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Реализация экономико-дидактических возможностей образовательного привузовского технопарка в ходе подготовки инженеров для пищевой промышленности

**Введение.** С появлением в системе непрерывного образования новой составляющей – детско-юношеского досугового технопарка при инженерных вузах – встала задача выявить его нишу в данной системе, определить образовательные и воспитательные возможности.

**Цели исследования** – определить экономико-дидактические возможности привузовских образовательных технопарков и описать принципы опережающего образования.

**Материалы и методы.** Материалом исследования послужила деятельность технопарка в области подготовки кадров для пищевой промышленности. Использованы системный, личностный, деятельностный и аксиологический методологические подходы. Применены технологии проектно-ориентированного обучения и научно-поискового метода обучения, технология сотрудничества, методика коллективно-творческой проектной деятельности, технологии STEM-образования, коллаборативное обучение.

**Результаты.** Досуговое обучение в технопарке для школьников с инженерными задатками нацелено на индивидуальное развитие школьника в творческом коллективе, на проектную деятельность под руководством наставника, демонстрацию своих научно-технических достижений на международных конкурсах, активный поиск своего творческого «Я» и выбор направления дальнейшего профессионального развития в стенах конкретного вуза и по уже выбранной специальности. Технопарк рассматривается и с позиций экономической педагогики. «Товар», который предлагает технопарк, – это навыки творческой работы, умения соединять знания, почерпнутые из разных областей технических и технологических наук, для генерирования новых знаний и создания уникальных отраслей производства, т.е. как интеллектуальный «товар» в формате навыков его использования и умений, аксиологической оценки результатов будущих достижений (аксиологический аспект обучения и воспитания). Технологии STEM-образования оптимально сочетаются с использованием лабораторных установок удалённого доступа для проведения исследований, что позволяет провести физические и химические эксперименты в реальном времени на реальных установках, удалённо управляя работой установки. Это позволяет формировать ясное представление о природных явлениях, их роли в технологических процессах.

**Заключение.** Создание привузовских технопарков перспективно для активно развивающейся технологической отрасли, оно позволяет формировать талантливый кадровый резерв, вырабатывать экологическое мышление.

**Ключевые слова:** привузовский образовательный технопарк, пищевая промышленность, экономика образования, коллективно-творческая проектная деятельность, лабораторные практикумы с удаленным доступом, STEM-образование

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Implementation of economic and didactic opportunities of the educational university-based technology park in the training of engineers for the food industry

**Introduction.** With the advent of a new component in the system of continuous education – the children’s and youth leisure technology park (technopark) at engineering universities – the task arose to identify its niche in this system, to determine educational and mentoring opportunities.

**Research purposes** are to determine the economic and didactic capabilities of university educational technology parks and to describe the principles of advanced education.

**Materials and methods.** The research material was the activities of the technology park in the field of training personnel for the food industry. Systemic, personal, activity-based and axiological methodological approaches were used. Project-oriented learning and the research-based teaching method, collaboration technology, methods of collective and creative project activity, STEM education technologies, and collaborative learning were applied.

**Results.** Leisure education in the technology park for schoolchildren with engineering inclinations is aimed at the students’ individual development in a creative team, project activities under the guidance of a mentor, demonstration of their scientific and technical achievements at international competitions, active search for their creative “I” and choice of direction for further professional development within the walls a specific university and an already chosen specialty. The technology park is also considered from the perspective of economic pedagogy. The “product” that the technology park offers is the skills of creative work, the ability to combine knowledge obtained from various fields of technical and technological sciences to generate new knowledge and create unique industries, i.e. as an intellectual “good” in the format of skills for its use and skills for ethical assessment of the results of future achievements (axiological aspect of training and education). STEM education technologies are optimally combined with the use of remote access laboratory installations for research, which makes it possible to conduct physical and chemical experiments in real time in real installations, remotely controlling the operation of the installation. This makes it possible to form a clear idea of natural phenomena and their role in technological processes.

**Conclusion.** The creation of university-based technology parks is promising for the actively developing technology industry, it provides the opportunity to form a talented personnel reserve and develop environmental thinking.

**Keywords:** university-based educational technology park, food industry, economy of education, collective creative project activity, laboratory workshops with remote access, STEM education

**For Citation:**
INTRODUCTION

The new Council of Europe education strategy of 2023, “Learners First,” declares “enhancing the social responsibility and responsiveness of education” as well as provision of inclusive and equitable quality education, ensuring inclusive and equitable quality education” [1]. And this, in turn, requires a timely response from the teaching community to the diverse needs of all students without exception.

