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УДК 372.891
МРНТИ 14.25.09 **https://doi.org/10.51889/1728-8975.2023.77.3.005**

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THE IMPORTANCE OF THE FORMATION OF NATURAL LITERACY AT THE SECONDARY EDUCATION LEVEL

Abstract

This article was devoted to determining the main parameters of predicting the success of education and professional and pedagogical activity in the formation of natural science literacy in secondary school. To date, there is a need for highly qualified specialists capable of professionally and professionally training and strengthening the Kazakh nation on the basis of special pedagogical natural science training.

The relevance of this study is related to the need to improve the quality of domestic education in the formation of natural science literacy at the secondary level and to the definition of PISA international education.

Kazakhstan's National Strategy for Educational Development for 2012-2016 emphasizes the formation of students' natural science literacy as one of the tasks of education.

This regard, the content of secondary school standards includes information about the modern natural science picture of the world, the role of modern theories and ideas in the formation of a scientific worldview. The main method of implementing the standard is activity - based and practice-oriented approaches, as well as the formation of natural science literacy at the secondary level.

Essential to the formation of teachers' natural science literacy in secondary education is the formation of the pragmatic component of literacy: special pedagogical natural science skills, the experience (skills) of successfully performing theoretical and practical actions to maintain the unity and integrity of the student body in the face of possible dangers based on existing knowledge.

To fix the primary importance of the educational result associated with the ability to act in a real-life situation is already beginning to gather like-minded people around them, consciously subordinating the educational process to the actual task under consideration.

The content of educational standards in secondary schools includes information about the modern natural science picture of the world, the role of modern theories and ideas in shaping the worldview of scientific knowledge.

Keywords: Formation, PISA, natural literacy, secondary education level, competencies.

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ОРТА БІЛІМ БЕРУ ДЕҢГЕЙІНДЕ ЖАРАТЫЛЫСТАНУ САУАТТЫЛЫҒЫН ҚАЛЫПТАСТЫРУ МАҢЫЗДЫЛЫҒЫ

Аңдатпа

Бұл мақала орта мектептегі жаратылыстану сауаттылығын қалыптастырудағы оқыту мен кәсіби-педагогикалық қызметтің табыстылығын болжаудың негізгі параметрлерін анықтауға арналды. Бүгінгі таңда арнайы педагогикалық жаратылыстану-ғылыми даярлық негізінде Қазақстан ұлтын кәсіби және білікті оқытуға және нығайтуға қабілетті жоғары білікті мамандар педагогтарға қажеттілік туындап отыр.

Бұл зерттеудің өзектілігі орта білім беру деңгейіндегі жаратылыстану-ғылыми сауаттылықты қалыптастыру және PISA халықаралық білімді анықтау деңгейінде отандық білім беру сапасын арттыру қажеттілігімен байланыстырылады.

Қазақстанның білім беруді дамытудың 2012-2016 жылдарға арналған ұлттық стратегиясы білім беру міндеттерінің бірі ретінде оқушылардың жаратылыстану-ғылыми сауаттылығын қалыптастыруға баса назар аударады.

Осыған байланысты орта мектеп стандарттарының мазмұны әлемнің қазіргі жаратылыстану-ғылыми бейнесі, ғылыми дүниетанымды қалыптастырудағы заманауи теориялар мен идеялардың рөлі туралы ақпаратты қамтиды. Стандартты іске асырудың негізгі әдісі-белсенділік пен тәжірибеге бағытталған тәсілдер, сондай-ақ орта деңгейде жаратылыстану сауаттылығын қалыптастыру.

Орта білім беру жүйесінде мұғалімдердің жаратылыстану-ғылыми сауаттылығын қалыптастырудың қажетті шарты сауаттылықтың прагматикалық компонентін қалыптастыру болып табылады: арнайы педагогикалық жаратылыстану-ғылыми дағдылар, қолданыстағы білім негізінде ықтимал қауіптер жағдайында студенттер ұжымының бірлігі мен тұтастығын сақтау бойынша теориялық және практикалық әрекеттерді сәтті орындау тәжірибесі (дағдылары).

Нақты өмірлік жағдайда әрекет ету қабілетімен байланысты білім беру нәтижесінің маңыздылығын бекіту үшін олар қазірдің өзінде білім беру процесін нақты қарастырылып отырған тапсырмаға саналы түрде бағындырып, пікірлес адамдарды жинай бастады.

Орта мектептерде білім беру стандарттарының мазмұны әлемнің қазіргі жаратылыстану-ғылыми бейнесі, ғылыми білім дүниетанымды қалыптастырудағы заманауи теориялардың, идеялардың рөлі туралы мәліметтерді қамтылады.

Түйін сөздер: қалыптастыру, PISA, табиғи сауаттылық, орта білім деңгейі, құзыреттілік.

