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## Methodological principles for the development of scientific literacy

Nowadays, the international research is being conducted in different countries for the determination of the quality of education, indicators of which help to define the leading countries and their competitiveness. To achieve the high results of participation in such international research, it is necessary to correspond the level of tasks offered to Kazakh students with the level of international research tasks. In that way, the article aims to identify the methodological principles for the development of natural literacy, which is one of the components of the implementation of national education. The development of students' knowledge and skills in a modern school and their education as a creative, ingenious personality responding to a query of the information society reveals the main directions and ideas of the research. The research methodology is based on competence, personal-oriented, and activity approaches. The implementation of the competency-based approach means the readiness of students to apply the acquired theoretical knowledge, skills, and abilities in real-life situations and practical activities. In addition, the personal-oriented approach provides the access to modern teaching, which includes the goals, content of education, and the forms of organization of students' educational activities. Therefore, the definition of methodological principles for the development of scientific literacy will improve the functional literacy of students. The completeness of the creation of the school education's national system and, accordingly, the methodological system of education increases the actuality of this considered issue. The development of practical tasks taking into account the objectives of PISA (Program for International Student Assessment) and other international research is the basis for the updating content of knowledge in each subject.

*Keywords:* natural science education, literacy, functional literacy, quality of education, methodological principles, competence approach, activity approach, international research tasks.

### Introduction

The scientific literacy is considered one of the most important characteristics of school education in world educational practice and is a criterion for assessment of the science education's quality in many international monitoring research (PISA, PIRLS, TIMSS, etc.). The indicators of international research show the level of education quality in countries, their competitiveness, and help to determine the best countries. Nowadays, one of the best international studies PISA defines the functional literacy of students aged 15-16, which means the ability to apply the knowledge and skills acquired at school in real-life situations. The functional literacy of students is assessed in 3 directions such as mathematics, science, and reading literacy. Organization for Economic Co-operation and Development (OECD) has constructed an international program every three years since 2000, which holds the comparable assessment of student's skills, the results of such studies determine that Singapore, Finland, Estonia, South Korea, Canada, Taiwan, Japan, Hong Kong (China) are the leading countries in the field of education [1; 2].

Functional literacy characterizes the ability of a person to adapt to a particular environment through knowledge, skills, abilities, and actions. That terminological combination was introduced in the 60s of the last century as a set of reading and writing skills, which was necessary to eliminate adult illiteracy for everyday application.

The achievements in the field of natural sciences, connecting with the process of defining types of literacy in science, reveal the meaning of scientific literacy and play the important role in science education [3].

In the era of the modern information flow, the importance of the natural sciences is growing as an effective tool for understanding the world. The construction of a scientific fundament for the educational process in the natural subjects means focusing on the unity of knowledge, skills, consciousness, and action. In this paper, we analyze the work of the Russian scientist E.A. Tamozhnyaya, who emphasizes the demand for the improvement of students' interest in science. It means that the knowledge is given in the educational process,

which is approved through the practical-oriented tasks, is the consciously acquired knowledge. Therefore, the discovery opportunities for the application of such knowledge in a variety of life experiences and in the organization of activities help students to convince the reliability, scientific character, and value of their knowledge. The training has the opportunity to plan the content of education through the system of action models, and also to control their quality. The checking of the learning outcomes of any subjects and controlling the quality of education's content have been done through practical-oriented projects. In addition, it is the main tool to form the competence of students [4].

Kazakhstan participated in the PISA program in 2009, 2012, and 2015. In a study involving students from 65 countries, Kazakhstani students ranked 59th, 63rd in reading literacy, 53rd, 49th in mathematics, and 58th and 52nd in science literacy, respectively 2009 and 2012. It was a much lower result than the average for the OECD countries. In 2015, the results of Kazakhstani students were not calculated due to errors in their coding [5].

The results of participation in the international program PISA-2018, which assessed the educational achievements of Kazakhstani schoolchildren, had shown a low indicator (the 15-years-old Kazakhstani schoolchildren take 69th place among students from 79 countries) (PISA-2018 International Research Results, OECD, 2019) [6].