Inclusive education is a broad concept; it applies not only to those who, due to health or social status, language, place of residence, etc., need to create different learning conditions, but also to gifted children who need educational programs of a different, more high quality level. The first format of the problem is quite rightly raised by the Council of Europe; it is extremely important for the democratization of education. The second format of inclusive education (training talented children) concerns a small number of children compared to the first format, but is no less important and also requires a responsible attitude: these children in the future will take over the management of the global economy, therefore, the level of their professional training and mastery of global Much will depend on cultural values. The life history of remarkable people (who showed abilities and realized their talent for the benefit of society) is in fact the history of the development of our civilization.

The above-stated made it possible to define the object of our research as inclusive high-quality education of capable schoolchildren (school students), and the subject of research as technologies for high-quality inclusive education of schoolchildren who show high abilities in the exact sciences and technical creativity.

It is reasonable to implement these technologies not within school education, but in the system of additional education, taking into account the needs of individual categories of schoolchildren. The needs of the mathematically and technically gifted students are to be met by school educational technology parks (technoparks) based at technical universities. Such technoparks are aimed at advanced education, pre-professional training for schoolchildren who want to get acquainted with certain engineering specialties in advance in order to clearly decide on the choice of university and faculty. This type of advanced education is usually considered “leisure” education, i.e. education received in the time free from the main classes, including secondary [2], further and higher [3] education. Such education requires the development of special programs [4] and the holistic system of leisure pedagogy [5] designed to unite students on a platform of common interests and respect for their alma mater [6].

The education of schoolchildren in university technology parks should be considered in the format of STEM education, which in this aspect meets the tasks of the intermediate stage, of “the connecting part between obtaining an education and further professional growth” [7], that is, one of the factors for the successful development of lifelong education. If we turn to the developments of the theory of STEM education in the world (including the Russian) practice, it is experimentally used in primary school [8], in secondary school (the analysis of a five-year sample based on Internet publications from around the world [9] and the analysis only of use in a single country, Turkey [10]), in higher school [11] in additional education [12], in adult education (directly those teachers who are ready to try the system on themselves in the process of advanced training, and then use it in teaching practice [13], when working with students who have a “vulnerability factor” (poor [14], with physical
disabilities [15], or is considered not yet theoretically substantiated enough for widespread implementation in pedagogical practice [16]. This indicates the active development of STEM education, its wide experimental application and analytical approach to its results.

In our opinion, STEM education has incorporated the most modern and promising technologies and teaching methods, and we will try to show these particular technologies, as well as why STEM education is most in demand in the system of additional education of the technology park as the structure most actively developing in the 21st century training structure.

Children’s and youth technology parks are being built according to the type of quantums—innovative and technological centers of additional education, creative associations designed to introduce the most in-demand areas of knowledge at a particular time. These are the professions of the future, which exist not separately, but in a complex: computer science, robotics, mechatronics, circuit design, etc., as well as areas that are no longer new, but have not lost their relevance for the development of all humanity—ecology, environmental management, food manufacturing technologies. The research proposed here is about the last of these areas, as the most in demand at the stage of the modern “humanitarian and technological revolution” [17], when it became necessary to combine the most ancient technologies for the manufacturing of food products with the latest complex of computer technologies, harboring (as it is customary considered) an environmental hazard and, therefore, requiring humanitarian (axiological in nature) control over their use, which can only be carried out by a humane, highly cultural society with developed categories of values. We find a similar idea in the interesting foreign concept of “Industry 4.0” and “Education 4.0” [18], which tells about the impact of the fourth industrial revolution (“Industry 4.0”) on education, as a result of which the digital educational space will create a completely different type of intellectual abilities among the new generation (“Education 4.0”), and what will finally appear is, according to F. Machlup’s definition, the “knowledge economy”, i.e. the economy sector “oriented towards knowledge production” – the economic model of education of the 21st century, equally required by educators [19] and economists [20], where the main factor in the development of society will be the quality of human capital (intellectual property). As we know, it is an intellectually and morally developed individual who is the bearer of terminal (principal universal) values. That is because an individual has an intellectual need both to master knowledge and to “alienate” it, i.e. in “embodying it into creative products” for transmission to other people, which is “a necessary condition for the development of society” [21, p. 182].

