

**FEATURES OF DEVELOPMENT OF SCIENTIFIC AND METHODOLOGICAL
SUPPORT FOR IMPLEMENTATION OF TECHNOLOGICAL EDUCATION
CONTENT IN THE GYMNASIUM (PRIMARY SCHOOL)**

*Anatoliy Tarara,
Candidate of Physical and Mathematical Sciences,
senior researcher, associate professor,
Institute of Pedagogy of the National Academy of Pedagogical Sciences of Ukraine,
Kyiv, Ukraine,
ORCID ID <https://orcid.org/0000-0001-7517-0651>,
e-mail: lab301@ukr.net;*

*Inna Sushko,
teacher of Kyiv National
University of Trade and Economics,
Kyiv, Ukraine,
ORCID ID <https://orcid.org/0000-0002-1905-192X>,
e-mail: sia_2011@ukr.net*

The article clarifies the state of coverage in the literature of scientific and methodological support for the implementation of technological education content of primary school students. To conduct the study, the modern technological education content of technical-technological and engineering-technical direction has been determined, its importance has been substantiated for the educational process in the gymnasium, technical progress. The importance of following the principles of didactics "logic" and "continuity" has been emphasized during the training of high school and high school students, the implementation of certain content in both parts of the school. The necessity of logical interrelation has been substantiated between training methods of gymnasium and high school students, the system approach in the course of pupils' training of these links of educational institution. The scientific (theoretical) basis has been created for development of a technique of realization for the maintenance of technical-technological and engineering-technical orientation in gymnasium. Psychological, pedagogical and methodological requirements (conditions) have been determined for the effective implementation of the technological education content in the gymnasium.

Keywords: content; teaching methods; scientific basis; didactic principles; methods; approaches; basic school (gymnasium); high school; technical creativity.

Formulation of the problem. Currently, the urgent problem is to develop a methodology for implementing of technological education content of high school students (primary school) in accordance with the requirements of the new state standard of basic secondary education, the concept of "New Ukrainian School". In the context of this *wewill determine the direction of the t of technological education content of high school students, which is important for the development of their creative technical activities and a modern approach, based on which a new method of its implementation*

will be developed. Note that in order to concise presentation, along with the term "scientific and methodological support" we will use a similar essence of the term "methodology".

The authors of the article in the Department of Technological Education of the Institute of Pedagogy of the National Academy of Pedagogical Sciences of Ukraine developed a manual "Technical creativity of students in the process of design and technological activities", a curriculum and a textbook. Technical types of work ", which are introduced into the educational process of primary school for experimental testing of their content [1; 2]. The content of the manual considers a wide range of methodological and didactic issues related to technical creativity of primary school students as a basis for their preparation for future creative technical activities (in particular, initial vocational and pre-professional training of students in 8-9 grades), general theoretical issues of technical creativity. features of formation of students' project-technological competence. *In the content of the textbook at the beginning of students' mastery of the basics of technology the students' technical creativity has been set strategically correctly* in the process of creating a product from idea to its implementation in the finished product in the process of design and technological activities, rather than traditional learning. We emphasize that the above approach in the content of teaching primary school (gymnasium) fully corresponds to the content of the 1st direction of technological education in the new state standard of basic secondary education (technological education) "Implementation of the idea into a finished product by the algorithm of design and technological activities" . It emphasizes the importance of creative activity of students, as the basis of design and technological activities, the implementation of all its stages is the creativity of students, in particular, technical.

In the context of the above we specify that the bases of successful performance of all stages of creation of any technical object (product) are 4 types of students' technical creativity (design, construction, rationalization, invention), means of technical creativity (methods, techniques, etc.) for their implementation in the process of creating a product and technology of technical direction. Therefore, the content of the above (the basis of the stages of product creation, manual and textbook) is a very important *component* of the

technological education content of high school students. At the same time, the level of its complexity should be different for students of 5-6 grades and 7-9 grades, to meet the age characteristics. Under the condition of successful, thorough performance by students of the basic school of all stages of a technical product creation in the course of development of the creative project, mastering of bases of the theory and practice of technical creativity, etc. *the content of education will correspond to the creative, modern technical-technological and engineering-technical direction* (unlike the traditional in the primary school - only the "executive" technical-technological). It should be emphasized that for technical progress, this direction of the education content of high school students, as future engineers, designers, etc., acquires special significance. *The above led to the choice of technological education the content in this area for the study.* However, the presence of only modern technological content will not be able to ensure the formation of students' project-technological competence at a high level. To meet the requirements of the new state standard, the concept of "New Ukrainian School" requires a modern, effective method of its implementation, which, in turn, requires the creation of a scientific (theoretical) basis for its development.

