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Conceptual framework of development of technological education of students

Marco conceptual del desarrollo de la educación tecnológica de los estudiantes

Robert Ambartsumovich GALUSTOV 1; Nataliya Vasilyevna ZELENKO 2; Grigoriy Nikolaevich ZELENKO 3; Anjela Arsenovna TERSAKOVA 4

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Contents

ABSTRACT:
Labor education and labor training have many centuries of history but the contemporary developmental stage of the society has its own characteristics and demands the study of socio-economical and technic-technological aspects of labor education of students. Based on the analysis of literature and electronic resources, in this article are considered the achievements and main directions of development of science, mechanisms and technology, and identified the role of subject Technology in the solution of the problem. In the process of the research were identified the scientific, technic-technological and socio-economical foundations of society development, justified the conceptual framework of development of technological education of students; was identified the role of the regions in provision of the practice-oriented direction of technological education of students. The scientific novelty of research consists of the development of conceptual framework of development of technological education of students, the offering of principles and mechanism of implementation of the suggested conceptual framework in the institutions of general education in Krasnodar territory.
Keywords: development of mechanisms and technology, philosophy of technological education, conceptual framework, mechanism of implementation.

RESUMEN:
La educación y formación laboral tienen muchos siglos de historia, pero la etapa de desarrollo contemporáneo de la sociedad tiene sus propias características y exige el estudio de los aspectos socioeconómicos y técnicos de la educación laboral de los estudiantes. Basándose en el análisis de la literatura y los recursos electrónicos, en este artículo se consideran los logros y las principales orientaciones del desarrollo de la ciencia, los mecanismos y la tecnología, e identificó el papel de la tecnología temática en la solución del problema. En el proceso de investigación se identificaron los fundamentos científicos, tecnológicos y socioeconómicos del desarrollo de la sociedad, justificaron el marco conceptual del desarrollo de la educación tecnológica de los estudiantes; se identificó el papel de las regiones en la prestación de la orientación práctica orientada a la educación tecnológica de los estudiantes. La novedad científica de la investigación consiste en el desarrollo del marco conceptual del desarrollo de la educación tecnológica de los estudiantes, la oferta de principios y mecanismo de implementación del marco conceptual sugerido en las instituciones de la educación general en el territorio de Krasnodar.
Palabras clave: desarrollo de mecanismos y tecnología, filosofía de la educación tecnológica, marco conceptual, mecanismo de implantación.

1. Introduction

The history of development of humans and society is a witness to the deciding role of labor in that process (Atutov & Kalney, 1987). In the process of its evolution the labor became significantly more complicated: the humans began performing more difficult and differentiated acts, using more organized means of labor, place and reach higher aims. During a rather long period of evolutional development the humanity provided itself with instruments and devices allowing quick and effective transformation of nature elements into consumption products – clothes, food, transport, communication and so on (Zarechnaya, Zelenko, Radchenko & Zarechniy, 2015).

The laboring activity lies in the base of any social relationships and significantly influences the relationships and interactions of people. Teaching labor and labor education have many centuries of history, but the modern society with its own special characteristics requires the extra careful study of socio-economical, technic-technological, cognitive, ethical and moral aspects of that problem (Kalekin, 2010).

2. The analysis of scientific literature relative to the problem

The second half of the twentieth century and the beginning of the twenty first century are characterized by the sharp increase of the volume of industrial production in the world, the appearance of the calculating equipment and new, and also high, knowledge-intensive, material-saving, energy- effective technologies.

The development of civilization led to the creation of more complicated, integrated and inter-sectoral technologies: microelectronics, aviation, astronautics, mechanical engineering that in their turn, being intertwined and interconnected, continued developing in the paradigm of sectoral industry and economy.

The development of information technologies was the base for creation of technologies of above-sectoral character. Thanks to them were created tele-medicine, distant learning, digitally controlled equipment, autopilot systems on ships and aircrafts, and so on. Thus, the information technologies became a hoop, of sorts, that methodologically and theoretically united and integrated different scientific disciplines and technologies (Kovalchuk, 2010). And so has begun the third technological revolution in the history of humanity, appeared the postindustrial society with a high level of intellectual labor, the society of "white collars", that came to take over the industrial society of conveyer belt industry, the society of "blue collars" (Krings, 2006).

The appearance of new technologies in the industry and agriculture led to a sharp increase of world social production (three times higher from 1990 to 2010). Presently this increase continues on.