The research purposes are: 1) to determine the economic and educational niche of the children’s and youth technology parks in the educational services consistently provided to society (in lifelong education): preschool education – school education – pre-university education (STEM education of the technology park, school “growth points”, centers for youth innovation creativity) – university education – continuing education; 2) to form the students’ needs to obtain creatively oriented intellectual property through classes in the technology park.

The research objectives are: 1) to determine the economic and didactic capabilities of the university educational technology parks at the level of the “consumer benefit” concepts; 2) to describe the principles of advanced education through the use of a modular set of remote access laboratory installations for conducting laboratory work in the field of introduction to the course of Food Technology and thus to ensure early professional training by motivating schoolchildren to enter technological, especially food universities in Russia;
3) to compare the principles of education in Russian technology parks with the principles proclaimed in 2021 by the UNESCO International Commission on the Futures of Education and with the new Council of Europe education strategy of 2023; 4) to consider the specifics of educational services provided by technology parks to the population and describe the university-based technology park as a separate link in the education system with specific goals of early career guidance, a special approach of the teaching staff to students; 5) to consider the students’ experimental activities while conducting laboratory workshops with remote access, as well as find out the features of the gifted schoolchildren’s worldview and describe the motivation processes that give them the opportunity to choose the engineering education, to choose a scientific -production area of development of food technology, to form economically oriented knowledge and skills.

**MATERIALS AND METHODS**

The object of this research (the inclusive education of gifted schoolchildren in the technology park) is within the framework of the economy of education, which makes it possible to consider the innovative pedagogical technologies of the technology park as a two-pronged process: the use of human resources (qualified teachers) and technical resources (university laboratory complex) to attract schoolchildren to the university in order to receive (after completing a special program development) of creative engineering personnel in food specialties necessary for the development of the Southern region of Russia, where there is a concentration of the main agricultural lands, fodder areas for livestock production and vast water resources—everything that is required for the priority development of the food industry.

The research material is the activities of the university-based school educational technology park “Quant Kuban-KubSTU” for training personnel for the food industry at Kuban State Technological University (KubSTU) in Krasnodar (Southern region of Russia).

The research uses the following methodological approaches: the systemic approach for studying the holistic learning process in the technology park, the individual approach for analyzing the interest and involvement in collective research work, the activity approach for the participation in conducting experiments in order to motivate the study of theoretical aspects of a certain science, the axiological (value) approach forming an ethical idea of the results of engineering activity and forming its direction and the responsibility for its results in the present and future. Also used are the following types of pedagogical research methods: the verbal methods (for carrying out collective research activities), the visual methods (the demonstration of experiments during laboratory work), the practical methods (conducting experiments and experiments, working with measuring instruments). When describing the theoretical material, the general theoretical methods are used, namely the analysis, the classification, the comparison, and the abstraction.

Based on the nature of research in economic theory, the research subject to consider is the features of pedagogical services provided by the technology park at Kuban State Technological University, and the use of the results of its activities in training the students of food technology.

In the educational technology park, it is optimal to use project-oriented training and the scientific search method of teaching due to the fact that they are aimed at meeting the intellectual needs of an individual in the field of experimental creative activity and correspond to the tasks of additional primary vocational education, taking place in the form of leisure education for adolescents, showing aptitude for engineering activities.
approach from the point of view of the methodology of forming an educational team, then the optimal options in this field of educational services are the technology of cooperation within a team of mentors and students and, as a result, the methodology of collective creative project activity, STEM technologies focused on the formation of a creative personality, as well as the use of collaborative learning (learning in collaboration) as a form of remote partnership activity with independent completion of tasks under the supervision of a teacher. If to approach from the position of acquired competencies, then it should be told about such a new educational technology as the T-shaped education [22, p. 555], where the vertical line in T symbolizes professional knowledge and skills, while the horizontal line at the top symbolizes cross-cutting competencies: team work, project activities, global systems thinking, mastery of IT and other educational skills focused on general (also called “soft”) intellectual competencies. This is due to the requirement for the versatility of the competencies of a modern specialist in the era of globalization.

RESULTS

The need for a qualitative change in the education system has been noted both in Russia and throughout the world at the level of decisions of the legislative branch of power. Let us compare their provisions and analyze how they affect the activities of technology parks.