The relevance of the presented research work is confirmed by the necessity to develop the functional literacy of Kazakhstani schoolchildren in order to increase the country's competitiveness, improve the quality of education and achieve high results in PISA studies. In that way, there raised the question if schoolchildren are not working on tasks that meet the high level of the PISA research, could they get the best results? For the improvement of students' knowledge, it is necessary to define the requirements of the international research and to analyze the level of tasks, and then it is needed to compare them with the requirements of Kazakhstani students in the educational process and to find their difference. The accordance with them gives the possibility to develop the functional literacy of students in the domestic education system and to improve the quality of education.

The object of the research is the teaching process of natural science in a general education school, and the subject of the research is the definition of methodological principles for the development of natural scientific literacy in schoolchildren. In this regard, the goal of the study is to identify methodological principles for the development of natural literacy, which is one of the components of implementing public education. In accordance with the goal, the following research objectives are identified such as:

- to study the scientific and methodological research works and scientific literature, which identify the factors affecting to the quality of scientific literacy of students learning from the domestic and foreign authors;
- to create an unified system of scientific and methodological approaches, which allow to integrate of the Kazakhstani system of science education with the PISA program and, on the basis of them it is possible to develop the scientific literacy of students.

The structure of the article includes an introduction, methods and materials, results and their analysis, and final sections. The actuality of the topic is shown, the scientific literature is reviewed, the problem, the object and the subject, and the goals and objectives of the presented research work are described in the introduction part. The methodology of research, the used methods, and the general description of the research material are given in the section "Methods and Materials". The following sections of the article present the results of the research and their analysis, as well as a conclusion.

### *Methods and Materials*

The transition of the education system to the content of action means that the teaching techniques of scientific subjects change here. The ability of students to apply knowledge in relation to life manifestations plays the first role in the planning and implementation of the educational process. The individual and meta-subject results of education were obtained by choosing the teaching methods of scientific subjects, the didactic tools applied in educational activities, and accessing the results.

The research methodology is based on competency, personal and problem-oriented developmental education, as well as access to the systematic and action-oriented approaches. The student-centered approach develops students' critical thinking and personal qualities. Indeed, thanks to a student-centered approach, students master different ways of learning, for example, correcting mistakes, applying theory in practice, etc., mastering effective teaching methods using other methodical approaches. This, in turn, is aimed at achieving modern education, which includes the goals and content of education, forms of organization of educational activities of students.

The study also uses the method of factor analysis, the task of which is the systematization of factors that affect the results of students' knowledge of natural sciences.

First of all, in the process of studying the development of students' scientific literacy, one should turn to the definition of "literacy" given by scientists. Literacy is a very flexible and comprehensive concept that accompanies education and is closely related to it. The history of its hierarchical scientific development has gone from "simple literacy" (the ability to read and write) to "scientific literacy" (high information culture) and has become more ambiguous in the field of science [7].

From a pedagogical point of view, the development of educational and cognitive competencies of students is characterized primarily by practice-oriented education. In this regard, as a prerequisite of the methodological principles for the development of science literacy, students should be able scientifically to explain the issues related to the natural sciences and technology, and connected with the competencies such as understanding the main features of natural science research and the ability to generalize scientific data, at their own level.

These competencies include the following components of scientific literacy:

- to know the basic natural scientific concepts, facts, laws and their effective application in educational activities;
- to understand the main features of the methods of natural scientific knowledge, to master the basics of natural scientific practice, to receive, to select and to analyze the natural scientific data;
- to identify the scientific nature of the problems that arise in the course of daily activities, including in social and political situations;
- to understand the publications with scientific nature, to analyze and to evaluate the presented information;
- to formulate their own arguments in the natural sciences and to evaluate the arguments of others [8].

These components make it possible to single out the content of natural scientific knowledge, which is the foundation of the development of students' natural scientific literacy and also to create practical tasks in disciplines in accordance with the PISA problems. It is known that the PISA problems are different from the standard tasks in our country. In that way, the realization of it for Kazakhstani students is difficult in accordance with the traditional educational paradigm.