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ЗНАЧИМОСТЬ ФОРМИРОВАНИЯ ЕСТЕСТВЕННОЙ ГРАМОТНОСТИ НА УРОВНЕ СРЕДНЕГО ОБРАЗОВАНИЯ

Аннотация

Данная статья была посвящена определению основных параметров прогнозирования успешности обучения и профессионально-педагогической деятельности в формировании естественнонаучной грамотности в средней школе. На сегодняшний день существует потребность в высококвалифицированных специалистах, способных на основе специальной педагогической естественно-научной подготовки профессионально и квалифицированно обучать и укреплять казахстанскую нацию.

Актуальность данного исследования связана с необходимостью повышения качества отечественного образования на уровне формирования естественнонаучной грамотности на уровне среднего образования и определения международного образования PISA.

Национальная стратегия развития образования Казахстана на 2012-2016 годы подчеркивает формирование естественнонаучной грамотности учащихся как одну из задач образования.

В связи с этим содержание стандартов средней школы включает в себя информацию о современной естественнонаучной картине мира, роли современных теорий и идей в формировании научного мировоззрения. Основным методом реализации стандарта является деятельностный и практико-ориентированный подходы, а также формирование естественно-научной грамотности на среднем уровне.

Необходимым условием формирования естественнонаучной грамотности учителей в системе среднего образования является формирование прагматического компонента грамотности: специальных педагогических естественнонаучных навыков, опыта (умений) успешного выполнения теоретических и практических действий по поддержанию единства и целостности студенческого коллектива перед лицом возможных опасностей на основе существующих знание.

Чтобы зафиксировать первостепенную важность образовательного результата, связанного с умением действовать в реальной жизненной ситуации, уже сейчас начинают собирать вокруг себя единомышленников, сознательно подчиняя образовательный процесс реальной рассматриваемой задаче.

Содержание образовательных стандартов в средних школах включает сведения о современной естественно-научной картине мира, роли современных теорий, идей в формировании мировоззрения научного знания.

Ключевые слова: Формирование, PISA, естественная грамотность, уровень среднего образования, компетенции.

Introduction. The formation of natural science literacy is one of them main parameters for predicting the success of further education and professional and pedagogical activities. Today there is a need for highly qualified specialists teachers who are able to professionally and competently train and strengthen the healthy nation of Kazakhstan on the basis of specially pedagogical natural science training.

The relevance is related to the need to develop natural science literacy at the secondary level and improve the quality of domestic education at the international level.

Kazakhstan's National Strategy for Educational Development for 2012-2016 emphasizes the formation of students' natural science literacy as one of the tasks of education.

This regard, the content of secondary school standards includes information about the modern natural science picture of the world, the role of modern theories and ideas in the formation of a scientific worldview. The main method of implementing the standard is activity – based and practice-oriented approaches, as well as the formation of natural science literacy at the secondary level.

Materials and methods of research. The level of formation of students' natural science literacy can be analyzed as a set of quantitative and qualitative indicators that comprise the cognitive, practical, and personal components of natural science literacy, including its components. In order to determine the effectiveness and quality of the process of formation of students' natural science literacy, it is necessary to characterize the measures of formation of this type of natural science literacy component. This is because the real opportunity to organize and implement special pedagogical natural science training in the field of education depends on this component.

Criteria were used to determine the level of pedagogical natural science knowledge (cognitive component of natural science literacy). The selection was based on an analysis of pedagogical literature on this issue.

An analysis was made of the work of researchers in the field of natural science and pedagogical training O.Abdullina, Yu.Babansky, A.Kossakovsky, I.Lerner, A.Markova, V.Orlov, Ya.Ponomarev, M.Skatkin, R.Shaporinsky, N.Yakovleva and enatural science training I.Aleksashina, O.Golubeva, L.Korobeynikova, O.Melekhova, N.Oreshchenko, S.Slinkin, and others A.Markov, referring to I.Lerner lists the following groups of knowledge and qualities of the natural sciences

a) Scientific, systematic, generalizing, recognizing, restraining and expanding;

b) flexibility, mobility, efficiency

c) effectiveness, concentration on practical application

d) fullness, strength, quantity.

The indicators to assess the level of theoretical knowledge in O.Abdulina's research are quantity (completeness, depth, strength), cognition (independence of judgments, grounded propositions, problem formulation), and interest in educational theory (natural science literature, participation in L.Korobeinikov's methodology and research activities):

- At the level of content reproduction, completeness of knowledge about the subject,
- generality in the knowledge of the essence, coherence in the knowledge of relations and relationships;
- At the activity-transformation level: strength, mobility, and validity of knowledge;
- At the activity-individual level: depth of knowledge.

Considering the data and other studies, teachers determined criteria such as completeness, generality, systematics, strength, and coherence in knowledge to characterize their special educational natural science knowledge.