The education system in the Russian tradition is usually viewed from two positions: as a social order of the state, which involves a combination of education with the upbringing of the spiritual and moral personality of a citizen (which is reflected in the law “On Education in the Russian Federation” [23] and in “The Concept of Spiritual and Moral Development and Upbringing of the Personality of a Citizen of Russia” [24, p. 9] and as part of the country’s economy, the national economy. The latter is agreed upon by both educators [25] and economists [26, p. 8], who also consider that the system of education has “supra-industry significance” [25, p. 165]. Both positions are not mutually exclusive. The first is based on the law “On Education in the Russian Federation,” which talks about human needs for intellectual, spiritual and moral improvement [23, Art. 10], and the Constitution of the Russian Federation [27], which asserts in Article 43 the right to “various forms of education and self-education” [27]. The second position is the position of the economy of education [27], a relatively new economic discipline [26, p. 8], which belongs to the field of the service economy. This discipline examines new ways of “effective functioning of an educational institution in the process of producing educational services” [26, p. 9] and, as applied to a technological university, the tasks of ensuring an increase in its educational capabilities.

Thus, the Russian educational technology park acts as a factor in the development of the country’s economy with a focus on the spiritual and moral development of the individual, carried out in a creative team where students personally choose the scientific sphere of their intellectual development based on the principles of the phenomenological model of education [29] (which means creating conditions for personal development in a creative team) based on the formation of life values [30].

In 2021, the UNESCO International Commission on the Futures of Education published a new social contract in the field of education [31], where one of the main goals is implementing economic ideas in the global education system. However, while in Russian education the idea of choosing an individual scientific path of development is set, UNESCO sets a single humanistic goal – building the “green economies”. Such economies
are “designed to offset the disadvantages of economic growth” associated with measured release of carbon dioxide into the atmosphere [32]. The solution to this problem is partially entrusted to education, which is responsible for the “common good” [33] and for the formation of a “carbon-neutral future” based on “the low-carbon economy” [31, p. 43]. This UNESCO idea makes it possible to unite student youth from all countries at the level of awareness of common environmental value – the use of alternative methods of generating energy (solar, wind energy, the use of batteries for its storage, etc. [34]), which will surely become the basis for international solidarity and cooperation.

According to the concept presented by the UNESCO Commission, school and university students should realize that it is necessary to reduce greenhouse gas and carbon dioxide emissions to zero and thereby achieve a “carbon-neutral future”, which will create “the low-carbon economy” [31, p. 43]. Due to the fact that all people on Earth are interested in such an economy, based on the use of alternative methods of generating energy (solar, wind energy, the use of batteries for its storage, etc. [34]), this mutually beneficial economic factor will be the basis of international solidarity and cooperation.

The idea of creating the future in the present is the main idea of education. And, according to the UNESCO Commission, students should develop “green skills” to prepare them for new professions in the “green economies”. As a result, a promising strategy for “carbon-neutral educational systems” will be created [31, p. 43]. To implement this idea, it is proposed to form the “disposition” [31, p. 50] of students to the style of environmental thinking (compare with the idea of Russian pedagogy about the humanitarian component that controls the course of rational environmental management). Environmental thinking requires the development of “responsibility, empathy, critical and creative thinking, alongside a full range of social and emotional skills” [31, p. 47] (compare with the axiological focus of training in a technology park [29]), which can only be formed in the process of students’ collaboration with each other [30, p. 47] using the “pedagogies of cooperation and solidarity” [31, p. 55] (the same idea is developed by the Russian methodology of collective creative project activity and collaborative pedagogy as a progressive global heritage, phenomenological pedagogy that studies the students’ individuality and creates conditions for their self-development [29]).

In this regard, “The Commission calls for a generalized, worldwide, collective research agenda on the futures of education” [31, p. 132] and at the same time actualizes the issue of lifelong education (“education throughout life” [30, p. 155]), the prospects for partnership between schools and universities [31, p. 102], as well as the enterprises [31, p. 156], claiming the necessity of the governmental support for this endeavor [30, p. 157] (compare with the state decision on the organization of technology parks in Russia). Fundamental views on educational technologies proclaimed by UNESCO, such as “interdisciplinary problem-oriented collaborative learning” [31, p. 51], are the development of progressive ideas of STEM education, and the focus is on the formation of value systems in society [31, p. 53] – the principle of axiological pedagogy.

If the report of the UNESCO Commission is addressed once again, several clearly defined pedagogical provisions can be identified: a) the education system should be aimed at solving the environmental and economic problems of the future, b) to solve these problems, it is necessary to form collectivism and an axiological (value) system of views on the world and the individual in it, c) it is necessary to build a system of lifelong education and subordinate it to a certain central task of education (preventing an environmental disaster associated with problems of air pollution, which certainly leads to a crisis in the field of food production, i.e. the aspect of chemical and technological problems is pointed out).
The goals and objectives set by the UNESCO Commission are relevant, and their solution is currently also being implemented in the Russian educational system, especially in the chemical and technological production industry and in the food industry, in the training of specialists in this field of knowledge. Therefore, this research is devoted to a description of the training of engineers specifically in the food industry at the stage of pre-university education.