In the educational system, it is necessary to demonstrate the functional completeness in the knowledge content of each subject, in addition, the integrated application of all methodological approaches is required. The laws of the knowledge theory at the general scientific level, the principles of system analysis, and every science including its own scientific level (such as psychology, pedagogy, physics, etc.) contribute to applicate their fundamentals. The ability to solve the problem in this way, of course, ensures the scientific consistency, and the methodological reliability of the obtained results. In addition, it increases their relevance both nationally and internationally. There is shown that it is essential to comprehensively application both the general scientific methods and the individual scientific methods to reflect the natural sciences and their subject components in the education system as a whole.

Any modern teaching technology requires self-improvement in order to reflect the elements of the methodological teaching system (goal, content, methods, forms, tools) with the dialectical relationship and as a whole. Only then the methodical system of education and the educational technology can act fully on their functions and acquire new qualitative features. All of these indicators find the demand for research results based on the integrated application of methodological approaches and effect positively for the development of science and pedagogical technologies, and for the improvement of the domestic education system.

In accordance with the scientific papers, there is observed in many types of research that special attention is paid to the theoretical issues of choosing the education's content, to ways of methodological development, and to every system element of the methodological system of education. Thus, any modern educational technology in its self-improvement implies the mandatory to reflect the elements of the methodological system of education with the dialectical relationship in general. Only then the methodical system of education and the educational technology contribute to work fully their functional literacy and achieve new qualitative features. In that way, the necessity of the creation of an integrated national education system, as well as the methodological system of education aimed at improving the functional literacy of schoolchildren, confirms the substance of the issue.

In the case when the unified system of natural science education is based scientifically on the achievements of natural science, their decisive influence on the development of modern technologies, then it can be fundamental for future theoretical and practical research from point of view on the educational-methodical support of the general school.

*Results and their analysis*

The state program of the development of education and science in the Republic of Kazakhstan for 2020-2025 is aimed at sustainable economic development through the security of quality education; it also determines the main directions such as:

- ✓ to increase the global competitiveness of Kazakhstani education and science
- ✓ to educate and teach personality based on human values;
- ✓ to increase the share of science in the socio-economic development of the country;
- ✓ to modernize the pedagogical education;
- ✓ to reduce the gap in the quality of education between urban and rural schools, regional educational institutions;
- ✓ to provide the safe and comfortable learning conditions;
- ✓ to introduce an updated system for assessment of the quality of students, pedagogical staff, and educational organizations based on best practices [9].

All changes in the structure of the school, the content of education, and the organization of the educational process should be aimed in accordance with the creation of conditions for the comprehensive development of the student's personality. The formation and progress of the student's personality, who is able to solve the time requirements in the unity and interaction of humans, the natural and social environment, is one of the mandatory components of school education. Furthermore, scientific knowledge plays the important role in scientific and technological civilization and socio-economic prosperity. All of the above research works show that in order to achieve the best results of international studies it is significant to contribute the level of tasks assigned to Kazakhstani students with the level of international research tasks and develop the functional literacy of local students through them. In addition, the insurance of the quality of natural scientific education is directed to define the scientific and methodological basis in school. For example, each of the competencies, assessed in the task, can be reflected in the following types of scientific knowledge:

- ✓ the meaningful knowledge, which means to know the scientific content in the field of “Physical systems”, “Living systems” and “Sciences about the Earth and the Universe”;
- ✓ the knowledge of action, which means to know the various methods used for obtaining the scientific knowledge, as well as knowledge of standard research methods.

The field of content can be formally called subject knowledge. For example, “Physical Systems” is the basic material of physics and chemistry, “Living Systems” is the material of biology, and “Sciences about the Earth and the Universe” are the materials of geography, geology, and astronomy. From that, it is possible to say that the used tasks in the study of PISA on scientific literacy are interdisciplinary [10].

The practice-oriented tasks allow students to systematize the subject knowledge in terms of interdisciplinary, integrated, activity-oriented, and practice-oriented direction. In this case, students, who mastered universal activities, will be able to solve their own important individual problems through subject knowledge.

