

# CONTENT AND PEDAGOGICAL CONDITIONS OF DEVELOPMENT OF RESEARCH SKILLS OF FUTURE ENGINEERS BASED ON INNOVATION APPROACH

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**Annotation.** Research activity is not only a means of personal development, but also a goal, and in our opinion, it is one of the main components that make up the system of the student training process. The content and pedagogical conditions of developing the research skills of future engineers based on an innovative approach, the main definitions of innovative activity, directions of cooperation with the scientific products, educational services and the labor market of an innovative active higher education institution are highlighted in the article.

**Keywords.** Research, person, purpose, process, approach, education, knowledge.

## Introduction.

Research activity is one of the main directions of the future engineer's professional activity. As part of this activity, the future engineer should be prepared to solve various research tasks, such as analyzing scientific literature and official statistical reviews, participating in statistical analysis and presenting the obtained results to the public. In this regard, the leading direction of training future engineers is to involve students in research activities and develop their research skills based on an innovative approach from junior courses. In order to implement this approach, conditions should be created for students to acquire the basic skills of scientific knowledge during their studies in higher education institutions. Research activity is not only a means of personal development, but also a goal, and in our opinion, it is one of the main components that make up the system of the student training process [6,9].

V.I.Zagvyazinsky [22], I.A.Zimnyaya [23], S.L.Rubinshtein [18] and other scientists dealt with the issues of development of students' research activity.

According to I.A.Zimnyaya, the research activity includes the special activity of a person controlled by consciousness and taking into account the activity of the person and aimed at the realization of cognitive and intellectual needs. The result of such activity is acquisition of new knowledge and skills [23]. The importance of

formation and development of scientific-research activities of students is emphasized in the educational process. I.A.Zimnyaya states that research activity is the object of development of modern higher education [23].

In the course of research activities, a person's unique research position is developed and developed, as a result of which each person has the opportunity to independently solve problematic situations and build his own life path. According to the scientist, the organization of research activities of learners is the most effective way of building education aimed at forming an active personality, successful in modern conditions of constantly changing life realities.

#### Methods.

In the process of research activity, two components can be distinguished:

- research activities (skills such as searching, analyzing, selecting and storing the necessary information are formed:).

- research (or experiment-testing) activities (selection of necessary data for the experiment, translation of problem conditions into official language, construction of descriptive models, promotion of scientific hypotheses, interpretation of the received data, conclusions and other skills are formed) [17].

There are three levels of development of research activities of students of higher educational institutions: reproductive, productive and creative. It can be developed by carrying out research activities, which occurs through a step-by-step transition from the reproductive level to the creative level.

At the initial stages of education, the involvement of students in research and research activities is connected with the tendency of rapid "obsolescence" of scientific knowledge. Students' research activity is an important type of their active independent cognitive creative activity, therefore the task of developing it in the educational process becomes the most urgent nowadays [8,16].

Thus, the main goal of modern education is the formation of students' research abilities, therefore, their acquisition of the experience of research activities in a higher educational institution, including the medical field, becomes the leading trend in the process of studying mathematical methods and activities for students of higher educational institutions.

The complex structure of research activity leads to difficulties in its modeling and organization, including in the process of teaching mathematical methods to future engineers, because any research (scientific or educational) has the character of an individual activity, and the research process includes the process of creative innovative activity [4,10,11,15,20].

Innovative activity is the process of putting the results of completed scientific research into practice and selling them on the market, developing scientific and technical achievements of new or improved products used in practice, as well as related scientific research and development, development of innovations;

- innovation (innovation) - a new or improved technological process introduced into practice in a new or improved form, put on the market, used in practice, is the final result of innovative activity.

At the same time, the analysis of the content of these concepts in different professions shows that they are not the same in terms of meaning and content (Table 1).