The university-based school technology park makes it possible to offer educational services (public goods) of high quality to high school students and allows them to develop, through participation in the development of joint scientific projects with teachers, a sustainable interest to the direction of production activity chosen within the technology park and performed by an engineer (in this case, a food processing engineer).

The importance of education and its market price increase depending on the level and quality of information about this type of education. And here the university technology park (one of the areas of activity of which is the preparation of schoolchildren’s projects for participation in the largest competitions of creative works by the younger generation of Russia) is indispensable. Here we see the implementation of the UNESCO-declared idea of the outreach function of the university, which is inseparable from research and teaching [31, p. 102]. The research results, reports on medals, diplomas, patents of schoolchildren in the Southern region of Russia appear on the pages of the magazine of the Quant Kuban-KubSTU technology park, which bears the inspiring name of “Technology Park of Discoveries”. These are victories in the field of engineering food research areas carried out in the quantum of the technology park under the guidance of mentors, such as the victory at the Archimedes 2022 competition, at which the project on determining the content of phospholipids in soy lecithin was awarded, as well as at the Archimedes 2021 competition, where the victory was won by the project on the creation of a sorbent that allows recycling waste; at the All-Russian scientific and technical competition Big Challenges 2020 the victory was awarded to the project on chemical water purification, and at INNOTECH 2022 the victory was awarded to the project on chemical water purification, and at INNOTECH 2022 the victory was awarded to the project on chemical water purification, and at INNOTECH 2022 the victory was awarded to the project on chemical water purification, and at INNOTECH 2022 the victory was awarded to the project on chemical water purification, and at INNOTECH 2022 the victory was 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The educational service in the format of the university technology park is aimed at meeting the needs of the consumer of this service – school students and their parents. This service falls under the socio-cultural services sector and requires research and development.

The system of announced federal projects makes changes to the system of additional education, providing the opportunity for remote access to laboratories for individual technopark quantum students who live in small localities [35]. This task also faces foreign quantums: the task of laboratory modeling [36], the problem of creating online laboratories in the system of higher engineering education [37], and the task of transition from using traditional practical laboratories to online learning of engineering specialties [38].

For chemical technologists in the Quant Kuban-KubSTU technology park, a modular complex of remote access laboratory installations has been specially developed for carrying out laboratory work in the field of food technology at a considerable distance (including from rural schools) in KubSTU laboratories.

The laboratory remote access installation allows for remote control of individual chemical reactions (provided the teacher is in the laboratory) and involves the following functional actions:

- dosage of a given volume of reagents into a sealed chamber;
- setting the temperature of individual reagents before mixing (heating/cooling);
- maintaining specified conditions in a sealed chamber (temperature/air humidity/pressure);
- forced stop of a chemical reaction (extinguishing a flame when it occurs/relieving excess pressure, etc.).

For example, the remote access laboratory installation “Modeling of Chemical Processes” provides for the installation of dosage modules for different numbers of substances N participating in the reaction. In the standard version, N=2. In this case, the dosing module makes it possible to heat/cool a given amount of the reagent to the temperature specified by the experimenter before feeding it into a sealed chamber.

The modular configuration of the laboratory setup makes it possible to adapt the experiment to various chemical processes by connecting various executive bodies and feedback sensors to the Control and Analysis block. An example of this is the laboratory workshop with remote access “Modeling the Processes of Lecithin Production.” Before conducting a laboratory experiment, students are familiarized with the theoretical part of the educational material – the application, properties and methods of obtaining lecithin – a direction widely developed at Kuban State Technological University. In addition to providing students with a description of the theoretical material, the purpose of the laboratory work is determined, the sequence of actions of the experimenter is described, the procedure for conducting the experiment is explained, and the preparation of a report, as is customary when conducting the virtual laboratory work [39].