In the last decade, the problem of creating curricula, textbooks, manuals on technology is solved at a qualitatively new level: the design of their content is carried out on a developed scientific basis [3-8]. Given the above, the method of implementing the content of technological education of high school students (in particular, a certain content of technical-technological and engineering-technical direction) should also be developed on a scientific basis (*proposed as an innovative idea*).

Thus, the urgent need to develop an effective method of implementing the content of technological education of high school students, which would meet the requirements of the new state standard and the concept of "New Ukrainian School" and would be based on scientific (theoretical) basis, *determines the urgency of the problem*. During the development of the methodology of content implementation it is necessary to solve another problem: to ensure systematization in teaching it is necessary to propose and substantiate a certain connection between the content of education and the developed methodology for primary school students with the content and methods of teaching high

school students, to reveal its essence and importance in the scientific and educational and methodological plan. To highlight the features of solving these scientific problems is the task of the article.

Analysis of recent research and publications. As mentioned above, the new state standard of basic secondary education emphasizes the importance of creative activity of high school students, the development of their creative abilities in the process of design and technological activities. The concept of "New Ukrainian School" also emphasizes the creative approach of students to mastering the material. Particular attention is paid to the need to form students' *technological competence* - very important for the XXI century.

Scientists of the Department of Technological Education of the Institute of Pedagogy of the National Academy of Pedagogical Sciences of Ukraine (A.M. Tarara, V.I. Tutashynsky, T.S. Machacha, V.V. Vdovchenko) prepared a monograph, which a method of forming basic concepts of the content of technological education has been developed in. A wide range of students' activities in grades 5-9 in the lessons of labor training has been covered: technical and artistic creativity of students, equipment and technologies, service types of work, etc. From them the basic concepts have been defined which should be mastered by students in the course of mastering of bases of technologies.

A.M. Tarara in 2 methodical manuals "Development of students' creative abilities of 5-9 classes in the course of design and technological activity" and "Technical creativity of students in the course of design and technological activity" covers methodical features of the organization of creative activity of students' of 5-9 classes in the course of design and technological activity.

V.I. Tutashinsky conducted research on methods of forming the of labor education content in primary school on the basis of project technology (manuals and textbooks for primary school).

T.S. Machacha in her dissertation research developed a method of forming the concept of "design and technological culture" in primary school students.

In the dissertation research V.P. Melnychuk developed a method of forming technical and design knowledge and skills of rural school students.

However, the author considers only the established (traditional) methods of formation of the specified knowledge and skills. At the same time, the author also ignores organizational forms of learning, new ways and approaches, the formation of students' project-technological competence (such tasks were not set in the dissertation).

Since the introduction of the project-technological approach in the content of technological education in Ukraine (2000-2005), a significant number of methodical manuals, methodical developments for teachers, articles, etc. have been published, which cover the methods of project-technological activity of students of 5-9 grades in the lessons of labor training, project pedagogical technology. Scientists O.M. Kobernik, V.K. Sidorenko, A.I. Tereshchuk, V.V. Berbets, V.P. Timenko, M.S. Korets, A.M. Tarara, V.I. Tutashinsky, T.S. Machacha, V.V. Vdovchenko, L.V. Kilderova, V.M. Slabko, I.V. Zhernokleiev and others considered in their works a wide range of methodological issues of implementation of the design and technological approach in the lessons of labor training, methods of organizing design and technological activities of students [9-14].

The essence of pedagogical designing and project technology has been substantiated by Kobernik O.M., features of its application for the decision of educational tasks and problems have been defined [15].

