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DEVELOPMENT OF STUDENTS' TECHNICAL THINKING ON THE BASIS OF INTERDISCIPLINARY INTEGRATION

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Annotation
In article questions of development of technical thinking of students are considered and recommendations about development of technical thinking of students are made.

Keywords: technical thinking, interdisciplinary integration, technical language, interdisciplinary communication, technical object, systematic approach, thinking inertia, technical contradiction, objective evaluation, inertia, integrative element, didactic communication, variability, regrouping.

Informatization and technologicalization of modern society place increasingly high demands on the training of university graduates. Today, young people entering the life of independent labor need in-depth scientific and technical, economic and environmental knowledge, regardless of the specialty, as well as the basics of engineering and technology.

At the same time, in practice, most graduates find it difficult to apply their technical knowledge in their professional activities due to insufficient coordination of science and profession organizers in the preparation of students. The above emphasizes the problem of developing students' technical thinking in the vocational education system. Its solution allows, on the one hand, to line up the teaching of sciences in the general system of training, on the other hand, creates conditions for the intellectual development of students.

The research data testifies to the urgency of the problem of developing technical thinking in the vocational education system and allows to distinguish the main approaches in its development.

One of the promising areas is interdisciplinary integration in teaching. The work of psychologists shows that there is a certain gap in the teaching of various cyclical disciplines in higher education, which in turn is known at the level of professional training and inhibits the development of student thinking. The development of students in the education system takes place without sufficient consideration of the field of "Technology" of education and in the absence of sufficient methodological basis for the selection of content, methods, forms and tools of professional training.

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Interdisciplinary integration in education should take into account the problems posed by programs in the field of "Technology" - the formation of psychological and practical readiness of students for creative design activities, the development of technical thinking, design creativity, polytechnic knowledge and skills in all forms of educational activity. This can be done by changing the content of the program material and choosing more effective forms and tools in student preparation from the point of view of organizing the learning process. Interdisciplinary integration is a similar tool and can help solve a given problem.

Technical thinking is the integrative psychological formation of the individual.

Research in the field of technical education shows that only teachers with highly developed technical thinking based on social experience, psychological, pedagogical and scientific knowledge, training and skills are able to find and apply new forms and methods, unique solutions and at the same time improve their professional function.

Technical thinking is a set of intellectual processes and results that provide solutions to problems in professional and technical activities (design, technological solutions, etc., which occur in the design, maintenance and repair of equipment).

Technical thinking is understood as a collective activity rather than thinking involving imagination, memory, and so on.

Analysis of the literature on the problem of technical thinking allows us to highlight the following features:

technical thinking arises in understanding and solving technical technological issues;

technical thinking has a special structure and includes components of concept, image, action (TV Kudryavtsev), technical language (M.V. Mukhina), operative (F.A. Zueva, M.V. Mukhina);

technical thinking assumes the existence of an integrative (generalized) system of knowledge and skills in performing similar activities;

Technical thinking is an operational part of technical ability.

Technical thinking is accomplished through thought operations that are as obvious as thinking in other forms (by way of mental action): analysis, synthesis, generalization, comparison, abstraction, specificity, type, proportion, specific separation forms and structuring of technical material content, and so on.

Research of psychologists The peculiarity of technical thinking is not in the means of logical storage (analysis, synthesis, generalization, etc.), but in the presence of technical problems and the nature of the conditions for its solution.

The above does not mean that technical thinking is characterized by its superiority, but most technical objects, the characteristics of the issues give a specific character to thinking. T.V. Kudryavtsev: "In man, the intellect is the same and the basis of the mechanism of thought is the same, but the forms of thinking activity are different, because in one way or another the problem facing the human mind is different."

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Within the systematic approach, we explore five-component thinking as an integrative system, revealing the interdependence of its components, the role of each of them in the process of thinking on a technical object, and the possibilities of technical thinking in shaping structural components.

We explain this in the formation of technical language as an independent organizer of technical thinking. The language of technology serves as a link between science and technology. Methodologists of technical knowledge confirm that the language of science is an important tool of scientific knowledge, because the concept used in it is characterized by clarity of terms, striving for accuracy and unambiguousness of assertions, strict consistency in the description of the material.