For technology park students, laboratory workshops can be held to motivate further studies at university in food sciences. In this case, they resort to advanced learning. The term “anticipatory learning” is used in its broad and narrow sense. In the broad sense, it means the introduction into the educational process of those concepts and ideas that are associated with the “law of accelerated development of human quality,” as well as with planning the emergence of new regional social orders for specialists [40]. In the narrow sense, “anticipatory learning” is an introduction to certain concepts and provisions of the subsequent curriculum six months ahead of schedule in order to motivate the further educational process. Thus, the program of classes in the technology park for future food
technologists takes into account that in the first semester, students of the bachelor programs in 19.03.02 Food Products of Plant Origin and 19.03.03 Food Products of Animal Origin study topics in the physics course on which they can conduct laboratory work six months ahead of schedule. The topics of these laboratory works are as follows: “Diffraction of Laser Radiation Using a Diffraction Grating” (section “Physics of Vibrations and Waves. Diffraction of Light Waves” and section “Quantum Physics. Molecule”), “Study of the Seebeck Effect” (section “Elements of Solid State Physics and Physical Electronics. Elements of Physical Electronics in Solids”), “Study of the Characteristics of the Solar Battery” (section “Elements of Solid State Physics and Physical Electronics. Elements of Physical Electronics in Solids” and section “Quantum Physics. Photons”). Preliminary acquaintance with these topics at the level of conducting experiments makes it possible to speak about the implementation of the task of introducing food specialties in the technology park at the motivation level of studying them.

Experimental remotely controlled activities make it possible to develop the following educational and research skills: the ability to analyze technical information given before the experiment (availability of technical modules, technical documentation, etc.), the ability to handle chemical equipment, the ability to conduct laboratory experiments. General analytical skills are required: to compare the results of the experiment performed with those that should be obtained, to give explanations of actions and their sequence, to conduct a remote dialogue with the teacher located in the laboratory, to demonstrate knowledge of theoretical material. During the experiment, it is necessary to develop the skills of independent innovative activity, which will manifest themselves in creative activity and an attitude towards achieving success. These include the ability to change the conditions of a task or set a new task, the ability to discuss it with a teacher, the ability to draw up a program of activities, record the changed conditions and results obtained, vary the ingredients if necessary, as well as the ability to explain the meaning of one’s actions, the ability to achieve a goal while overcoming difficulties, using the recommendations of the teacher located in the laboratory.

Laboratory research make it possible to lead the students to performing independent project activities. Projects, as it is known, are usually divided into research, creative, and informational [41, p. 103]. The first require setting a hypothesis, obtaining results and putting forward proposals for the further development of the research topic, the second require understanding the goal and identifying possible ways to achieve it, the third require studying the subject of research through the collection and analysis of experimentally obtained information, generalization of the collected facts confirming known theoretical data.

Laboratory workshops with remote access in technological specialties should be classified mainly as information projects that prove the correctness of the theory, which is introduced through a lecture and practical course, as well as an educational publication. In addition, the laboratory workshop makes it possible to motivate students to participate in research projects and – if the project activity takes place face-to-face in a specialized laboratory under the guidance of certified scientists and technologists – in a creative project as well. In this case, we can speak about collective creative project activity, in which the individual route of a learning technology park is implemented.

It is of interest to determine the features of an educational children’s and youth technology park. Here we should talk about the creation of a special “child-adult community” (D.V. Grigoriev’s term) [42], which is the main difference between receiving any leisure education in the format of technical creativity and promotes socialization and career guidance. For this purpose, project-oriented learning, or project technologies [41], or the project method is
used, which is successfully applied in teaching students of technological specialties and high school students who have chosen this direction of education.

Project-oriented training contributes to the popularization of the engineering profession and “the development of practical skills: technological, design, research, communication, organizational, oratory in the process of project and competitive activities” [41, p. 101]. In addition, project activities make it possible to create a product that has economic and social significance, and this in turn makes it possible to increase the prestige of the profession being acquired.

Project activity contributes to the formation of a special type of personality of the student, who develops the readiness for innovative activity [41, p. 102].

The readiness is formed in technopark quants under the guidance of practicing engineers who are most passionate about their field of knowledge, as well as scientists, teachers of Kuban State Technological University, and postgraduate students. Thus, due to their knowledge, experience and inspiration, mentors help quantum students calmly go through several psychologically difficult stages of learning their future specialty and give them the opportunity to immediately experience the final stage of training – the beauty and attractiveness of the creative work of an engineer. And this “guiding star of passion” (the memory of their personal creative victory) further leads the schoolchildren along the path of acquiring the chosen engineering specialty.

