group, at lectures and practical exercises in mathematics, the above conditions for the formation of students' self-organization skills have been created.

In this study, at an intermediate control (exam), students not only solved standard mathematical tasks that determined the level of knowledge in mathematics and professionally oriented problems, but also tasks in which they needed to set a goal, identify a problem, draw up a plan for solving the problem found and summarize the goal

To estimate the level of students' self-organization, the questionnaire by A.D. Ishkov (2004) "Diagnostics of the features of self-organization" [24] was used, which made it possible to identify individual characteristics of self-organization. Questionnaire by A.D. Ishkov contains one integral scale (level of self-organization) and six private scales indicating the level of development:

- volitional efforts - the personal component of self-organization,
- goal-setting, situation analysis, planning, self-control, correction - functional components of self-organization.

As a result of the experiment, 83,6% of students in the experimental group completed the test, 70% correctly solved professionally directed problems, and 57,6% completed tasks in which it was necessary to set a goal, formulate a problem, set tasks to solve a problem and solve them. By the method of A.D. Ishkov "Diagnosis of the peculiarities of self-organization" 63,1% of students showed a high level of self-organization of educational activity. Students in the control group completed the test predominantly (78%). In this test it was necessary to solve standard problems from a mathematics course. Only a part of them solved professionally-oriented tasks (42%), and only 18% completed tasks in which the manifestation of regulatory skills was required. And only 48% of students in the control group showed a high level of self-organization of educational activity according to the method of A.D. Ishkov (2004).

3 Conclusion

The study of psychological and pedagogical literature and our own research on the problem allow to regard that self-organization is an important component of the educational process. The degree of self-organization skills formation among students positively affects the effectiveness of educational activities, expanding the possibilities of successful self-realization and creative expression in future professional practice.

Self-organization skills should be systematically and purposefully formed from the very beginning of studies in higher education, bearing in mind the inextricable link between self-organization and motivation for learning activities. The more the subject of training will be interested in mastering the vocational educational program, the higher the level of self-organization will be.

Students' independent work should be organized in such a way that it may form a cognitive need, the purpose of which is to develop motivation for self-organization. The results of the study indicate that the use of frequency analysis in determining intersubject communications of disciplines in the chosen program training and the selected conditions for the organization of the educational process contribute to the development of self-organization of students' educational activities. The effectiveness of the selected conditions is confirmed experimentally.

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