INVESTIGATING THE BASIS FOR DESIGNING FUNCTIONAL MODEL OF RESEARCH TRAINING OF STUDENTS IN TECHNICAL UNIVERSITY

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Abstract: the significance of the issue under investigation is molded by the ebb and flow inconsistency between the general public interest for skilled designing staff arranged for research exercises and poor advancement of the hypothetical and deliberate premise of understudies' examination preparing. Characteristics of building exercises, reconciliation of a skill approach into designing instruction, reception of instructive and word related measures result in a shiny new way to deal with understudies' preparation and achieve a requirement for an encouraging model focused at planning graduates for research exercises. The point of the article is to settle the issue of creating and executing the useful model of understudies' exploration preparing with regards to capability situated building training that would characterize the substance of inventive didactics and permit to achieve the objectives set in designing instruction. This paper organizes, singles out, and creates flow ways to deal with tackling the issue of research preparing of specialized college understudies that add to the improvement of a methodological structure of this arrangement as a useful model. Empiric strategies (surveying, perception, interviews, testing, self-evaluation, record audit, investigation of expectations, instructive structure) empowered examination of the development dimension of research fitness of first-year understudies and graduates before the beginning of the trial, after each phase of the trial and toward the finish of the test. 1,520 people were locked in, including 1,390 understudies and 130 educators. The instructive examination was focused at assessing practical model execution by distinguishing changes in the development dimension of the understudies' exploration skill. Results have been confirmed by method for a measurable examination based check utilizing scientific measurements criteria. The exploration preparing practical model expounded and actualized empowers undeniable satisfaction of the prerequisites of instructive and word related principles, cultivates the innovative advancement of understudies, their examination capacities and useful research abilities as all inclusive methods for association with the outside world. Article materials might be useful to the showing staff of designing colleges, experts in instructing, hypothesis and techniques for word related training and expanded training framework.

Key words: research activities, research competence, engineering education, functional model.

1.Introduction

The problem of developing research competence in students at the modern stage of engineering education development is among the most relevant ones. Its relevance is due to the growing demand for competitive engineering staff willing to actively participate in innovative engineering processes, develop new ideas, settle research production tasks, able to think and make “out-of-the-box” decisions and engaged in investigative behavior. Quality of engineers is one of the key factors behind the state’s competitive power, the basis for its technological and economic independence [10].

According to the National Doctrine of Engineering Education of the Russian Federation [15], its main direction of development is the special arrangement of students’ work as part of comprehensive multidiscipline practice-oriented teams, engagement in active creative work, creation of practice-oriented modes of study, assurance of participation in research and educational activities [9]. Peculiarities of engineering activities, integration of a competence approach into engineering education, adoption of Federal State Educational Standards of Higher Education (FSES HE), occupational standards result in a brand new approach to students’ training and bring about a need for a teaching model in a technical university targeted at preparing graduates for research activities. It has to be used as the basis for innovative didactics of a technical university, which helps implement FSES HE, establish a set of competences, foster the creative development of students, their research capabilities and functional research skills as universal ways of interaction with the outside world.

2.Study methods. Theoretical (study, analysis and synthesis of educational, social, engineering, economic reference literature on the matter in hand; review of the study subject; educational process simulation; summation of study results); empirical (review of normative documents, observation, interviews, testing, self-assessment, review of documents, study of deliverables, educational design); experimental (educational experiment, methods of statistical analysis of the results).

3.Study results and their discussion

3.1.Basis for design of the functional model of research training

Considering a number of issues observed in engineering education in Russia, practice analysis has shown that increase in industrial output, development of innovative technology, research and development has exposed an acute lack of specialists capable of designing and introducing competitive equipment and technology, proficient in modern technology and targeted at research activities in their jobs. Discrepancy between the professional competences acquired by technical university graduates in the course of study and stricter requirements of high-tech enterprises, research institutes and design organizations is one of the main inconsistencies of the Russian higher engineering education. The main hindrance to innovative economic development is the deficiency of qualified staff. As a result, "despite quite high and often excessive number of engineering graduates, the business demand for high-quality specialists is not met. According to monitoring data, "a share of employed university graduates does not exceed 40%" [11].