The methodological support of design and technological activities of students should include various educational and methodological materials developed by the staff of the Ministry of Education and Science of Ukraine and regional institutes of postgraduate pedagogical education (S.I. Diatlenko, N.I. Borynets, V.M. Gashchak, G.M. Gavryliuk and others). Model samples of creative projects, methods of their implementation have been developed in the educational process. As can be seen from the analysis of literature sources, scientific developments of scientists relate mainly to the methods of organization of students' design and technological activities.

The design-technological approach in the content of technological education of primary school students is quite important, but it does not mean that it should be unique. However, at this time in the scientific literature new, innovative ways, approaches are not sufficiently disclosed to implementing the content of technological education, methods of their use in the educational process. In addition, the above methodological support for the

implementation of the content involves design and technological activities of students (according to existing curricula and textbooks for students 5-9 grades) after mastering the basics of materials science, engineering and technology, *which does not meet the new state standard*, underestimates the importance of the project approach as the basis of students' creative activity, development of their creative abilities. The vast majority of works do not address the issue of methods of using interactive methods and innovative organizational forms of learning in the classroom.

Well-known scientists paid attention to the development of methods and techniques of labor training of students in different years: D.O. Thorzhevsky, V.K. Sidorenko, V.I. Kachnev, V.A. Gorsky, P.M. Andrianov and others. A classification of methods (explanatory-illustrative, reproductive, problem-based, partially exploratory, research) has been developed, which have proved themselves well for the organization of technical and technological activities of students. In recent decades, a significant number of innovative organizational forms of learning have emerged. However, it should be noted that in different learning situations, at different stages of developing a creative project, etc. these and other methods and forms of teaching must be used by the teacher methodically correctly, and the teaching methods in general must meet the requirements of the new state standard and the concept of "New Ukrainian School". Of course, it is important for the teacher to use each individual method or organizational form of teaching skillfully. However, the educational activity of students to master the basics of technology is a multifaceted and wide-ranging process, and therefore it is impossible to say about the effectiveness of the use in the educational process of certain methods, organizational forms, methods, approaches and so on. In modern teaching conditions (in accordance with the requirements of the new State Standard and the concept of the "New Ukrainian School"), the question of developing a methodology for the systematic use of traditional methods, forms should be raised in the educational process, the development of modern methods of teaching technology in general. Finally, it should be noted that all the above research *did not involve the development of methods for teaching technology to primary school students on a previously established scientific basis*.

Thus, the analysis of the state of the identified problem shows that there is an urgent need to develop a new method of implementing the content of technological education of high school students (new scientific and methodological support), which would meet the requirements of the new state standard, the concept of "New Ukrainian School" and would be based on scientific basis.

Forming the goals of the article. The purpose of the article is to substantiate the choice of technological education content, its importance for teaching high school students and creating a scientific (theoretical) basis for developing methods of implementing the content of the chosen direction in the educational process of high school.

Presentation of the main material. In recent years, due to the urgency of the specialized training problem of school graduates, the Department of Technological Education conducted research on 2 topics: fundamental "Designing the content of specialized technology training in high school" (2015 - 2017) and applied "Scientific methodical support of the variable component of the content of profile technology training in the professional lyceum "(2018 - 2020). In the process of implementation of the first of them the theoretical and methodological bases, a scientific basis of designing of the maintenance of profile technology training in senior school have been developed. The results of the study are presented in a collective monograph. As an example of the research results implementation, the authors developed the content of the manual for high school "Scientific and technical creativity" [16]. In the process of implementing the 2nd topic, the attention of the department was focused on designing the content of special courses that meet the priority areas of industrial development of Ukraine and developed a method of implementing the content of specialized technology training in high school. In particular, the authors of the article developed a special course (curriculum and manual, that is, its content) "Design and construction of equipment" and most importantly - *a new method of implementing the content* of technical-technological and engineering-technical direction (which is the content of the special course and above manual)[17; 18]. *We emphasize that this method was developed by the authors for the first time.* Thus, the content of technical-technological and engineering-technical orientation for profile

technology training and a new technique of its realization have been introduced in the high school.