The creation of calculated machines led to the appearance of informational world and high technologies and to a significant increase of the amount of information used by population.

Various manifestations of technical reality could have been impossible without the unity of three elements: science, mechanisms and technology, but only during the New time they began uniting into one whole (Mironov, 2014).

Science as knowledge, mechanisms as an instrument and technologies as sequence of actions, three combining parts of "techno", have always been there, but only in the nineteenth century something has happened that changed the principles of their relationship with each other. The science as a verbal knowledge began influencing the further development of the mechanism and afterwards the creation of technologies (Mironov, 2014).

The reinforcement of the paradigm of integrity created the understanding of the need for the global multifaceted look onto the world. The processes of differentiation occurring in science clearly outpace the processes of integration. The science is divided into areas poorly connected with each other. Often we have a scientist speaking a language not comprehendible by colleague scientists from the neighboring branch of science (Krysova, Alieva, & Shevchenko, 2012).

In the past centuries the duration of the machine use was many times higher than the duration of human life. The rules regarding the usage of the machine and the social norms of organization of technology were passed from generation to generation. The lifetime of mechanisms was measured in years (Mironov, 2014).

Nowadays the period of mechanism exploitation is, on the average, a half of human life. Alongside that is a different direction of mechanism's evolution – one-time-use equipment. Today a computer is changed much earlier than the end of its material resource (prior to the end of its function). This example shows two ever fighting tendencies: modernization and revolution. Computers with the system block as a tower allow a basic change in the aspect of a mother board and the capabilities of the processor. The laptops are practically non-upgradable. The real life of a smartphone is 3-5 years, after which they become too old to compete.

Term "technology" has become applicable not only to the description of material transformations but also to energy, informational and social ones. Nobody is surprised by the terms such as "social technologies" or "pedagogical technologies".

The innovative economy based on the usage of new knowledge, novel ideas, has been developing actively. It relies on talent, creativity and initiative of humans as the most important resource of economic and social development.

Characteristically the possibility itself of technology implementation is directly connected with involving people in the process of production (material or informational). Technologies cannot exist beyond the social institute. The change of people, mechanisms and knowledge happens within the technological process.

The proportions of labor needed by different branches of service and industry have changed considerably. By the end of the twentieth century more than 50% of population was involved in material production. According to the forecasts of specialists by year 2020 the plants and factories will have only 5% to 10% of labor force left, at the same time the sector of information-communicational technologies will have at least 50% of the total amount of labor force. The handling of information is becoming the main type of labor.

During the twenty first century the majority of population will be employed in the service sector including education and medicine, and in the sector of information, science and culture. Even in agriculture and industry more laborers would be working with information than with soil or conveyer belt (Introduction, 2015).

2.1. Synthesis and systematization of information

Today the labor education as the transfer of experience from one generation to another is losing its importance. The first place is now given to the development of creativity, shaping of the abilities to learn, comprehend and to create something new. The outpacing development of education (introduction to what is just being developed) has a deciding meaning not only for the development of society, but also for individual lives of every human being.

Fundamental meaning in upgrading the content of education has been acquired by the fundamentality which provides the universality of received knowledge, the study of generally recognized cultural-historical achievements of humanity, the possibility of application of the knowledge in new situations; the strengthening of the methodological component of education content, the study of main theories, laws, principles, ideas, methods of research used in the main sciences, methods of cognition and transformation of the world (Ovechkin, 2005).

One of the current trends in the development of education belongs to integrativity that scientists divide into three main aspects: scientific integrativity (interdisciplinary), integrativity of science, education and industry, and integrativity of knowledge, skills and personal characteristics (competency) (Slastenin, 2005).

The contemporary model of labor education in Russia has been established in 1993 when the educational subject Technology was distinguished among the content of base curriculum. The reason for that was the need of sturdy modernization of labor education: its enrichment with an intellectual-creative component.

The cross-cutting lines of the content of the subject Technology include alongside the study of methods of processing materials also the mastering of the culture of labor, information technologies, design, applied economy, ecology, graphics, and the bases of the profession selection and completion of creative project.

Nowadays the subject Technology works as a main integrating mechanism allowing in the process of practical and project-technological activities for the synthesis of natural-scientific, scientific-technical, technological, entrepreneurial and liberal arts, revealing the methods of their application in different areas of human activities, and providing the pragmatic (applied) direction of general education (Khotuntsev, 2013).