Transition to innovative economy, design and dissemination of complex man-machine systems and social engineering has brought about a qualitative change in engineering and turned it into a comprehensive drive of society's technology transformation. These changes and the pace of development will only grow stronger with time. Analysis of occupational standards, engineering activity structure, set of common cultural and professional competences has revealed that the research nature shows itself as the leading component of engineer's activities, labor functions identified in combination with required skills have a research component (focus) and determine the need for preparing technical university students for research activities, the indicator of which has to be an established research competence of graduates. The "Concept of the development of research and innovative activities at Russian universities" [6] says that new skilled workers have to be oriented at future technology, study of problem situations and finding technically adequate solutions.

The pragmatist focus of engineering education, the idea of which has been used as the methodological framework of our concept, implies as follows: students' review of the essence, content, peculiarities of engineer's research activities; introduction of research elements in teaching and studying all the classroom disciplines set out in curricula; use in teaching of the methods that foster research activities and creative thinking in students; retargeting teaching and tutorial activities of the teaching staff at particular contribution in the comprehensive and holistic teaching of students. Preparation for research activities ensures value-based attitude to research; promotes the ability to identify the lack of information and enables the acquisition of new knowledge to settle research tasks in engineer's professional activities on the pragmatist level.

Theoretical engineering thinking is targeted at discovering new laws, principles, regularities, rules of design and operation of devices, mechanisms, processes, etc. Practical thinking is engaged during activity to transform reality. These ideas were developed by A.A. Verbitsky who offered a context-based approach targeted at teaching people to find knowledge and use it in the situations that simulate real-life professional situations. "To this end, one needs to consistently simulate the content of specialist professional activities in student activities in terms of their subject-technology (subject context) and social components (social context) [3]. When developing the model, these provisions helped us proceed from the idea that an engineer has to have comprehensive thinking with both theoretical and practical focus. Learning has to establish a pragmatist position promoting the experience of the holistic systemic view of professional activities, research actions in it and the ways to settle new research problems and tasks.

With all the importance of special educational exposures, the research training process is based on the student work techniques brought close to real-life engineering activities. Here, one has to consider a possibility of each student's involvement in the active cognitive research process targeted at independent activities, practical application of the knowledge obtained and clear understanding of where, how and for what objectives it may be used; possibility of teamwork when settling various problems involving not only a teacher, but also peers; possibility to get free access to information in order to establish one's own independent and substantiated opinion about the problem [5].

We viewed the structure of research training of students as a system of various forms of arranging student activities. Educational and cognitive activities act as a process of settling training tasks targeted at learning regularities, principles, production setup methods and mastering of fundamentals of working operations. Practical activity is characterized by the process of settling the tasks of practical use of theoretical knowledge when tackling practical tasks. Independent activity is the process of settling research tasks based on acquired knowledge and skills (students' learning and research, students' research, theory of inventive problem solving, etc.).

All activities are interrelated: when acquiring knowledge, student use it to solve practical problems, settle research tasks, while practical activity includes observation of manifestations of technical and technology regularities, knowledge interpreting and summarizing. A backbone component of the system is students' practical activity since it synthesizes cognitive, practical and research components of future engineers' activity; it is arranged on curricular and extracurricular classes and during practical training. Students develop the methods of solving research tasks stepwise: first, they use information receptive methods; next, they master practical activity techniques by repeatedly using them in a similar situation in order to develop skills and abilities. In order to gain experience in creative activities, students face new problems and the scene shifts to the inner (intellectual) form.

We pay special attention to the didactics of solving research tasks with task assignment and assessment of given conditions; definition of result requirements; research planning (search for ideas), selection of research methods and determination of the structure of actions, verification of results, their evaluation (Figure 1) [4].