As already mentioned, for the development of scientific and methodological support for the implementation of the technological education content in the gymnasium, we also chose the content of technical-technological and engineering-technical orientation. Therefore, the development of methods for implementing the content in the gymnasium of this orientation is important to *ensure systematic teaching of gymnasium and high school students, to promote the choice of 9th grade students of special engineering courses for specialized education in high school (next proposed idea)*. In this article, as the first stage of the study, we will consider the issue of creating an appropriate scientific basis for the development of scientific and methodological support. Consider this question.

First of all, it should be emphasized that one of the important components of the scientific basis for the development of methods for implementing the content of technological education of high school students should be known *scientific approaches: competence, activity, personality-oriented*.

The content of technological education in the gymnasium of technical-technological and engineering-technical orientation is consistent with the content of the same direction of the special course "Design and construction of equipment" and the manual "Scientific and technical creativity" for specialized training of high school students. However, if the content of education in the gymnasium and high school is typical (of the same subject, direction), then the method of its implementation, the method of teaching students should be logically interconnected, not to have fundamental differences. *Thus, we have identified the following important component of the scientific basis: the presence of a logical relationship in the teaching methods of high school and high school students*. This connection is especially important in the process of teaching students in grades 8-9, where you need to carry out pre-professional training. Teaching students the content of technical-technological and engineering-technical direction will significantly contribute to their choice of special courses of the same direction in the process of specialized training in high school. This approach is an important

psychological, pedagogical and methodological requirement (condition) for the implementation of technological education content in the gymnasium.

According to the defined interrelation, in the process of development of a technique of realization of technological education maintenance in gymnasium it is necessary to adhere to the *basic principles of didactics: "sequence" and "continuity"*.

In the case of typical content for high school and high school students in the educational process a systematic approach should be implemented. Accordingly, in the process of developing scientific and methodological support the principle of "system" should take into account. At the same time, the method of teaching high school students should be simpler, that is, meet the didactic *principles of "taking into account the age characteristics of students", "conformity", "differentiation"*.

The content of the 1st direction of technological education in the new state standard, the above-mentioned manuals and textbooks provides for technical creativity of students in the process of design and technological activities (design and construction of technical object, development of creative project in general, etc.). Therefore, in the process of developing a methodology for implementing the content of technological education should follow *the principle of "creativity"*. The technical creativity of students is based on the practical necessity of the product designed by students, and therefore the method of teaching students the basics of gradual creation of a product from idea to implementation in the finished product should meet the *principles of "connection of learning with practice", "clarity", "variability"*.

An important component of the scientific basis for the development of methods for implementing the content should be the *basic provisions (principles) of the psychology of technical creativity*. In particular, in the process of developing a methodology for implementing the content, the peculiarities of human mental activity should be taken into account. Such features, first of all, include: the inertia of human thinking in the process of solving creative technical problems, subconscious human thinking (intuition), the ability of man to associative thinking (the use of different types of associations).

In the process of implementing the content of technological education, the teacher should attach importance to the game type of learning - game role-playing games.

Collective creative games, in the process of which it is necessary to carry out search activities, to quickly navigate in difficult situations that mimic production activities, are of exceptional importance for the activation of students' creative activity, effective development of their creative abilities, professional orientation. In the general case, game learning is an active cognitive activity, during which students show initiative, independence, initiative, develop an active position, create an emotional and intellectual atmosphere, psychological comfort. Game training provides the development of skills to take an active position, skills for self-management (self-organization, self-realization, self-control), personal activities, etc. [19]. Thus, the next component of the scientific basis should be *the principle of "team-game training"*. Especially important in this case is the presence in the business game of roles that mimic the creative technical activity of professionals. Peculiarities of the use of game learning in the educational process, its methodically correct organization by the teacher are referred to *the psychological-pedagogical and methodological requirements* (conditions) for the implementation of the technological education content in the gymnasium.

Specific methodological approaches, innovative ideas and methods of technical creativity should be a necessary component of the scientific basis for the development of methods for implementing the content of technical-technological and engineering-technical direction (in particular, in the process of organizing "technical" role business game). Consider them.