Table 1  
Basic definitions of innovative activity

| ce                      | Content of the concept of "innovative activity".                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| large economic activity | <b>innovative activity</b> is the implementation of new or improved ideas (usually results of scientific research and development or other scientific and technical achievements), put on the market, a product used in practice, or a new approach to services. Usually, six types of innovative activities are shown: a) organization of instrumental preparation and production; b) training and retraining personnel on the use of new technologies and equipment, production and action products, including product and technological process modifications; c) letting of new products; g) implementation of new technologies in the form of patents, certificates, know-how innovations, trademarks, constructions, biological content models and services; d) introduction of new technologies - lines and equipment related to the implementation of productive and process variations; e) design the required production for concept, development, action and marketing to create new products and processes |
| sary of innovation      | <b>innovative activity</b> is the field of development and implementation of technical, technological and organizational-economic innovations, which includes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|                               |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               |            | only innovative processes, but also marketing research of product sales, their marketing, as well as information, consulting, social and other service areas.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| onal<br>clopedia              | social     | <b>innovative activity</b> - activity aimed at the commercialization of accumulated knowledge, technology and equipment. The result of innovative activity is considered to be new or additional products/services or new quality products/services.                                                                                                                                                                                                                                                                                                                                  |
| t<br>ary                      | scientific | <b>innovative activity</b> is the development and implementation of completed scientific research and development or other scientific and technical achievements, a new or improved product, a new or improved technological process used in industrial activity, as well as additional related scientific research and development.                                                                                                                                                                                                                                                  |
| ntific and technical<br>ary   |            | <b>innovative activity</b> is an activity that ensures and implements the creation of innovations. The process of creating innovations includes the creation of innovations, including practical research, preparation for production and commissioning, scientific and technical services, marketing research, training and training of personnel, organizational and financial activities.                                                                                                                                                                                          |
| hological<br>clopedia         |            | <b>innovative activity</b> is a formal process that requires taking into account the human factor, in particular, it overcomes social and psychological barriers that exist at all stages. Various social groups (customers, developers, producers of experimental samples, makers, etc.) are involved in this activity, each of them has its own interests, goals and tasks. The members of each group may have different views, expectations and feelings about the results of the innovation.                                                                                      |
| ge legal glossary             |            | <b>innovative activity (implementation)</b> - the activity of creating and using an actual idea, bringing a new idea to a ready-made product on the market, testing samples of new techniques and technologies, conducting expertise for the purpose of obtaining a patent certificate, introducing and publishing discoveries, production samples, trademark, scientific research, project, experimental work, organization of marketing studies)                                                                                                                                    |
| ary glossary                  |            | <b>innovative activity</b> is a scientific research to improve the quality of the produced product (goods, service) leading to innovation, entering the domestic and foreign market economy, providing for scientific, technical, technological, organizational, financial and commercial activities, developing technologies for preparation, updating and expanding the nomenclature, and activities aimed at the use and commercialization of development results. Also, innovative activity is defined as the activity of creation, adoption, distribution and use of innovation. |
| inical - engineering<br>ary   |            | <b>innovative activity</b> - creation of a new or improved product, new or improved technological process used in the economic sphere using scientific research, development, design-experimental works or other scientific and technical achievements.                                                                                                                                                                                                                                                                                                                               |
| chising and<br>ess dictionary |            | <b>innovative activity</b> in the field of economic management is the activity of the participants of economic relations, which is carried out on the basis of the implementation of long-term scientific and technical programs that require costs and the introduction of scientific and technical achievements in other areas of production and social life.                                                                                                                                                                                                                       |
| sary of scientific<br>rch     |            | <b>innovative activity</b> - improvement of the production process, economic, legal and social relations in science, culture, education and other areas, use of scientific research results and developments in other areas of society.                                                                                                                                                                                                                                                                                                                                               |

Table 1 summarizing the definitions of the term "innovative activity" leads to the definition of scientific, technological, organizational, financial and commercial activities aimed at creating a new or improved technological process, making it a competitive product and entering the domestic and foreign market economy.

### Results and Discussion.

In a narrow sense, the term innovative activity is understood as an activity aimed at the commercialization of scientific and technical achievements.

The main contradictions in explaining the content of the term "innovative activity" in the cited approaches are that innovative activity in a broad sense means creating and "implementing" innovations; in the

narrow sense - means only "implementation". Based on this, it can be noted that the creation and implementation of innovation is the result of innovative activity carried out in the scientific and technical sphere [4].

Thus, the content and pedagogical conditions for the development of research skills of future engineers based on an innovative approach are activities that increase the efficiency of the implementation of technological and production processes that ensure the creation or improvement of a new product produced in the scientific and technical field, and are aimed at implementing the results of scientific research and developments into practice [10].