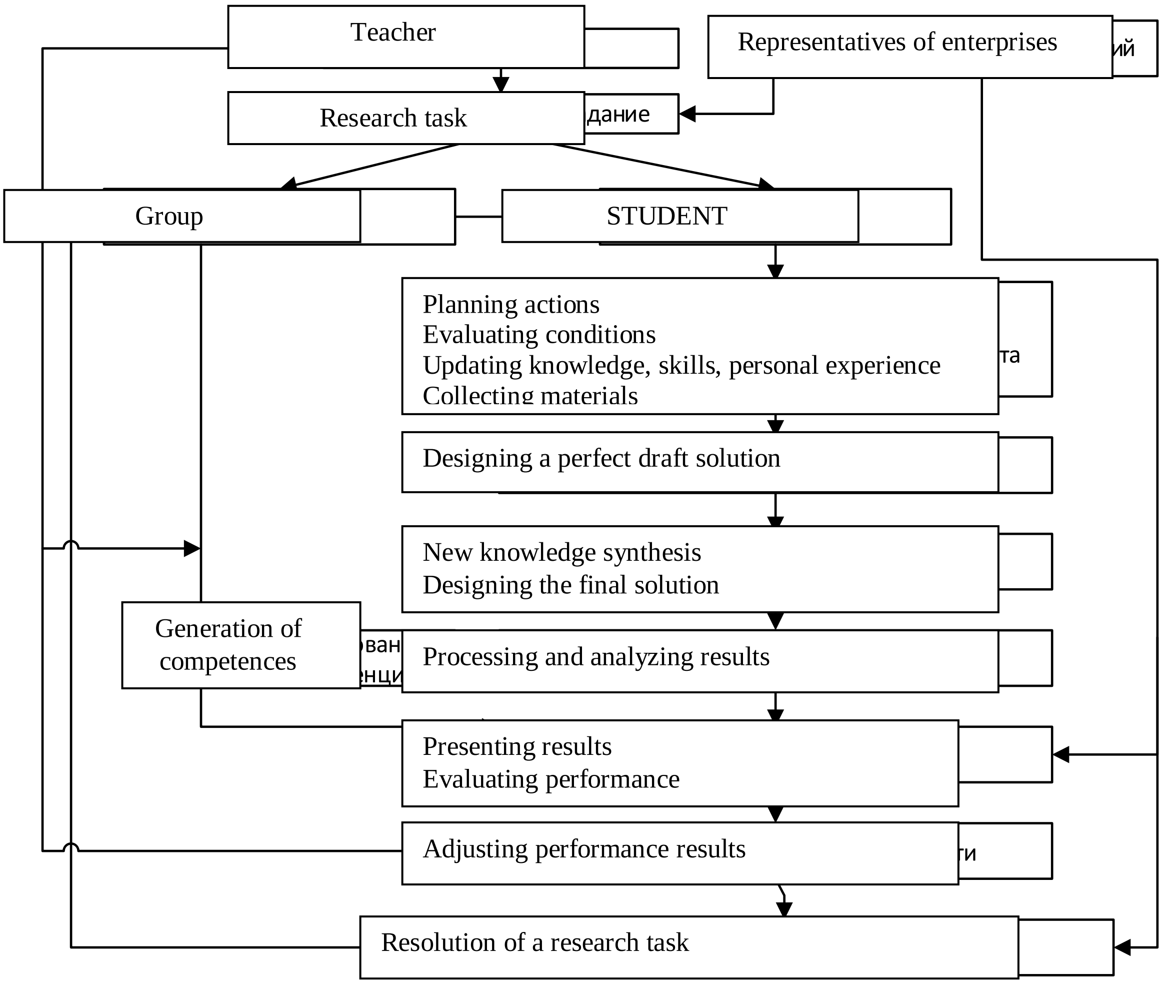

Figure 1. Student's flow chart when performing a research task

When simulating the research training processes, a special focus is on students' independent work that helps them attain personally relevant goals and values with students' values motivations and interests being top priorities. Independent work allows to assimilate the experience of research activities and their content, fosters students' self-actualization, self-organization and self-development. Students' research and cognitive actions are formed by proposing tasks of various types that get increasingly complicated. These tasks are classified by the following criteria: nature of cognitive activity; level of complexity (student-selected); number of students that take part in task performance; form of performance, degree of independence during performance.

In terms of the nature of cognitive activity, the tasks of the following blocks are envisaged: block 1 – intellectual and reflexive – comprises tasks with contradictory conditions; tasks with excessive (missing) data; tasks intended to introduce students to the following notions: research activities, research competence, readiness for research activities, research task, task situation, problem, etc; block 2 – information receptive – comprises the tasks targeted at the development of information skills: information decoding when reading; text decomposition on various levels; task performance planning, etc.; block 3 – basic-projective – comprises the tasks targeted at task structure decomposition, synthesis, analysis, identification of principal applicable conditions, their correlation with own study requirements imposed; block 4 – project-empiric – comprises the research tasks targeted at generating an information product as a deliverable (article, report, database, etc.); block 5 – research – comprises the tasks that provide for benchmarking of existing theories, concepts; study and analysis of new sciences; presenting one's own solution of a problem based on the analysis of available experience.