For the realization of it there the entire arsenal of scientific and methodological approaches is used: the laws of the knowledge's theory; the theory of the gradual formation of mental activity; the fundamentals and principles of systematic approach; the action methods; the application of the comprehensive methodological approach based on the laws and principles of pedagogical science. Accepting all of them there is essential to operate the following methodical recommendations such as:

- ✓ the description of the scientific and methodological basics of domestic and foreign authors for improvement of the students' scientific literacy; the characteristics of the importance and features of the international PISA research;
- ✓ the comparative analysis of problems in Kazakh textbooks on natural sciences and tasks of the PISA research level, and the system of tasks in these textbooks, which is supplemented with tasks corresponding to a high level of PISA research;
- ✓ the application of the content of the level items and the complicated complex questions of PISA research in the content of textbooks on scientific subjects at the school.

First of all, it is necessary to systemize the concepts and principles, which serve as a scientific and methodological fundamental for improving scientific literacy, for the provision of the quality of school education by the domestic and foreign authors, for the research works to improve the scientific literacy of students, the analysis of the material about the international PISA program. The determination of the significance and features of the international PISA program increases the scientific consistency, gives the opportunity to create an

optimal and effective learning process in the education system, and also ensures the quality of science education in RK schools.

Secondly, it is crucial to determine the expected learning outcomes in the direction of education “Natural Science” in order to increase the scientific literacy of students. The several factors direct to the transition of the competency-based model, aimed at improving of students’ scientific literacy. For example, there are the analysis of the items connecting with the scientific literacy of PISA program, the selection of the items for each level, the collation of Kazakhstani textbooks’ tasks by the natural scientific subjects with the level tasks of the PISA program, and the addition of tasks and questions in each textbook in accordance with high-level tasks of the PISA program.

Thirdly, the methodological recommendations on the use of the content of school textbooks by the natural subjects, logical, complex, interdisciplinary, including free answers, supplemented by the problems related to life experience in accordance with the level tasks of the PISA program promote to create each student as an individual in an educational model. He/she will construct an educational space, which allows them to discover and determine their own potential, to choose consciously their future life in the context of further development of the labor market [11].

For the solution of these problems, it is necessary to create an educational space, which contributes to the implementation of a student-oriented and competence-based approach, to the learning, self-determination of students, and their conscious choice of the future in the development of the labor market. Using all process, the educational mechanism has to be directed to develop the scientific literacy of students.

In the realization of the personal-oriented approach, natural science and its teaching are mutually agreed with the mechanisms of cognition, features of thinking, and behavior. The attitude of the “teacher-student” is kept on the cooperation and freedom of choice of students. In the present time, the significant changes in the education (its direction, goals, objectives, content) consider the “free development of the child” in the conditions of creativity, self-sufficiency, competitiveness because the “knowledge-centric” education is the cause of the overloaded information and reduction of training motivation. This model is aimed at the obtainment of reproductive results [12].

Unlike traditional learning, a student-centered approach develops the personality structure, subjective qualities, and individuality of students, allowing the student to freely apply the acquired knowledge in real-life. The theory of the development of personal activity is dominated [13].

According to researchers, the analysis of the strengths and weaknesses of Russian schoolchildren in the framework of the PISA 2020 program shows that the results of schoolchildren's literacy are associated with the most diverse factors. Examination of the analysis results reveals the characteristics of students and educational organization, which are the essential predictors of test results of student literacy. It is defined that teachers’ behavioral intervention affects negatively test scores. The practical recommendations on the basis of research results are given to teachers and parents, for example, one of them is aimed at developing the financial literacy of students [14]. The results of such studies supply to improve the functional literacy of students, taking into account the modern requirements of the world educational space, and also develop the school system at the national level. As a result, they contribute to the formation and development of students as competent individuals.

Therefore, it is imperative to take into account the content of all-natural sciences in the jointed national educational space, and also to recognize the content of their disciplines and modules. However, the functional completeness and continuity of the content of individual disciplines in the education system are not maintained by the existing educational standards and programs ensure. Moreover, for each stage of education the standards and curricula, which were developed, excluding their relationship, have led to an increase in the contradiction between the structural form and content of education.