The psychological commonality of technical language with other languages of science determines that the methodology of its formation is the same. In the language of technology, especially in symbols, both the result of knowing at the same time and the ways of obtaining them are evident. The language of the mastered technique becomes the operator of logical actions, the internal weapon of the psychological activity of learners, an indicator of the productivity of their thinking. Technical language incorporates features of other fundamental sciences: makes it possible to apply the features and logic of mathematical elements, physical quantities, general science concepts, and more to technology.

The study of this issue testifies to the fact that the acquisition of technical language can only be shaped by the means of technical sciences.

Our experience shows that in the context of informatization and technologicalization of society, the obsolescence of technology and the replacement of one technology by another is rapidly taking place, technical thinking must enter a new stage of development, that is, the specialist must adapt to modern man-made environment. In addition to mastering the "core" of professional knowledge, the future specialist must learn to think systematically, curb the inertia of thinking and solve technical contradictions, develop unique technical ideas, learn to solve problems and evaluate them objectively, and first of all science. should be able to manage reflection in teaching methodology. All this, to one degree or another, is aimed at the development of students' personalities and ensures the effectiveness of future educational and professional activities.

Integrating interdisciplinary communication. We have already mentioned that technical thinking has a generalized (integrated) nature - it synthesizes knowledge and skills from many disciplines, so education based on interdisciplinary integration is one of the effective methods of educational development.

Integration refers to the process of bringing together previously scattered constituents into a whole, which is manifested in a dialectical unity with opposing differentiation (M.S. Pak). Interdisciplinary integration forms a whole that reflects the integral quality (L.L. Gabibullina, E.L. Syrtsova).

An important idea used in interdisciplinary integration in education is to develop the structuring of knowledge acquired by students.

The basis of integration is the theory of interdisciplinary relations. In the literature, interdisciplinary relationships are considered from different perspectives.

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Interdisciplinary relations are a form and principle of interaction between individual academic disciplines and serve to generalize and systematize knowledge, but do not reflect the new quality of knowledge. Interdisciplinary communication is a mechanism for the integration of knowledge and methods of action to ensure methodological integrity in science education, increase the quality of students' knowledge, the development of systematic thinking, overcoming the one-sidedness and inertia of science.

The mechanism of interdisciplinary communication is the transfer of elements of the content of one discipline to another and the implementation of actions on them. It should be borne in mind that the transfer should not be done mechanically.

The implementation of the proposed idea was facilitated by the development of interdisciplinary teaching methods, which are based on:

Determining the content of the subject according to its characteristics: selection of basic learning elements, structural analysis, separation of integrative elements, selection of the optimal ratio of theoretical and practical components;

Realization of educational content acceptance: establishment of didactic connection between chemistry, general and special disciplines, strengthening of practical and functional components of chemistry, construction of logical system of connected concepts;

taking into account the psychological and pedagogical features of reception: analysis and synthesis of educational material, the development of personal intellectual characteristics, the variability of educational issues, the interdependence of the character system.

The proposed methodology is implemented through the following steps:

1. Activation of knowledge and skills acquired in school subjects.
2. Addition and expansion of technical content at the expense of the invariant part of the subject of higher education.
3. Professionalization of the course content at the expense of the variable part and introduction of technological issues in the educational process.
4. Formation of the level of assessment of knowledge and skills in science (control and independent work, test assignments, academic mastery).

From the above, the following conclusions can be drawn.

1. Development of technical thinking of the specialist in the profile of the engineer is a necessary condition of professional training, which is based on the position of the analysis of the questions set by the State educational standard of the specialty and the educational program. This way of thinking allows the future specialist to solve students' professional problems related to the organization of creative design activities more productively.
2. Interdisciplinary integration in education, which assumes the interdisciplinary transfer of technological knowledge and training, ensures the development of students' technical thinking by involving the individual in the process of creating innovation. The content, procedural and organizational-methodological aspects identified in interdisciplinary integration ensure its integrity

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when applied to the methodology relevant to the learning process and allow the development of technical thinking.

3. The development of technical thinking of students takes place only in a specially organized training, which takes into account the characteristics of the professional activity of specialists of the engineering profile and the technological issues included in the educational process. Such issues are aimed at shaping the content and functional-operational components of technical thinking.

4. Interdisciplinary teaching has a positive effect on the level of formation of students' technical thinking, performing operations on images, regrouping organizers, memorizing and generalizing images, working with three-dimensional objects in practical space increases the level of technical thinking.

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