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**BASICS OF PRODUCTION AS A SYSTEM-FORMING COMPONENT  
OF PROFESSIONAL TRAINING OF A MODERN TEACHER OF NATURAL SCIENTIFIC  
AND TECHNOLOGICAL CYCLES**

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**Abstract**

The complication of the technogenic sphere is proceeding at an accelerating pace; therefore, more and more developed technological competencies are required from a subject of activity. The intensification of the technological sphere requires its reflection in the field of professional training of a modern teacher. The purpose of the article is to justify the need to revise the content, as well as the choice of means and methods, of professional training in connection with the formation of a new technological structure in society, based on a continuous change in the nature of production. A set of psychological and pedagogical conditions that ensure the effectiveness of professional training of students is highlighted. The materials of the article can be used by authors and developers of new approaches and concepts in the modernization of the content and technologies of professional training of a modern teacher.

**Keywords**

Basics of production – Flexible professional competencies – Modern teacher



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## Introduction

The continuous and ever-accelerating activity of humankind has led to the emergence of a technogenic environment, which is a combination of means and processes that have a supertotal effect. Since the complication of the technogenic environment is proceeding at an accelerating pace, flexible technological competencies are required from a subject of activity. Given the exponential increase in knowledge-intensive technologies and the creation of new technical means that save people from routine activities in the field of physical and mental work, one of the first tasks is “creating a scientific and technological system that includes the development and implementation of ‘uninhabited’ nature-friendly digital technologies, artificial intelligence”<sup>1</sup>.

The difference between the genetically determined state of a person and their state as a subject of activity is constantly growing; therefore, each new generation in the modern world experiences more and more difficulties in adapting to a real technical and technological world. Due to the constant change in the technogenic space, a person is forced to acquire flexible professional competencies. These competencies should be linked with the corresponding representation of a person who is able to actively function in the technical and technological environment: the characteristics of production and the variety of types of transformative activity, as well as the results and consequences of their influence on the personality; the dependence of processes, methods and means of activity on the development of science; the impact of transformative activities on the development of science itself. It is necessary to know the general laws of processes and methods of transforming resources in obtaining the final or intermediate result, as well as means and organizational forms, principles of action, functions and methods of production management, providing these processes.

Professional competencies of a modern teacher should include skills in prediction, designing and modeling processes and objects, as well as the implementation of a variety of technological operations for the management, maintenance and operation of common production facilities. There should also be the readiness to assess the state of the socioindustrial and technological environment in the context of digitalization of education and predict the success and mobility of one’s own professional activities.

The hypothesis of the study: preparation for the activities of teachers of natural scientific and technological cycles will be effective if the basics of production are the backbone of the training.

## Methods

The accelerating pace of technological development inevitably determines even higher rates of development of education at all levels; therefore, the problem of the formation of the subject of professional activity should be solved by the education system as a specially organized subsystem of the human community. Consequently, the effectiveness of professional training of a modern teacher can be achieved only in the process of implementing the content of education, which provides for the formation of knowledge about the basics of modern production and the acquisition of practical skills in

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<sup>1</sup> “Strategii nauchno-tehnicheskogo razvitiia Rossiiskoi Federatsii” na period do 2035, utverzhdennom Ukasom Presidentom RF №642 ot 01.12.2016 goda. Retrieved May 31, 2019 from: <http://www.kremlin.ru/acts/bank/41449>

the aspect of the transformation of objects of activity. The inclusion of students in practical activities through professional trials helps to activate cognitive and functional processes, which leads to the formation of an objective attitude to the surrounding reality, and to identify potential of students for professional activities<sup>2</sup>.

When solving this strategic problem, the exceptional importance of highlighting a number of areas in the context of solving the problems associated with the training of students becomes apparent. Particular importance should be given to the direction in preparing students for participation in the WorldSkills Championship.

This championship is organized by WorldSkills International (WSI), an international nonprofit association whose goal is to increase the status and standards of professional training and qualifications around the world and to popularize working professions through international competitions in certain competencies.

The implementation of this direction involves:

- strengthening the applied aspects of the study of laws, rules, conditions, forms and means of technological transformation of objects of activity;
- the formation of knowledge about the world of professions and production processes in the material and nonmaterial areas of activity;
- development of professionally significant personal resources of students on the basis of identifying professional orientation in the process of preparing for participation in the WorldSkills championship;
- awareness of the need for the rapid development of constantly emerging activities, including using digital technology and artificial intelligence.

## Results

Insufficient use of ideas about the basics of modern production in the process of training leads to the fact that the synthesis of transmitted educational information is spontaneously assigned to the students themselves, so the effectiveness of training is insignificant; therefore, the formal dissociation of the studied disciplines occur. For the purposeful formation of professionally significant personal resources in students in relation to specific areas and types of further professional activity in educational organizations, the design of the content of professional training should be carried out on the following main points:

1. the implementation of an approach that provides a systematic structuring of the content of professional education, taking into account the basics of production;
2. selection of a group of academic disciplines with a common object, subject and learning objectives aimed at preparing students for further effective educational activities in educational institutions;
3. improving the socioeconomic effectiveness of training by strengthening its targeting;
4. taking into account local changes in the needs of labor markets in accordance with the development perspective of production<sup>3</sup>.

