

RESEARCH SKILLS THAT ARE FORMED IN STUDENTS BY TEACHING TECHNICAL SCIENCES

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ABSTRACT

This article provides an understanding of the formation of research skills in students through the teaching of technical sciences, the use of research methods, and the formation of research skills in students by providing knowledge.

KEYWORDS: *Research, Pedagogical Concept, General Pedagogical Method, Didactic, Cognitive Education, Heuristic Education, Problem Teaching, Object.*

INTRODUCTION

The use of the research method in teaching has a long history, it constantly appears from the point of view of practical teachers and appears in the structure of various pedagogical concepts of education and upbringing.

A. Y. Gerd was one of the first to introduce the research method of teaching into pedagogical practice. He clearly and clearly defines the role and importance of research activities in the process of cognitive education: "all real knowledge is acquired by mankind through observation, comparison and experiments, with the help of gradually expanding conclusions and generalizations. It is useful to acquire knowledge not only in this way, but also by reading can be" [30, p. 203].

B. E. Raikov is an active promoter of the research method, who emphasizes the developmental nature of such education. When the research method is properly formulated, it contributes more to the development of the ability to think logically in the field of concrete facts. Clearly, there is a similarity between student research and research: the student and the scientist follow the same logical path [114]. B. E. Raykov describes the research method as "a teaching method that leads a certain logical process based on independent observation of real events" [114, p. 170]. The research approach to teaching is found not only in the works of A. Y. Gerd [30] and B. E. Raikov [114], but also in the works of P. P. Blonsky [18], S. T. Shatsky [153] and others.

It should be noted that in the 20s and 30s, the use of the research method as a general pedagogical method of teaching led to the consistent violation of the most important didactic principles. Therefore, the research method was temporarily forgotten until the beginning of the 60s, when the specific characteristics of teaching general professional subjects required the inclusion of elements of research activity in the educational process.

Close to the research method of teaching is problem-based and heuristic education (V.I. Andreev [7], A.M. Matyushkin [69], M.I. Makhmutov [71], M.N. Skatkin [126], A.V. Khutorsky [150] and others). Let's look at the commonality between exploratory, heuristic and problem-based teaching methods.

First of all, it is possible to note certain features of problem-based and research methods of

teaching. First of all, in both cases there is an active skill of a person with methods, methods, which are characteristic of any creative activity. I. Ya. Lerner "there is only one way to teach a person to create - it is necessary to teach him creative procedures, that is, the structures that make up the essence of creative activity. Everything plays only an auxiliary role. For this:

- 1) independently transfer acquired knowledge and skills to a new situation;
- 2) Being able to see the problem;
- 3) See the new function of the object;
- 4) Determining the structure of the object;
- 5) Finding an alternative solution;
- 6) Combining previously learned methods of activity with new ones in relation to the problem that has arisen" [132]

M. N. Skatkin, who distinguishes three types of problem-based education, directs the research method to the third type of problem-based education [126]. Second, the concept of the problem situation has common roots with the research task. According to M.I. Makhmutov, the problem arises only when there are three conditions:

- 1) The existence of a logical connection with predetermined concepts and ideas;
- 2) Dissatisfaction with the level of knowledge, skills and qualifications compared to a new, unknown phenomenon;
- 3) Elimination of difficulties to a certain extent [71, p. 49].

How? Why? What comes of it? How to solve this problem? All such questions set some directions for solving the problem, stimulate creative search strategies. Such questions and assumptions create a problematic view in the broadest sense of the word.

Research and heuristic teaching methods also have common features. According to V.I. Andreev [6], three signs can be distinguished:

- 1) Stimulation of students' creative thinking based on heuristic methods (N.F. Talzina [136]);
- 2) Development of methodical culture of students in solving research tasks independently (application of scientific knowledge methods);
- 3) Creative readiness and the ability to discover new objects in the surrounding world through real interaction with him (A. N. Poddyakov).

Thus, the analysis of various active teaching methods (research, problem-based, heuristic) shows that all of them arise from the need to include elements of research activities related to scientific knowledge methods in the content of higher education.