Being aware of the set tasks and goals of independent work, students are able to choose various tasks, resources, communications, work techniques using external support and assistance (provided by the teacher or other students). When performing independent tasks, students come up with possible solutions and are responsible for deliverables. Classroom (laboratory and practical works), extracurricular (field laboratory works, independent work) activities, networking are envisaged for the task performance. There is a possibility of each student's involvement in the active cognitive research process, practical application of the knowledge obtained and clear understanding of where, how and for what objectives it may be used, which generates their pragmatist position.

Competence paradigm of engineering education has promoted the use of the learner-centered approach in the design of the functional model of research training of technical university students. This helps students develop relevant self-concept, get a proper view of their own actual and potential possibilities and capabilities in research activities; discover students' individual peculiarities; recognize each student as an independent and active research actor; establish and develop students' research properties and attributes and capabilities to make the best of their personal peculiarities and possibilities in research activities.

Quality of the training process in technical universities is improved with student's substantiated involvement in research activities that become attractive and satisfying. An important argument is to ensure problem-based nature of teaching so that a student could shift from learning to self-learning. The technology of problem-based study implies regular students' involvement in solving the problems and problem-based tasks built around teaching materials. Problem-based learning contributes to the development of research-based mental performance that promotes engineering mind characterized by reflexivity, responsiveness and openness to innovative processes, flexible, out-of-the-box and effective thinking. Arranging students' cognitive activity in line with the problem-based method brings learning closer to real-life engineering activities. The problem-based method is used when implementing projects. Projects of the initial (basic) level are used as part of project activities during years 1-2 of study. These projects help master the basic knowledge and develop general cultural (organization and self-organization of design activities, methods of project work, culture of presenting results, issue of deliverables in line with regulatory requirements), professional and special competences. The enhanced project level (students' research, term projects, graduation thesis (GT)) requires information and new data search, analysis and arrangement, longer time for preparation; thus, they are conducted on an extracurricular basis. To implement such projects, action groups are set at chairs. Results of creative task and project implementation are summed up at conferences, workshops, round-table discussions together with representatives of basic enterprises that provide for interactive communication using network resources [4].

Term papers and graduate qualification works are an important form of students' research. To ensure their successful performance, instructional guidelines have been adjusted with a focus on preparation for research activities. An important feature of preparing technical university students for research activities is the use of end-to-end research tasks (when preparing term projects, graduate qualification works, their topics were tied in with demands and lines of activity of particular production sites, materials were selected during practical training).

The use of network instructional resources when learning promotes an active, initiative and responsible personality targeted at research activities. "Students consciously choose their instructional strategy and tactics and know how to implement them in the most effective way" [7]. Virtual laboratory and practical works and workshops are elaborated to provide access to unique laboratory equipment, facilities, scientific and technological experiments. This promotes students' interest and engagement in the research process. Network co-operation agreements allow to conduct research using unique equipment of industrial production sites, scientific organizations, other universities. Remote observation of the processes that take place at actual production sites foster the development of research competences in students [20].

An important reason behind design of the functional model of research training of technical university students was a possibility to widely use the interactive technology that implies classes based on students' active cognitive and research activities. Various interactive training forms and methods were used: discussions: dialogue, group discussion, case study, etc.; games: didactic and creative games, including business (managerial), role, organizational and pragmatist games; classes organized in the form of trainings.

When considering the technology aspect of research training of technical university students, we should turn our attention to the choice of teaching methods. Students' research activities are enhanced by gaining new experience from its theoretical understanding by way of the application of problems in the solution process. The research training process is based on the student's work methods that come closer to actual research activities and that simulate real-life professional situations. Laboratory and practical works are performed based on the principle of co-creativity, joint research activities of students and teachers; classes are built by the context type [2]. When laboratory and practical tasks are performed, students develop research skills, which is also driven by the use of capabilities of networking with representatives of basic enterprises; electronic (network) educational resources that allow to observe the processes under study, hypothesize, collect data for study, simulate objects and processes, find the best solutions. Laboratory courses are arranged in the individual and group modes. Students feel that the tasks performed get increasingly complicated and have positive emotions that come with the experience of success. The use of the laboratory equipment system arouses students' interest in research and promotes active cognitive settings.