1. The developed technique of the maintenance realization should provide methodically correct organization of students' activity in gymnasium on the principle of activity of industrial design bureaus, department of the technologist, experimental model shop, presentation hall. The essence of creative activity in this case is that each student chooses a certain creative role in the game: designer, constructor, technologist, game manager. Students can change roles if desired. This will help to create a learning environment close to production in the classroom. This *methodological approach of the teacher* significantly increases (as practice has shown) the effectiveness of students' mastery of relevant educational material. The considered approach should also be

attributed to the *psychological-pedagogical and methodological requirements* (conditions) for the implementation of technological education content in the gymnasium.

2. The use of innovative ideas as an important component of the scientific basis. Example of the idea: "Methods of implementing the content of technical-technological and engineering-technical orientation in the gymnasium should be consistent with the content of the main types of specialists' technical creativity (design, construction, rationalization, invention), differentiated to the students' level, not the content of their traditional group work.

3. The use of specific methods of technical creativity. The main stages of product creation by the students in the process of design and technological activities should include: formulation of the problem situation, ideas, product design; resolution of overdue technical contradictions; creation of a sketch project in the process of product design; performing product design operations; development of product manufacturing technology and direct production by the students. The essence of these operations, features and sequence of their performance, etc. are components of the technological education content of technical-technological and engineering-technical orientation. Successful solution of problem situations in the process of product design, performance of these creative operations by the students requires knowledge and skills to use specific methods of technical creativity methodically correct. *Therefore, in the process of developing a methodology for implementing content, it is necessary to take into account the peculiarities of the use of these methods* and, accordingly, to refer them to the components of the scientific basis for developing a methodology for implementing content. Consider an example of a specific method and features (methodology) of its use by students in the process of solving technical problems.

Problem. "Knees" (rounded sections) of pipelines that transport crushed coal, quickly wears out due to erosion. How to be?

Problem solving. We formulate a technical contradiction in this problem: coal is transported, but the "knees" of the pipeline do not wear out.

The cause of the problem (knee erosion): in a rounded section of coal acts on the walls of the pipe with a force much greater than the force with which it acts on the straight sections of the pipeline.

The goal to be achieved is to prevent the "knees" of the pipeline from being worn out by coal fines.

We analyze the problem situation. Wear of the "knees" will not occur only when the coal will not slide on the "knee". We formulate the following idea: near the surface of the "knee" it is necessary to create a layer of coal that would protect the wall of the pipe, constantly recovering.

A technical solution is possible: on the inner wall of the "knee" you need to create a lattice, which would constantly accumulate coal, which is transported. At the same time there is a protective covering - coal prevents wear of "knee".

The essence of the method: to create an accumulator of abrasive medium, which protects the surface of the "knee" from operation under the action of the flow of the medium. It turns out that the object seems to "serve" itself. The resulting method of solving a technical problem was called "*self-service method*". It is interesting to know that in technology there are many cases when the object in question "*serves*" itself.

4. The scientific basis should include the approach, which is especially important in the process of pre-professional training of students in grades 8-9. In order to maximize the students' interest, to intensify their creative activity, the teacher should: maximally visualize the specialists' professional activities and other educational material of the production plan; to reveal the features of specialists' professional activity, their tasks and responsibilities, qualification requirements for professions; provide information about the life and work of prominent designers, scientists, etc.

5. The method of implementing of technological education content of high school students should *provide* links with related school subjects (physics, biology, economics, etc.) and general technical disciplines of higher education institutions.

Thus, we considered the main components of the scientific basis for the development of methods for implementing of the technological education content of high school students. A significant part of the components of the scientific basis are both

psychological and pedagogical and methodological requirements (conditions) for the implementation of the technological education content in the gymnasium.

Conclusions. The article highlights the results of the analysis of literature sources on the research problem. The authors note that a significant number of scientific works are devoted to the definition of methodological features of the implementation of the content of technological education of high school students, methods of teaching students technology. However, most of these works considered the method of organizing the design and technological activities of primary school students, which did not involve the development of a scientific basis. Scientists have created classifications of teaching methods, in the last decade there have been innovative forms of organization of the educational process. However, in the literature there is no information on the development of methods of systematic use in the educational process of traditional methods, forms, etc., development of methods of the maintenance realization of technical-technological and engineering-technical orientation.