Various classifications of research works, especially their division into qualitative and quantitative, short-term and long-term, planned work and creative tasks, are presented in modern stylistic literature. V. G. Razumovsky [113] and others divide research into two groups: research and project-design.

In the work of L.A. Ivanova [49], it is proposed to classify the following tasks in scientific researches:

- a) Prediction of results;
- b) Planning the experiment;
- c) Explanation;

d) Examination of technical and technological concepts and laws, laboratory work.

Practical and didactic studies show that the success of teaching depends on the correct definition of educational goals and content, as well as ways to achieve goals (teaching methods) [43].

Teaching methods are divided into lecture, story, explanation, etc., and can also be divided into listening, comprehension, practice, modeling, inquiry, examination, project defense, etc. Verbal, visual and practical methods are distinguished by sources and methods of information transmission. Depending on the nature of didactic tasks, methods of learning are distinguished; methods of formation of skills and competences (for example, the method of systematic formation of mental actions and concepts); methods of forming creative activity; methods of control of knowledge, skills and competences. According to the characteristics of the students' cognitive activity, it is divided into explanatory-illustrative, reproductive, problematic, heuristic (partially exploratory) and research methods [121].

There are four stages of the research method [93]:

1. Follow up. Provides an opportunity to learn scientific facts and them;
2. Forming a hypothesis. Includes development of initial ideas and concepts;
3. Experience. Hypothesis testing. This includes laboratory tests.
4. Processing the results. Explanation and generalization.

We believe that the identified stages of this method should be used as a basis for solving the tasks of educational and research activities.

The importance of the research method in teaching is revealed through its functions [130]:

- mastering the methods of scientific knowledge;
- Formation of creative abilities, interest, needs;
- Acquiring conscious and flexible knowledge.

The psychological basis of the formation of these needs is the innate human needs, including cognitive needs [28]. In the works [55, 151] it is noted that teaching methods of scientific knowledge, synthesis of experimental and theoretical methods of studying objects and events, teaching students with the help of scientific research methodology.

Various forms of scientific research work can not only serve the diversity of the educational process itself, but also give a positive impetus to further increase the intellectual level of students. According to V. I. Andreev [7, p. 65], he suggests conducting research by performing programmed tasks (heuristic programming) during the lesson that require a high degree of independence.

Today, various forms of organizing research activities have been developed in higher education, including lessons on the use of heuristic methods, research lessons, the use of elements of research activities outside the classroom (special courses, student research, participation in conferences, etc.).

It is appropriate to use independent research assignments in the teaching of general professional subjects in technical higher education institutions. At the same time, the object of students' research should be real reality, and the method of learning should be independent research activity under the direct or indirect guidance of the teacher.

On the one hand, the teacher organizes this activity by showing the sources of information and tools to achieve the goal of research. But the existence of such tasks is not a guarantee of solving

them. It is important for the teacher to give research assignments taking into account the individual characteristics of students; organizing this activity to involve all students; to give a positive impetus to the study of general professional subjects. On the other hand, the student acquires knowledge and skills, develops intellectual and personal abilities. A wide range of research tasks, various forms of its implementation provide great opportunities for the implementation of an individual approach to the teaching of general professional subjects.

The main features of independent research activity (as well as any other type of activity) are its goals, content, methods, forms of organization, and evaluation of results. Accordingly:

- Development of experimental and theoretical skills;
- Development of independence, thinking, creativity, communication and organizational skills;
- Forming a scientific worldview and mastering the methods of scientific knowledge;
- Creating positive motivation and sustained interest in the studied subject;
- Includes conscious assimilation and strengthening of the studied material.

The content of research activity is based on the system of educational experiment. Experimental research tasks play a very important role in the system of didactic tools designed to form the productive thinking of students while reliably mastering basic concepts and skills. A. Einstein, a great scientist of the 20th century, expressed his attitude to learning on an experimental basis in this way: "at the first stage of learning, everything should be excluded except the experimental side that causes visual interest. A beautiful experience in itself is more valuable than thirty formulas. "Relying on the experiment in the teaching of general professional sciences is absolutely necessary, because it is limited by all the components of technical theory.

Educational and technical experience includes demonstration experiments, laboratory and practical work.

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