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<sup>2</sup> F. A. Zueva, Predprofilnoe i profilnoe obrazovanie kak evolyutsionnye stupeni professionalnogo reproduktivnogo potentsiala lichnosti: monografiia (Chelyabinsk, IUMTS "Obrazovanie", 2007).

<sup>3</sup> F. A. Zueva, Predprofilnoe i profilnoe obrazovanie...

The structural component of the content of education with the basics of production is presented in Figure 1.

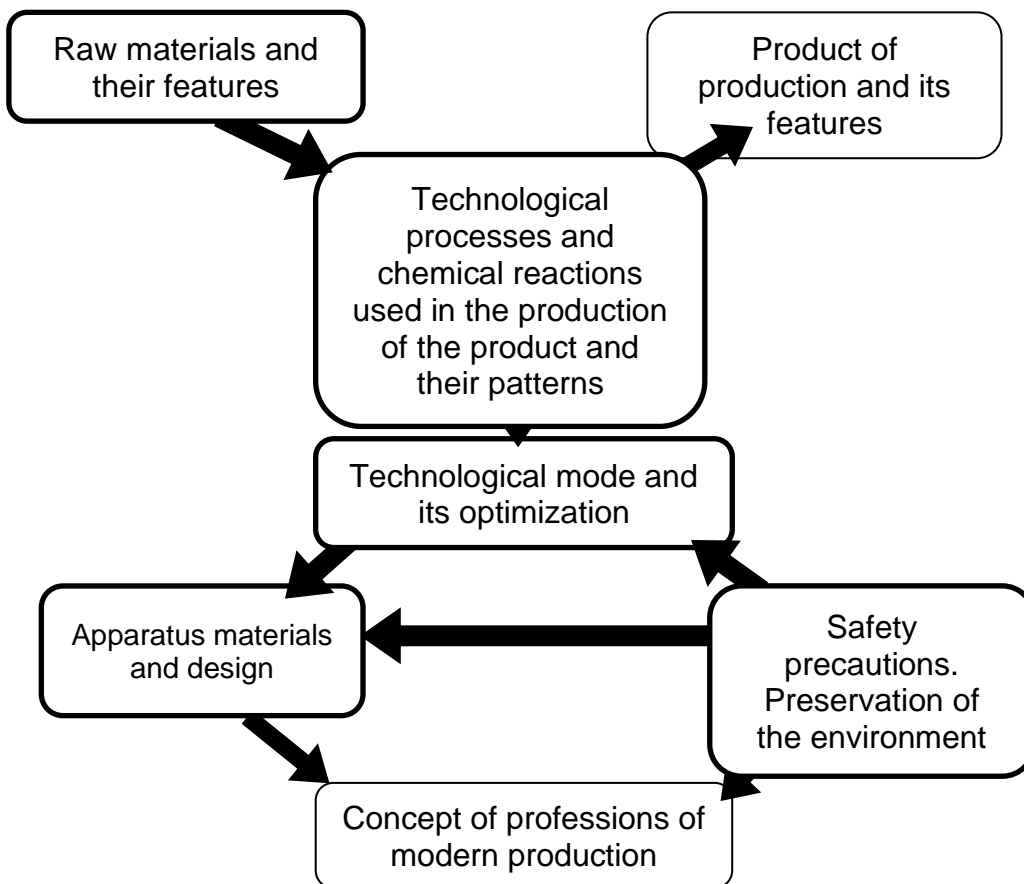


Figure 1

The structural component of the content of education with the basics of production

An important organizational direction is the formation of a student's functional competence, which requires mandatory knowledge of production technology and the principles of its organization. For example, the study of the production of sulfuric acid, allows students to demonstrate the applied nature of training. Substances are considered from different positions: as raw materials (sulfur or pyrites) and as a product of production (sulfuric acid). Based on its features, the areas of application of sulfuric acid in various industries are analyzed.

The rate of chemical reactions and the observance of the sequence of technological processes are the basis for establishing production modes and determining the design features of the corresponding equipment: kiln, electrostatic precipitators, contact apparatus, heat exchangers, adsorbers and others. Consideration of materials and apparatus designs allows to focus on techniques for increasing productivity and intensifying production, such as the use of oxygen-enriched air at the stage of firing raw materials, introduction of fluidized bed reactors, ensuring continuity, automation and remote control of technological processes, including the preservation of the health of people involved in the sulfuric acid production. When discussing environmental issues, particular attention is paid to the principles of organizing waste-free production and

sewage treatment systems, for example, the use of cyclones in the treatment of furnace gas and monitoring emissions of sulfur dioxide, sulfur and other substances that pollute the atmosphere, soil and water bodies<sup>4</sup>.