Nowadays, the PISA program has become a universal tool for a comparative assessment of the effectiveness of school education in the countries of the world. One of the main criteria for the level of literacy is the study of the quality of education in accordance with the international level in the context of the assessment of knowledge and skills of schoolchildren.

According to the definition used in PISA, scientific literacy is the ability of a person to maintain active citizenship on socially significant problems related to the natural sciences and his willingness to be interested in scientific ideas. A naturally literate person tends to engage in discussion based on issues that connect with the natural sciences and technology, for example:

- to explain scientifically phenomena;
- to understand the main features of the natural sciences;

- to require the using competence in scientific data to interpret data and form conclusions [10].

It is known that among the countries of the world in pedagogical education Singapore, Great Britain, Finland and Germany are the leading countries. For example, the next points are revealed in the process of analyzing the concepts and principles that serve as a methodological basis for improving the natural science literacy of the Finnish education system, the country's educational achievements:

- first, the positive attitudes of society towards education;
- secondly, the high status of teachers (the competition for the profession of a teacher is large, for example, up to 10 people for 1 place and high wages);
- the main reason is that every student is treated as a valuable element of the country's human capital.

The Finnish education system is based on seven principles such as equal education, free education, trustworthiness, focus on practice, single education, independence or self-education.

Summing up the above said, the principles and approaches to education in the educational system of the Republic of Kazakhstan were identified. To do this, it is necessary to direct the attention to:

- providing students with personality-oriented (student-student) education as an active component of education;
- coordinated (comprehensive) preparation and implementation of educational programs for secondary schools and educational programs for pedagogical universities;
- strengthening the balance between teaching theory and research and pedagogical practice, increasing the priority of research in education;
- implementation of learning integration (SLIL (subject-language integration of learning); STEM (Science, Technology, Engineering, Mathematics));
- digitalization of education (use of digital tools in education and teaching);
- inclusive education (socio-cultural context of teaching, i.e. providing the diverse needs of students in education/training);
- professional development of teachers (lifelong learning/education in professional activities);
- implementation of a person-oriented and competence-based approach in teaching to implement the principles of improving the competitiveness of school teachers, university teachers, general education schools, pedagogical universities, etc. for high-quality education, the ability to determine students' own potential, and their conscious choice of their future life path in the conditions of further development of the labor market, it is necessary to focus on improving the natural science literacy of schoolchildren through the creation of an educational space.

In addition, it is advisable to use the theories and laws of pedagogical and psychological sciences and general methodological approaches. Also, it is essential to consider the experience of developed countries and our country for the improvement of scientific literacy.

Recently, for assessment of education quality and student performance in individual subjects the education system of Kazakhstan takes part in other international surveys, for instance: IRLS (International Reading Literacy Study), TIMSS (Trends in the Study of Mathematics and Science), PIAAC (International Adult Competency Assessment Program), ICILS (International Computer and Information Literacy Study), TALIS (Teaching and Learning International Survey) in addition to PISA program [15]. There is the question "Why?" in society.

Firstly, the modern school sets the task of developing in students the ability to use the intellectual and research culture, knowledge, and experience, which contribute to considering life situations from the point of view of the requirements on convinced knowledge. In other words, the expected learning outcome can use the acquired knowledge as a personal resource. The transformation of learning guidelines is the orientation to create conditions for students to realize their potential in the educational process, and to master the methods of cognitive activity. It also requires the application of new methods for the measurement of the expected learning outcomes. In this regard, we can say that the competence-based approach has more perspectives. It is known, that international PISA programs are carried out in the framework of a competency-based approach.

An important result of education is scientific literacy based on the formation of a person's scientific worldview. After all, the natural literacy of students reflects their cultural level in society and the action of citizenship in solving issues related to the natural sciences. For example, there is the ability to understand and master the modern scientific and technical processes, and the ability to realize the impact of natural sciences and technologies on the ecological condition, material, intellectual and cultural spheres of society.