Due to the fact that the schoolchild does not yet have the knowledge that a certified engineer has, a talented quantum leader is needed who will perform part of the technical engineering work that is beyond the capabilities of a teenager – of course, not individually, not separately from the young project developers, but together with them, directing their cognitive activity. Young developers who are passionate about a scientific idea and receive sensible answers to their questions are capable of many things. Fostering initiative and developing passion under the guidance of a teacher is the main task of Quants. Mentoring makes it possible to establish partnerships in a creative teenage team of like-minded people based on the use of the method of collaborative learning (learning in cooperation) [43], performed in our case in the technopark learning environment [44]. Collaborative learning is conducted when a single task is divided into blocks so that the one who has completed his or her part of the work can explain to partners what and why he or she has done. It is in this way that knowledge is exchanged, agreement is reached, and knowledge of the specialty occurs in the course of creative activity.

Thus, the innovativeness of the approach to educational activities in quants lies in creating a guaranteed success of the schoolchildren’s project activities. Moreover, the idea of the project is born together with the teacher of the leisure center, who assesses the schoolchildren’s capabilities and strengths, forms their desire for independent cognitive activity, monitors and directs the steps of learning, which is carried out in the process of dialogue between interested parties, and is not imposed. The educational situation makes it possible to fully realize the basis of the bidirectionality of educational activity: the interconnectedness of teaching methods and learning methods (if the teachers explain, then the students comprehend, and if they correct the actions, then the students’ counter-reaction is self-correction, etc.). Successful interpersonal communication allows the mentor to reach the level of friendly dialogue and give the student initiative. That is, it provides the opportunity for making the students themselves the initiators of learning, who assumingly takes on the role of teachers: they ask questions that the teachers-mentors must answer, design the application of their projects, which is also organized by the teachers. Thus,
we get the opposite bidirectionality of educational activity with the dominant initiative of the student. Here, in our opinion, the foundations of “progressive pedagogy” and “transformative learning” by John Dewey are implemented [45]. At the same time, it is the individual educational trajectories of leisure learning implemented in the technology park that make it possible to solve the problems of elite training of talented schoolchildren placed in a single information educational space of the technology park. This is how the technology park differs from a public school; this is its career guidance feature.

The socially significant “project method” proposed by John Dewey is based on Hegel’s view of human cognition as a “process of action-doing-construction” [46], which underlies any world-transforming human activity and depends on the development of thinking and creativity. imagination. It is the goal of developing the creative imagination of students that is placed at the forefront of the educational activities of the quantum. The project method belongs to the category of problem-based learning methods, therefore it motivates the cognitive activity of students, forms the sphere of independent decision-making, and does not allow them to doubt their chosen engineering profession.

DISCUSSION OF RESULTS

To describe the significance of the work we have done and its specific results, let us turn to our stated goals and objectives of the study and compare them and our results with the goals and objectives put forward in the field of education by major international organizations such as UNESCO and the Council of Europe.

The results of our research are, firstly, a description of the economic and educational niche of children’s and youth technology parks in Russia based on the analysis of the educational services consistently provided to society (in the “education for life” system). Here we fully agree with the opinion of the international community, expressed in the report of the International Commission on the Futures of Education [31], that “the values and organization of all levels of education should be connected”, and “partnerships between school systems and universities can contribute to reimagining and strengthening education” [31, p. 107], and also agree with the educational strategy of the Council of Europe [1], which declares “access to quality education for every individual.” These provisions are fully consistent with the provisions of Article No. 23 of the Constitution of the Russian Federation [27], which declares the right to “various forms of education and self-education” [27]. It is these provisions that allow us to distinguish technology parks into a separate educational niche at engineering universities, aimed at a special contingent – schoolchildren who show outstanding abilities in the field of exact sciences and are predisposed to engineering activities. Innovative in solving this problem was the development of technologies for working with gifted schoolchildren, which consists in the creation and experimental use of a modular complex of remote access laboratory installations for conducting laboratory work, which gives gifted schoolchildren the opportunity to try themselves in experimental activities under the guidance of university teachers.

The next result of our research can be called the analysis and testing of educational technologies for school university-based technology parks. STEM education technologies are used in many countries, including Russia, and they can be aimed at any student contingent. The learning results we obtained are consistent with UNESCO’s theoretical idea of “interdisciplinary problem-oriented collaborative learning” [31, p. 51], on which the
social project method is based [31, p. 54]. Our data are also consistent with the practical developments of foreign colleagues on the use of STEM education technologies at different stages of the lifelong education system. The essence of STEM education technologies is that they make it possible to move from theoretical study of material to research activities using acquired knowledge formed on the basis of practice-oriented skills in order to develop technology-oriented and economically oriented practical skills for using them in solving practical problems. In this regard, we have experimentally proven that optimal results are obtained from the use of STEM education technologies in the additional training of talented schoolchildren at an engineering university. The result of such education is a significant number of innovative projects and victories of schoolchildren at serious international competitions and Olympiads, which demonstrates the economic and didactic capabilities of technology parks and contributes to the development of the economy in the field of education.