Management of the process of technical university students' research training implies control activities, i.e. certain system for its efficiency audit. Control is intended to ensure external (teacher's control) and internal feedback (students' self-testing). Control is aimed at obtaining the information that the teacher may use to adjust the learning process as required; it may concern changes in the content, revision of the approach to the choice of teaching forms and methods.

In educational literature, control and evaluation of knowledge and skills are addressed by a number of special studies that present the methods of control and requirements to the quality of students' knowledge, abilities and skills (V.P. Bespalko, V.A. Slastenin [12], A.A. Faktorovich [13], Yu.G. Fokin [14], etc.). The functional model uses three types of control. Current and midterm control (evaluation of results of solving certain types of research tasks, study of a program section); final control (year exam, test); closing control (state exam, defense of the graduate qualification work) [12]. They all have common control benchmarks: updating of the knowledge, skills, experience acquired; comparing their parameters to those required and evaluating their compliance; identifying reasons for discrepancies; further adjustment by getting back to other training methods: awareness, exercise, sometimes motivation.

Student performance is always evaluated based on control results with due regard to qualitative and quantitative indicators of their research activities. Teachers should strive for objective and realistic evaluation of student performance. What matters to us are the educational requirements to control organization established by the training theory and practice [1], which, if met, will ensure reliability and performance of its tasks when preparing future engineers for research activities:

- individual control that requires inspection of each student's performance and personal progress;
- systemic and regular control at all stages of preparation for research activities, its combination with other aspects of educational activities;
- variety of control forms, heightening students' interest in control and its results;
- comprehensive nature that implies that control has to ensure inspection of the maturity level of all the components of students' readiness for research activities;
- objectiveness that rules out teachers' premeditated, subjective and erroneous value judgments and conclusions;
- differentiated approach that considers specific features of each readiness component, academic program section, types of research tasks and students' individual merits that call for teaching tact and proper control procedure;
- consistency of requirements of the teachers engaged in control of the course and results of students' research activities in the group.

We assign high priority to self-testing, which we define as an ability to independently ask questions and answer them thus verifying the correctness of actions made. To successfully arrange research activities, self-testing has to be shifted to the beginning of the activity mastering procedure and it has to cover the entire process. The goal of self-testing is not only to state the maturity level of research competence attained by students, but also to encourage them to further development.

3.2.Foreign experience of preparing technical university students for research activities

Study of the foreign experience of preparing students for research activities has enabled identification of a number of provisions that are expedient to consider when preparing the functional model of research training of technical university students:

- supplementing the curriculum with the special disciplines targeted at preparation for research activities (McLeod F. [22], P. Arden [15]). British scientists define engineer's research activities as the "synthesis and implementation of knowledge in original, viable and necessary new products, processes, services" [16];
- stepwise introduction of the ways to solve research tasks, use of heuristic approaches and brainstorming techniques ([23], [24], [25], etc.). When viewing research activities as a way to develop a creative personality, scientists (H.-G. Melhorn [26], U. Starke [27], etc.) note that reasoning, out-of-the box thinking, self-discipline, initiative and sense of purpose need to be developed in the first place;
- developing skills of industrial design, aesthetical development of students (designing the system of tasks and using it in curricular and extracurricular activities) (Baumol W.J. [16], Cooper R.G. [18]). Leading didacticians of the UK (M. Baxter, R. Cooper, B. Meleod [22], etc.) affirm that an engineer needs to have well-established knowledge and skills of industrial and engineering design, which is promoted by the development of styling design for the purpose of students' aesthetical development, which is a high priority;
- implementation of group and individual research projects (tasks) to involve students in research activities. The practice of engineering education in the UK has borrowed the system by Belbin M.R. [17] that provides for the implementation of both independent and group projects when group projects may be mono-discipline; this develops the skills of professional communication during teamwork.
- close co-operation with production. "All the scientific organizations in Germany work in close co-operation, there is no gap between the academic and industrial science, which speeds up the introduction of inventions and implementation of the country's scientific potential" [8];
- replacing competitiveness with co-operation (team research project works) **(**H. Becker, S. Browdy, Cooper R.G.).
- free access to information resources and software; promoting ethics (knowledge of and compliance with copyright laws) [19].