Important role in the solution of tasks of technological education belongs to a method of projects, allowing practice-oriented direction and opening great opportunities for implementation of the person-oriented approach.

Monitoring researches conducted by teachers of the Faculty of Technology, Economics and Design of the Armavir State Pedagogical University, and i
the discrepancy between the content of technological education received by school graduates, the professional interests of youth and market deman
the low level of material and technical support for training workshops and classrooms, which does not allow to fully meet the objectives of achie
the insufficient motivation of pedagogical workers to improve the quality of technological education.

At the same time, the demands of the labor market clearly put before the system of education the task of familiarizing the younger generation with modern and promising emerging technologies, with the key ones being: technology for creating new materials (bioplastics, carbon plastics, genetically modified products, etc.); transformation of materials (nanotechnologies, laser technologies); energy saving technologies, alternative energy, biofuel; information technologies (computer equipment, robotics, 3-Dimensional technologies, Global Navigation Satellite System, etc.); transport and agricultural technologies; technologies of sustainable development (material saving, waste processing).

It is characteristic that it would be wrong to impose strict standards of technology choice on educational institutions and students. An important role in the selection of priority technologies is played by the socio-economic characteristics of the regions, the development of which is directly related to the preparation of competitive personnel needed by the regional labor market.

3. The results of the research

Based on the studies carried out and taking into account the role of technological education in solving this problem, we proposed a Concept for the Development of Technological Education in the Krasnodar Territory, ensuring the achievement of a competitive level of quality of technological education in the institutions of general education of the region (Galustov & Zelenko, 2015).

At the heart of the strategic goal of the draft Concept for the development of technological education in the Krasnodar Territory is the idea of achieving a competitive level of quality of technological education in the institutions of general education of the region through the rational use of socio-educational, information and technic-technological capabilities of organizations and factories of educational, industrial and sociocultural spheres, parents and other interested persons and structures that have these capabilities.

The advancement of this goal is based on an understanding of the reasons behind the decline in the quality of technological education, which is the starting step in the process of reproduction of human resources for the regional economy.

To design the Concept of the development of technological education of students in the Krasnodar Territory were applied such methodological approaches, as systemic, synergistic, personal and activity.

The concept is developed in accordance with the basic principles:

- the principle of conformity of the development of technological education to the main directions of the state policy of the Russian Federation and Krasnodar Region in the field of education;
- the principle of flexibility and adaptability contributing to a preventive and mobile response to changing conditions, growing demands of customers of educational services: employers, society and the individual;
- the principle of openness, which assumes the formation of an accessible information environment in the framework of network interaction, as well as the system of social partnership and public reporting on the results of joint implementation of the Concept provisions;
- the principle of innovative development, which contributes to the formation of initiative, independence, responsibility amongst all participants in the system of technological education;

- the principle of collegiality, which assumes situational or technical coordination of what was planned beforehand with taking into account new realities via the collective discussion of most important, for technological education, directions of development of regional education;
- the principle of competence, reasonable pragmatism and staff success, providing for the inclusion in the process and responsibility for the end result of all participants in the development of the system of technological education;
- the principle of multilevel technological education, the construction of an individual educational trajectory;
- the principle of succession of stages and steps of technological education;
- the principle of flexibility, maneuverability and variability of the content and technologies of the educational process in the system of technological education;
- the principle of integration of educational structures, creation of a unified educational space.

In the proposed by us Concept of the development of technological education in institutions of general education of the Krasnodar Territory and the region the following objectives have been identified:

- orientation onto the high technologies, creation of innovative infrastructure;
- creation of motivational conditions for involving the subjects of educational institutions in the development of technological education;
- improvement of the material base of technological education on the basis of the development of forms of network interaction between educational institutions of various levels, as well as the development of social and educational partnership of educational institutions with high-technology industry and business structures;
- creation of conditions for obtaining education, improving professional skills of technology teachers and leaders of technical circles, and attracting young specialists to the education field.

Among the leading tools to achieve these goals of improving the quality of technological education, the Concept refers to the appropriate mechanisms.

In the process of implementing the first objective, the orientation towards high technologies, the creation of an innovative infrastructure supporting the development of technological education in the Krasnodar Territory, the leading, by definition, are the mechanisms for creation and development of resource centers (technoparks). The material-technical, financial, organizational-methodological, information and consulting services of technological education are designed to acquaint students with the theory and practice of usage of innovative technologies in modern production.