Therefore, it is necessary to improve the content of all-natural sciences in a unique national educational space, the content of their separate disciplines following world standards. If the program of natural subjects

doesn't save the functional structure, the opposite between form and content of the teaching structure is occurred. It is not the total side of "Natural science", this is only the real characteristics of an individual subject (for instance, physics).

Thus, natural literacy depends on a person's comprehensive understanding of the world's scientific picture, including natural science such as the unity of knowledge, skills, and actions; the ability to assess positively the achievements of the natural sciences, and readiness to use the available scientific knowledge for solving the theoretical and practical problems, which arise in the course of human activity.

Researcher Lee J. has got the data of the empirical evidence of 60 non-cognitive structures from approximately 600 research works, which were published between 1950 and 2010. As a result, the direct, scientifically proven connections between the academic achievements of schoolchildren with a few non-cognitive constructions were established. The list includes the following factors: attitudes, anxiety, self-confidence, classroom behavior, strategies of control, developmental programs, participation, enjoyment, extra-curricular activities, homework, interests, metacognition, motivation, parent's involvement, condition of the school, kinship, self-confidence, self-awareness, self-efficacy, the relationship between student and teacher, teacher's effectiveness, teacher's support, and time spent on assignments. Furthermore, these variables are grouped into four main categories, which are the student's activity, the learning strategies, the condition of the school, and socio-family influences. The first two of them refer to personal preferences, and the last two of them consider the socio-contextual inspirations.

In addition, the TIMSS and PISA non-cognitive assessment reflect thirteen groups of psychological research: reputation, curriculum/content, homework, study and learning time, motivational factors, peculiarities of person, planned behavior, condition of the school, self-confidence/socio-cognitive theory, style of self-regulation/learning strategies, teacher's character, motives and professional interests [16].

The scientist-teacher A. Leontiev defines the determination of a "functionally literate person" as the ability of a human to use the knowledge, the qualification, and to solve problems accumulated throughout life in various areas [17]. In summary, it commits that functional and scientific literacies of students are competencies for the effective use of knowledge, skills, and abilities acquired at school in the performance of any practical problems by disciplines.

The person-centered approach focuses on the goals and content of education, the activities of the teacher, the forms of organization of students' educational activities, the problems between "teacher and student", and "student and student". In that way, this method is considered modern learning. The development of practice-oriented tasks, taking into account the projects of PISA and other international programs, can become fundamental for updating the content of knowledge in each subject.

### *Conclusions*

Scientific literacy reflects the cultural level of the individual and society, and it is a stable fundamental for specialists in other fields of science (medicine, forestry, agriculture, environmental protection, etc.).

In order to improve the scientific literacy of students, it is necessary to develop methodological manuals for school courses in physics, chemistry, and biology, which are competence-oriented and contextual tasks (in accordance with PISA problems). In addition, there is recommended to use innovative technologies (problem, individual and group, research, information, etc.) in the educational process to improve the level of students' knowledge of scientific subjects and their ability to apply learning skills in real-life situations. For instance, today it is very important to use information technologies in the educational process. In this regard, the definition of methodological principles for the development of natural science literacy of students is formulated theoretically, and its prerequisites are identified.

In accordance with the objectives of our research works, the international issues about the development of students' scientific literacy devote to assessing objectively the level of education in countries, determining the quality of Kazakhstani education, and comparing it with other countries, to the application of modern teaching technologies and monitoring results in domestic practice.

The obtained results in the present work are also necessary for the education system of the school. Furthermore, it is also the reason for the development of the integration of natural knowledge at the school, the production of new teaching technologies, etc.

In conclusion, the definition of the methodological foundations for the development of scientific literacy of students influences positively the following main actions: to determine their own potential, to progress schoolchildren's natural science literacy by creating an educational space that allows them to choose consciously their future life in the further development of the labor market. As a result, it allows for the

development of the lifelong education system in accordance with the requirements of the modern world educational space, to improve and modernize the national education system.