We used the identified provisions to design the functional model of research training of technical university students.

3.3.Functional model of research training of technical university students

The mentioned reasons that we have identified during foreign experience analysis have enabled our design of the functional model of research training of technical university students comprising target; motivational, conceptual; operational and pragmatist; control-result components (Figure 2) [21].

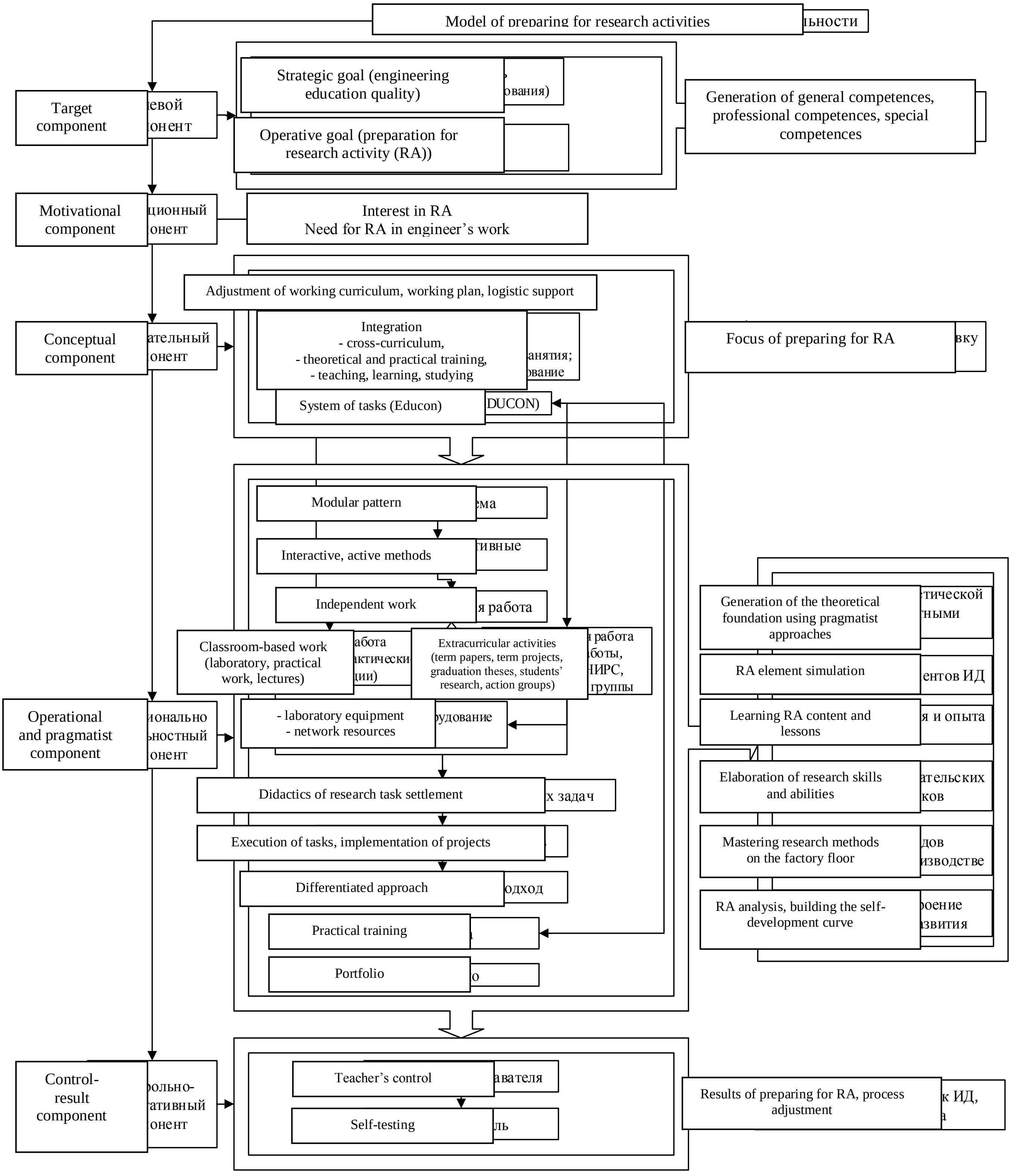

Figure 2. Functional model of research training of technical university students

3.4.Organization and results of experimental work for the implementation of the functional model in the training process of a technical university