In this regard, creating a system of unification of scientific idea creators (higher educational institutions, scientific research institutes, etc.) implementing technological processes and putting innovations into practice with production enterprises for the integration of various resources that enable the implementation of innovative activities in the scientific and technical sphere will be the direction of development [11].

The result of innovative activity in the scientific and technical sphere is in this case innovative product, process, technology-based scientific research results and innovations based on developments [15,20].

According to V.I.Averchenkov, innovative activity is characterized by the following features:

- scientific-based technical solutions, scientific-technical innovations, which are among the first to be used;
- practical implementation in production, agriculture, education and other spheres of activity;
- satisfaction of customer requirements, commercialization [2].

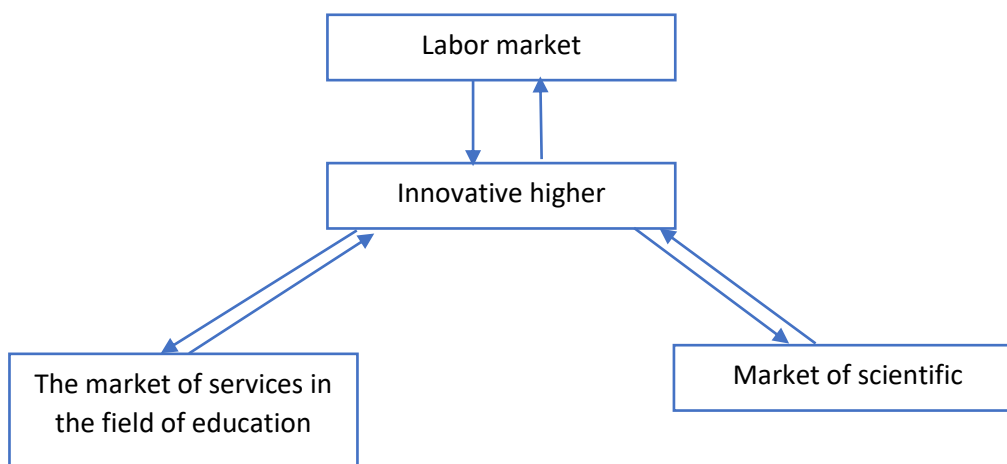
These characteristics of innovative activity lead to the conclusion that no matter how carefully the idea is written, formed and depicted in schemes and drawings, it is not yet an innovation. In practice, innovation can only happen when it is implemented in a product, service or process.

### Conclusions.

Therefore, the activities of educational institutions in the field of higher professional education should be directed to scientific-technological products, adaptation of education to market conditions and increasing the competitiveness of their graduates in various fields of professional activity (Fig. 1).

O.A.Latukha is a mechanism that enables the formation of personnel for innovative areas of professional activity that implements and implements new types of techniques and technologies in the "higher educational institution-organization", "science-production" system, creates the material infrastructure of society, implements scientific and technical development defines as [12].

The basis of this system is engineering activities, which are prepared in higher technical educational institutions, scientific research institutes in the field of industry, and are carried out in the form of knowledge-creation of labor activity through experimental design developments as a necessary condition for technological progress and production development.



**Figure 1. Cooperation of an innovative active higher education institution with scientific products, educational services and the labor market.**

Developing the research skills of future engineers based on an innovative approach and increasing the role and importance of engineers' activities is related to the processes characterized by the consumption of matter, energy, information and rapid change [21].

The activity of an engineer is characterized by research, design, construction, production technology, operation and other engineering works [5,19].

At the same time, the essence of engineering tasks remains synthesizing, which requires, on the one hand, the cooperation of representatives of various engineering specialties, and on the other hand, deep scientific training, broad competencies and active professional self-awareness of each engineer [7,13].

The activity of an engineer is based on technology, production, the potential of productive forces of society, and science. The special features of the work of an engineer are the interaction of technological processes with the environment, human life activities, and a practical approach to technology. It refers to the development of engineering solutions and their implementation in the form of technical devices, technological processes, the mode of operation of infrastructures is carried out on a scientific basis [14].

Therefore, in order to introduce innovations in the training of modern engineers, it is necessary to teach them new techniques, innovative technologies and their effective use in practice.

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