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## Жаратылыстану-ғылыми сауаттылықты дамытудың әдіснамалық қағидаттары

Бүгінгі таңда әртүрлі елдерде білім беру сапасын анықтау үшін халықаралық зерттеулер жүргізілуде, олардың көрсеткіштері алдыңғы қатарлы елдерді және олардың бәсекеге қабілеттілігін анықтауға мүмкіндік береді. Осындай халықаралық зерттеулерге қатысу барысында жоғары көрсеткіштерге қол жеткізу үшін қазақстандық оқушыларға халықаралық зерттеулер деңгейіне сәйкес ұсынылатын тапсырмалар деңгейін келтіру қажет. Зерттеудің мақсаты ұлттық білім беру міндеттерін іске асырудың құрамдас бөлігі ретінде жаратылыстану сауаттылығын дамытудың әдіснамалық принциптерін анықтау. Заманауи мектепте білім алушылардың білімі мен дағдыларын дамыту және оларды ақпараттық қоғамның сұранысына жауап беретін шығармашыл, креативті тұлға ретінде тәрбиелеу зерттеудің негізгі бағыты мен идеясын ашады. Зерттеу әдістемесі құзыреттілікке, тұлғаға-бағытталған және қызметтік тәсілдерге негізделген. Тәжірибеде құзыреттілік тәсілді іске асыру білім алушылардың нақты өмірлік жағдайларда және практикалық қызметте алған теориялық білімдерін, іскерліктері мен дағдыларын пайдалануға дайындығын білдіреді. Тұлғаға бағытталған тәсіл білім берудің мақсаттары мен мазмұнын, білім алушылардың оқу қызметін ұйымдастыру нысандарын қамтитын заманауи оқытуға қол жеткізуді көздейді. Осылайша, білім алушылардың жаратылыстану-ғылыми сауаттылығын дамытудың әдіснамалық негіздерін анықтау оқушылардың функционалдық сауаттылығын арттыруға мүмкіндік береді. Мектептегі білім берудің ұлттық жүйесінің толықтығын, тиісінше оқытудың әдістемелік жүйесін құру қарастырылып отырған мәселенің өзектілігін арттырады. PISA және басқа да халықаралық зерттеулердің міндеттерін ескере отырып, практикалық бағыттағы тапсырмаларды құрастыру әр оқу пәні бойынша мектептегі білім мазмұнын жаңартуға негіз бола алады.

*Кілт сөздер:* жаратылыстану-ғылыми білім беру, сауаттылық, функционалдық сауаттылық, білім беру сапасы, әдіснамалық ұстаным, құзыреттілік тәсіл, қызметтік тәсіл, халықаралық зерттеулердің міндеттері.

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## Методологические принципы развития естественнонаучной грамотности

Сегодня для определения качества образования в разных странах проводятся международные исследования, показатели которых позволяют выявить передовые страны и их конкурентоспособность. Для достижения высоких показателей в ходе участия в подобных международных исследованиях необходимо привести уровни заданий, предлагаемых казахстанским учащимся в соответствии с уровнем заданий международных исследований. Целью исследования является определение методологических принципов развития естественнонаучной грамотности как одной из составляющих реализации задач национального образования. В связи с этим развитие прочных знаний и навыков обучающихся в современной школе и воспитание их как творческих, креативных личностей, отвечающих запросам информационного общества, раскрывают основное направление и идею исследования. Методология исследования основана на компетентностном, личностно-ориентированном и деятельностном подходах. Реализация компетентностного подхода на практике означает готовность обучающихся к использованию приобретенных теоретических знаний, умений и навыков деятельности в реальных жизненных ситуациях и практической деятельности. Личностно-ориентированный подход предполагает достижение современного обучения, включающего цели и содержание образования, формы организации учебной деятельности обучающихся. Таким образом, определение методологических основ развития естественнонаучной грамотности обучающихся позволит повысить функциональную грамотность школьников. Создание полноты национальной системы школьного образования, соответственно методической системы обучения, повышает актуальность рассматриваемой проблемы. Составление заданий практической направленности с учетом задач PISA и других международных исследований может служить основой для обновления содержания школьного образования по каждому учебному предмету.

*Ключевые слова:* естественнонаучное образование, грамотность, функциональная грамотность, качество образования, методологический принцип, компетентностный подход, деятельностный подход, задачи международных исследований.

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