The third result of our research is the study of the formation of the need of talented schoolchildren to obtain creatively oriented intellectual property, which is one of the factors in the spiritual and moral development of the individual through classes in any creative group (in this case, in a technology park). Implementation of the position of “pedagogies of cooperation and solidarity” declared by UNESCO [31, p. 50], with collective forms of creative development, is considered one of the main objectives of education declared at the highest international level. The search for an idea on the basis of which solidarity can be realized occupies the minds of the best educators of our time. UNESCO successfully puts forward as a unifying idea the universal struggle for the ecology of the planet, “a consciousness of the planetary” [31, p. 113], which requires the formation of “green skills”, which can only be organized in an interdisciplinary way. The format for the formation of interdisciplinary consciousness is consistent with our ideas about the formation of high life values in the creative team of the technology park, with the axiological component of training [30], which is precisely aimed at the formation of the “consciousness of the planetary”.

The fourth result of our research is an analysis of the development of the personality of a student in a technology park, which occurs as a result of immersion in a single information educational space of a technology park, which is consistent with John Dewey’s idea of “transformative learning” and with his “project method” [45], and is also consistent with times the concept of early career guidance we are developing, which allows, through the use of the motive for achieving results (achieving success), to redistribute responsibilities between the mentor and the student so that the second asks questions while solving a creative problem, and the first answers them.

Students of the technology park at the food university are united by the environmental idea of preserving the planet. Economic pedagogy does not stay aside from the moral problems of society, since without high integrity of members of society it is impossible to realize the stage of globalization of the world economic community, it is impossible to escape from the shadow economy in certain industries, including the production of educational services. High integrity in combination with scientific activity is primarily formed in such a link of the education system as the educational technology park, which satisfies the highest needs of the individual – the need for creative communication between the teaching staff and students.

An educational technology park at a technological (food) university makes it possible to build a clear continuity of education between school – additional technological education – food university – food production. Thus, the technology park offers an additional economic resource in the form of a consumer winning a university education and the implementation
of this service during the period of independent activity of a process engineer. All this makes it possible to consider university technology parks as a small innovative structure, one of the tools for comprehensive socio-economic development in the field of education.

The university-based school educational technology park Quant Kuban-KubSTU, which develops remote forms of participation in laboratory workshops, should be classified as part of the system of the children’s technology parks, which involve the remote learning format, and considered an important “growth point” for the economy, the initial stage of building economic zones of technopolises.

Educational technology parks are a technological and technical-innovation platform, in which, on the basis of advanced training, not only interest in a future specialty is formed, but also such an important value as respect for oneself as a creative person is developed, and the view of an adult emerges from the position of an accomplished creative personality; the attitude towards the future path of life changes.

The role of mentoring is great, implemented by teachers of the educational technology park, who, due to their knowledge and experience, help students in their early youth go through several psychologically difficult stages of learning classical academic subjects and the fundamentals of their future specialty and give them the opportunity to immediately feel the final stage of engineering activity – the beauty and attractiveness of the process engineer’s creative work.

CONCLUSION

Technology parks for children and youth are characterized by the development of design technologies, the formation of scientific skills, knowledge of a specialty in the process of a creative approach to solving production problems, and the formation of individual readiness for the innovative nature of activity.

The novelty of the research lies in identifying the goals and objectives of the educational university technology park as an innovative educational institution of additional education, designed to provide early vocational guidance in the format of leisure education, teach how to work in a creative team, use modern laboratory equipment that allows experiments to be carried out in a remote access format, as well as effectively motivate students to create creative projects, participate in competitions and festivals.

Although the activities of technology parks from an economic point of view are of supra-industry importance, the creation of a university-based technology park Quant Kuban-KubSTU is promising for a technological university, as it allows solving the problems of attracting talented students to enter food sciences, developing their creative and practical-economic guidelines in the profession.

The activities of school university technology parks correspond to the ideas put forward in the 2021 UNESCO report and in the 2023 Council of Europe educational strategy, the positions of STEM education, cooperation pedagogy, and value-oriented pedagogical activities.

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