Implementation of the model presented in the training process of a technical university has brought about a need to promote developing instructional setting, which is an essential condition for the creation of the innovative didactics of a technical university. Employers' requirements to the training of graduates with individual and productive style of engineering activities were taken into account.

We have proven that the developing instructional setting needs the following:

1. arrangement of the interaction and synergy of all the subjects sharing the learning setting;

2. teaching and research integration at all stages of the educational process;

3. transformation of the education content, development of new and improvement of existing methodological support; review of organizational and technology fundamentals of the educational process;

4. establishment of the system of partnership with universities, research organizations, enterprises. The "resource model" of the network form of implementing the principal vocational educational program (PVEP) is used, according to which integrated co-operation agreements are made with basic enterprises. This enables the well-aimed allocation of graduates, involvement of enterprise representatives in the students' research training process (elaboration and adjustment of PVEP; practice programs, pool of evaluation tools, research tasks, participation in the defense of research works, term projects, student's research); practical training; field laboratory and practical works; teachers' traineeships).

6. - students' self-regulation, self-generation (assurance of students' personal and professional development, involvement in the education quality co-management subject to their self-organization in the course of preparation for research activities (increased share of independent work, abandonment of reproductive methods).

Implementation of the functional model of research training of technical university students has contributed to the following developments:

1. students were motivated to conduct research activities, their subject attitude as educational process actors was developed through adopting common goals and harmonizing interests of all subjects, atmosphere of productive activity was promoted;

2. education content was structured,

- integrative processes were implemented: use of intersubject communications, integrated courses and integration of private knowledge and skills into operational complexes;

- the following special courses were made part of occupational training: "Fundamentals of Research Methods", "Fundamentals of Engineer's Research Activities", "Professional Identity"; special workshops: "Methods of Solution of Engineer's Non-Standard Research Tasks", "Research Culture", "Mathematical Statistics Methods in Engineering Research", "Creation in the Engineer's Occupation", "Heuristic Research Methods", etc.;

- special forms and means of extracurricular activities were designed: field laboratory and practical works; research tasks, projects, action groups.

3. information technology and network educational resources were used. Use of Educon, electronic education support system has contributed to the following developments: discipline electronic teaching materials; virtual laboratory and practical works were designed); presentations, tours; system of tasks for curricular and extracurricular work, evaluations; access to information and public educational resources was extended; teachers and students were engaged in interactive communication (consultations, reviews).

4. The system of tasks was elaborated and used, students underwent directive training in their performance techniques during studying and practical training; end-to-end research projects were used when preparing theses and GT, paper topics were tied in with chair research directions and demands of a particular production site;

5. Conditions were created to promote students' self-consciousness and self-testing (self-analysis and self-assessment skills were developed in order to engage students in self-observation, self-cognition, self-assessment and peer review), public access to rating figures was provided.

Functional model performance is confirmed by the improved quality of engineering education, in particular: development of a set of competences, research abilities, functional research skills in graduates as universal ways of interaction with the outside world, which is confirmed by experimental work results. Cognitive, personal and pragmatist components were defined and used as criteria to assess the maturity level of research competences. The experiment was held as part of the learning process at technical universities in Surgut and Tyumen in 2010-2016. A total of 1,520 persons were engaged in experimental activities, including 1,390 students and 130 teachers.

It was determined at the stage of statements that at the point of entry in the experiment, no research competence was developed in first-year students (Table 1); before the experiment, students with low research competence prevailed among graduates (high level – 5%; medium level – 28%; low level – 58% ; zero level – 9%).