It is also necessary to dwell on the rotational method of studying technological processes at various stages of production. A study of the work of a process engineer, chemist, analyst, operator, repair and set-up technician and other specialists helps to discuss various aspects of improving technologies, production processes, apparatus and equipment, which entails the development of flexible professional competencies of students and contributes to the universality and effectiveness of training of students in general.

## Discussion

It is known that there is a close relationship between educational and professional interests. On the one hand, the deep and steady interest of students in the studied discipline awakens or enhances the cognitive interest in the chosen direction of professional activity. On the other hand, the emerging interest in the direction of professional activity contributes to the further development and deepening of educational interests, as well as the active assimilation of knowledge. Only a component of the content of professional training with the basics of production will allow students to develop their polytechnic horizons and the ability to navigate modern science-intensive technologies in the areas of production, service, digital interactions and communications. Students will be able to learn to understand the designs and principles of operation of the means of material and intangible production, master the basics of controlling common technological machines, devices, apparatuses and mechanisms, form practical skills of cognitive, creative and transformative activity and learn the applied elements of emerging competencies<sup>5</sup>.

Thus, one can talk about the development of new approaches to preparing students of educational institutions from the standpoint of imparting a developing, polytechnic, informational and technological orientation to the content of education in specialized disciplines. Structuring the content of education based on introducing a component with the basics of production for all training specialty is proposed as the basis for developing professional training of students since it is in the content of this component that natural scientific, as well as technical and technological knowledge that reveals how they can be used in various fields of human activity, is synthesized.

Therefore, this approach allows ensuring the practice-oriented nature of training students in all fields of study. There is a need to provide various options for combinations of specialized disciplines, providing a flexible system of training. Without dwelling on the basic general educational disciplines, which are compulsory for studying on all training specialties, one can determine the content of specialized disciplines in the context of professional training of students. The basis for building the structure of the content of educational material within the framework of specialized disciplines should be based on

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<sup>4</sup> N. V. Zabolotnaia, "Obshaia khimicheskaiia tekhnologiiia: "Proizvodstvo sernoi kisloty. Komputernoe modelirovanie". Orenburskii universitet. 2010.

<sup>5</sup> F. A. Zueva, "Optimalnoe sochetanie zadanii reproduktivnogo i produktivnogo kharaktera kak uslovie razvitiia myshleniia obuchaushikhsia", *Sovremennue naukoemkie tekhnologii* num 5 (2019): 122–126.

the block-modular principle. All content consists of logically complete blocks, arranged in turn from modules that represent certain technologies from various fields of activity. Their totality for the entire period of professional training will allow students to familiarize themselves with the basics of production in the main areas of professional activity. At the same time, the solution of various types of training problems covering the production areas contributes to the development of the professional training function and the formation of ideas about the basics of production on the basis of personal experience gained during professional tests in the process of educational pedagogical and production practices<sup>6</sup>.

## Conclusion

To summarize, one can conclude that the effectiveness of the professional orientation of students is achieved in the process of creating the following set of psychological and pedagogical conditions:

- consideration of the component with the basics of production in the content of specialized disciplines of natural science and technology cycles in conjunction with the future professional activities of students in the aspect of the holistic development of an individual;
- continuous monitoring of the nature of changes in the technological environment and emerging trends and making adjustments to the content of the education of professional training of a modern teacher;
- application of an integrative approach for the development of a student's systemic ideas about the surrounding technical and technological environment in conjunction with the formation of a student's initial experience in the process of conducting professional tests;
- the solution of multidisciplinary technology-oriented tasks related to the basics of production.

Thus, the content of the preparation of a modern teacher of natural scientific and technological cycles, the systematizing component of which is the basics of production, will ensure the continuity of training in profiles at a deeper substantive level and through the integration of the common component in the content of the educational material of specialized subjects. Forming an interconnected knowledge system among students, adequate to the modern scientific level in the context of preparation for the further professional activity will be ensured as well. At the same time, the component with the basics of production presupposes the accentuation of the student's attention on the application of the knowledge acquired that is significant for society. Therefore, the opportunity for using necessary competencies that are mutually beneficial for society and a particular subject of activity is created. This ensures the creation of an educational environment for "the formation of independent learning activities based on individualization and professional guidance, preparing a student for life in society, independent life choice, continuing education and the beginning of professional activity" declared by the Education Act in the Russian Federation.

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<sup>6</sup> F. A. Zueva; M. Zh. Simonova; S. G. Levina; I. A. Kilmasova y I. N. Likhodumova, "Influence of the functional relationship between concept, image and action on the process of solving interdisciplinary technology-oriented tasks", *Amazonia Investiga* num 8 Vol: 23 (2019): 391-397.

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