The main mechanism for achieving the second objective, creation of motivational conditions for involving subjects of educational relations in the development of technological education, is the information-motivational accompaniment. Motivational conditions have a subjective origin, that is, they are created by people (teachers, parents, heads of general educational organizations or educational authorities), respectively, the creation of an appropriate motivational environment can be managed. Selecting and implementing the reasonable motivational conditions, it is possible to create an environment that will provide a sustainable stimulating effect on the various subjects of the analyzed segment of pedagogical activity.

The main mechanism for achieving the third objective, the improvement of the material base of technological education, is the development of network interaction between educational institutions of various levels, as well as the development of social-educational partnership of educational institutions with high-technology industry and business structures. The existing in the region experience of such interaction (Ust-Labinsky district, Timoshevsky district) testifies to the high efficiency of such interaction.

The basis for the achievement of the fourth objective, the creation of conditions for obtaining education, improvement of the professional skills of technology teachers and leaders of technical circles, we see as the involvement of young specialists into the education field, the development of a network of internships, information-methodological support of the educational process.

4. Discussion of the results

The ideas offered by us had been widely discussed during methodological seminars, scientific-practical conferences, on the pages of scientific-pedagogical journals (Galustov & Zelenko, 2015) and have always found support by the progressive educators, students and their parents. Summarizing of the experience of schools and institutions of additional education shows that the proposed by us ideas for the development of technological education have already found their fans and are being successfully implemented. The greatest popularity in schools is gained by educational robotics. Acquaintance with robotics and teaching robot design usually takes place with the use of the LEGO® Education WeDo constructor, aimed at work with children of different ages and different levels of training (Galustov & Zelenko (Eds.), 2016).

Another but not less significant direction of innovative development of technological education supported in pedagogical circles and possessing a huge potential are Three Dimensional (3D) technologies. They are based on the development of 3D models or prototyping, assuming the availability of skills in the manufacture of prototypes of parts, units of products or whole products. They also include the acquaintance of students with computer graphics, focused on the development of blueprints, virtual models and files containing information necessary for the life cycle of parts, components and whole products.

The experience of teachers in acquaintance of students with 3D-modeling showed that students, starting from 6-7 grades, easily and willingly learn the appropriate skills. Step-by-step instructions provide the formation of skills to develop three-dimensional models and manage the 3D-printer.

In April 2017, the final stage of the All-Russian Olympiad of students in technology was held at the Armavir State Pedagogical University. Participants who chose practical work in the nominations “Robotics” or “3D-modeling” successfully coped with the tasks assigned to them: they assembled and programmed a robot, or in three hours developed a 3D model and printed it out on a 3D printer. All this confirms the vitality of the proposed concept, actualizes the need for its implementation in the practice of schools.

5. Conclusion

The changed socio-economic conditions and the demands of the labor market clearly put before the system of education the task of acquainting the younger generation with modern and promisingly developing technologies.

The subject area Technology acts as the main integration mechanism that allows, in the process of object-practical and project-technological activity, to provide: motivation for high technologies; improvement of the material base on the basis of the development of forms of network interaction of educational institutions of various levels, as well as the development of the social and educational partnership of educational institutions with high-technology industry and business structures; improvement of professional skill, updating of staff.

An important role in the conceptualization of technological education belongs to the regions whose socio-economic characteristics are directly related to the preparation of competitive staff demanded by the regional labor market.

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1. Federal State Educational Institution of higher education "Armavir State Pedagogical University" (FGBOU IN "ASPU"), 352901, Russia, Krasnodar Territory, Armavir, Rosa Luxemburg street, 159

2. Federal State Educational Institution of higher education "Armavir State Pedagogical University" (FGBOU IN "ASPU"), 352901, Russia, Krasnodar Territory, Armavir, Rosa Luxemburg street, 159

3. Federal State Educational Institution of higher education "Armavir State Pedagogical University" (FGBOU IN "ASPU"), 352901, Russia, Krasnodar Territory, Armavir, Rosa Luxemburg street, 159. E-mail: uzelnv@rambler.ru

4. Federal State Educational Institution of higher education "Armavir State Pedagogical University" (FGBOU IN "ASPU"), 352901, Russia, Krasnodar Territory, Armavir, Rosa Luxemburg street, 159

5. Federal State Educational Institution of higher education "Armavir State Pedagogical University" (FGBOU IN "ASPU"), 352901, Russia, Krasnodar Territory, Armavir, Rosa Luxemburg street, 159

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[Índice]

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