The article substantiates the choice of modern content of technical-technological and engineering-technical orientation for the research. It is emphasized that for technical progress such direction of the education content of high school students, as future engineers, designers, etc., acquires special significance. The idea is substantiated, according to which the method of realization of the technological education content of gymnasium students (in particular, determined for research of the content of technical-technological and engineering-technical direction) should be developed on a scientific (theoretical) basis. The necessity of logical interrelation between methods of teaching high school and high school students, a systematic approach in the process of teaching students has been substantiated.

The scientific (theoretical) basis has been created for the development of a realization technique of the maintenance of students' technological education in gymnasium. Its components are: known scientific approaches, the logical relationship between the content and methods of its implementation for high school and high school students, didactic principles, developed methodological approaches and specific methods of technical creativity, innovative ideas, the basic principles of psychology of technical creativity.

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Анатолій Тарара, кандидат фізико-математичних наук, старший науковий співробітник, доцент, відділ технологічної освіти Інституту педагогіки НАПН України, м. Київ, Україна;

Інна Сушко, викладач Київського національного торгово-економічного університету, м. Київ, Україна

ОСОБЛИВОСТІ РОЗРОБЛЕННЯ НАУКОВО-МЕТОДИЧНОГО ЗАБЕЗПЕЧЕННЯ РЕАЛІЗАЦІЇ ЗМІСТУ ТЕХНОЛОГІЧНОЇ ОСВІТИ В ГІМНАЗІЇ (ОСНОВНІЙ ШКОЛІ)

У статті з'ясовано стан висвітлення в літературі науково-методичного забезпечення реалізації змісту технологічної освіти учнів основної школи. Для проведення дослідження визначено сучасний зміст технологічної освіти техніко-технологічного та інженерно-технічного спрямування, обґрунтовано його важливість для навчального процесу в гімназії, технічного прогресу. Наголошено на важливості виконання принципів дидактики «логічність» і

«наступність» під час навчання учнів гімназії і старшої школи, реалізації визначеного змісту в обох ланках школи. Обґрунтовано необхідність логічного взаємозв'язку між методиками навчання учнів гімназії і старшої школи, системного підходу в процесі навчання учнів цих ланок освітнього закладу. Створено наукову (теоретичну) основу для розроблення методики реалізації змісту техніко-технологічного та інженерно-технічного спрямування в гімназії. Визначено психолого-педагогічні та методичні вимоги (умови) для ефективної реалізації змісту технологічної освіти в гімназії.

Ключові слова: зміст, методика навчання; наукова основа; дидактичні принципи; способи; підходи; основна школа (гімназія); старша школа; технічна творчість.

Анатолій Тарара, кандидат педагогических наук, старший научный сотрудник, доцент, отдел технологического образования Института педагогики НАПН Украины, г. Киев, Украина;

Инна Сушко, преподаватель Киевского национального торгово-экономического университета, г. Киев, Украина

ОСОБЕННОСТИ РАЗРАБОТКИ НАУЧНО-МЕТОДИЧЕСКОГО ОБЕСПЕЧЕНИЯ РЕАЛИЗАЦИИ СОДЕРЖАНИЯ ТЕХНИЧЕСКОГО ОБРАЗОВАНИЯ В ГИМНАЗИИ (ОСНОВНОЙ ШКОЛЫ)

В статье выяснено состояние освещения в литературе научно-методического обеспечения реализации содержания технологического образования учащихся основной школы. Для проведения исследования определены современное содержание технологического образования технико-технологического и инженерно-технического направления, обоснована его важность для учебного процесса в гимназии, технического прогресса. Отмечена важность выполнения принципов дидактики «логичность» и «преемственность» при обучении учащихся гимназии и старшей школы, реализации определенного содержания в обоих звеньях школы. Обоснована необходимость логической взаимосвязи между методиками обучения учащихся гимназии и старшей школы, системного подхода в процессе обучения учащихся данных звеньев образовательного учреждения. Создана научная (теоретическую) основу для разработки методики реализации содержания технико-технологического и инженерно-технического направления в гимназии. Определены психолого-педагогические и методические требования (условия) для эффективной реализации содержания технологического образования в гимназии.

Ключевые слова: содержание; методика обучения; научная основа; дидактические принципы; способы; подходы; основная школа (гимназия); старшая школа; техническое творчество.