Table 1 Research competence of first-year students before the experiment

Levels	Personal component, %				Cognitive component, %		Pragmatist component, %	
	motivational		reflexive					
	Ex.	Ctrl	Ex.	Ctrl	Ex.	Ctrl	Ex.	Ctrl
Top	0	0	0	0	0	0	0	0
High	0	0	0	0	1	0	0	0
Medium	5	2	5	2	4	2	5	2
Low	53	38	53	38	52	36	55	28

Zero	42	60	42	60	43	62	40	70
χ^2	0.33		0.33		0.038		0.28	

Educational feasibility of implementing the functional model of research training has been proven experimentally at the stage of establishment. The summarizing stage was targeted at evaluating model performance by identifying changes in the maturity level of the students' research competence and analyzing results obtained. Table 2 shows the resulting maturity level of students' research competence at the end of the experiment.

Table 2Students' research competence at the end of the experiment

Levels	Personal component, %				Cognitive component, %		Pragmatist component, %	
	motivational		reflexive					
	Ex.	Ctrl	Ex.	Ctrl	Ex.	Ctrl	Ex.	Ctrl
Top	3	1	3	1	3	1	3	1
High	45	9	45	9	50	19	49	9
Medium	40	26	40	26	40	38	40	43
Low	10	54	10	54	7	40	7	44
Zero	2	10	2	10	0	2	1	3
χ^2	172		172.8		167.8		157.8	

Data benchmarking in the beginning and at the end of the experiment has shown increase in indicators of all the components. Changes in experimental groups are stable for all the components. Positive developments in control groups mean that the maturity level of students' research competence increases with the accumulation of experience in learning and research activities as part of conventional teaching, but the process is not active enough.

Results have been verified by way of a statistical analysis-based check using mathematical statistics criteria: Peirce chi-square. When implementing the functional model, the students from experimental groups have revealed statistically significant considerable changes in the maturity level of all research competence components.

4.Conclusion

In the world of today, engineering activities have an expressed research focus; engineers use them to interact with the world as subjects and become empowered to change it. The functional model of research training of technical university students that provides for the establishment of developing instructional setting has been elaborated and implemented. Its specific content is as follows: encouraging students to research activities, developing their subject attitude; promoting an atmosphere of productive activity; structuring the instructional content, conducting cross-curriculum integration, supplementing professional training with special courses and workshops; designing special forms and means of extracurricular activity jointly with representatives of basic enterprises; using network educational resources; designing and using the system of tasks relevant to professional engineering activity and students' directive training in their performance techniques; developing students' self-consciousness and self-testing. The results of experimental work prove the efficiency of the functional model of research training of technical university students designed and implemented.

The theoretical relevance of the study lies in the following facts:

- theory and methodology of vocational education have been enriched with insights into the essence of the process of developing technical university students' research competences that enable the development of general cultural and professional competences for training the specialists with an individual and productive style of engineering activities;
- the basis for design has been determined and used to build the functional model of research training in the context of competence-oriented engineering education that provides for incorporation of employers' requirements to the preparation of technical university graduates for research activities and provisions of occupational standards. Inquiry-based learning has been defined as the basis for the establishment of the innovative didactics of a technical university that enables implementation of the requirements of educational standards of competitive graduates;
- content of the innovative didactics of the technical university presented as a functional model has been determined; this model fosters the creative development of students, their research capabilities and functional research skills as universal ways of interaction with the outside world.
- effectiveness of implementation of the functional model of research training of technical university students has been proven experimentally; this model provides for the arrangement of theoretical, production and hands-on training, independent and research activities that use: elaborated practice-focused techniques, special-purpose forms and means of extracurricular activities; information technology, network educational resources; system of tasks, comprehensive, end-to-end research projects, interactive forms and methods; students' self-testing and self-assessment in the process of training.

Thus, the work develops the theory of vocational education, in particular, as related to students' professional preparation for research activities and consideration of engineers' training in terms of the competence paradigm. The work examines the idea of the modern engineer's professional self-actualization.

The practical relevance of the study lies in the following facts:

- the functional model of research training of technical university students that meets modern society and production development requirements brought by the author to the level of state-of-the-practice may be used in the arrangement of the teaching process at technical universities to improve the quality of engineering education and in the practice of further vocational education to improve the competition of graduates;

- recommendations as to the arrangement of preparing students for research activities for the teaching staff of technical universities, with regard to the level of their readiness for this process may be used in the advanced training system of technical university teachers.

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