Essential to the formation of teachers' natural science literacy in secondary education is the formation of the pragmatic component of literacy: special pedagogical natural science skills, the experience (skills) of successfully performing theoretical and practical actions to maintain the unity and integrity of the student body in the face of possible dangers based on existing knowledge It is The question of qualitative and quantitative characteristics of skills as a necessary component of professional and pedagogical training is developed as follows in many studies of teachers and psychologists (O.Abdullina, N. Belokur, G.Zasobina, N.Kuzmina, G.Selevko, L.Spirin, N.Yakovleva, etc.

For example, L.Spirit emphasizes that the degree of skill formation depends on the functional unity of structured skills.

Knowledge (as informational background), skills and heuristic behavior as part of the skills. As main indicators, scientists use ideological and moral orientation, professional competence (scientific competence, expediency and purposefulness, originality, and assimilation); N.Belokar identifies

qualitative characteristics of cognitive behavior, which are expressed by a system of indicators, including the level of mastery of a system of meaning, depth of meaning. The main indicators of the formation of skills G.Gnezdilov considers: stability, speed, error-free, and the quality of the performance of the action, effectiveness A.Usova it is proposed to choose as indicators characterizing natural science skills, completeness of operations, rationality, order of execution, awareness of actions, generality of skills and the degree of complexity of mental operations.

Considering the above, the main indicators determining the level of formation of the practical component of the natural science literacy of teachers are the degree of awareness of skills

- (Degree of dependence on theoretical knowledge),
- the degree of transmission, the level of mastery of the system of meanings (the ability to attribute the object of cognition to a certain class, group of phenomena, etc.).

Natural science literacy involves not only knowledge, skills and abilities, but also an evaluative and semantic attitude to the world and its activities. Just because a student knows a natural science idea and correctly uses it to explain a phenomenon in reality does not mean that he or she is convinced of the truth of this idea and, consequently, this idea does not cause an evaluative attitude in the student until the idea becomes part of the student's worldview. The latter implies a positive focus on the process of creating conditions for maintaining and strengthening the student's body and eliminating damage, spoilage and destruction, as well as value-semantic representation (attitude) to the content and results of health-saving activities K.Platonov identifies the following characteristics in accordance with the orientation structure: breadth, intensity, stability and validity.

V.Slastenin indicates that

- Maturity of orientation (degree of social significance of the individual);
- intensity of orientation (the strength of the individual's aspirations to achieve the goals set);
- hierarchy of orientation types (selection of leading, major and dominant orientation types in the system), orientation breadth (range of individual manifestations, desire areas).

An important indicator of the development and formation of value-semantic relations of a secondary school teacher, including in the process of special pedagogical natural science training, is the setting of specific goals in the course of educational and professional activities, ensuring the unity and integrity of the student's body and creating conditions for the development of a sense of purpose. The development of motivation encourages the student to set more important goals, the achievement of which will satisfy his spiritual needs. In this process, B.Dodonov identifies four elements:

1. the pleasure of the activity itself, the importance for the individual of its immediate results, motivational power (reward for activity) and compulsive pressure on the individual.

Therefore, we propose to use modality (the positive and negative foundations of its components) as the main criterion for the student's orientation to the process of creating conditions that ensure unity and integrity in adolescence. Determine the value-semantic representations (attitudes) about the content and results of health-saving activities through perseverance and satisfaction brought by this type of activity. Determining the effectiveness of the process of formation of natural science literacy based on specific criteria, such as completeness, generality, consistency, systematicity and strength of special educational natural science knowledge; the degree of transfer, recognition and mastery of the value system of special educational natural science skills; as well as style, stability and satisfaction, taking into account the process and results of health-saving measures, this allows you to identify the effectiveness of the process of formation natural science literacy. Using a tiered approach, we were able to determine the levels of effectiveness of the process of forming natural science literacy as low, medium and high. The definition of criteria and levels of formation of natural science literacy of teachers makes it possible to scientifically substantiate and implement this activity, which, in turn, contributes to improving the effectiveness of the general educational process.

Currently, the preparation of secondary school students for real life, for work, is one of the leading priorities of education and requires revision in the education system. The current understanding of educational programs goes beyond the usual list of knowledge, skills and abilities. Educational outcomes are the end product of Student Guidance Process at school and indicate qualitative changes in the student's personality. The crucial stage is the presentation of the results of education, natural science literacy of the individual, this is formed based on the development of key competencies and subject competencies. Key competencies are the state's requirements for the quality of a high school graduate's education, which are stated in state educational standards and curricula.

Requirements for the level of training of high school students in science subjects, based on the development of competencies, include the main qualities that a student must acquire during the training period. Currently, Kazakh children participate in international comparative studies in the field of education such as TIMSS and PISA.

The concept of natural science literacy refers to the ability to take an active civic position on issues related to the natural sciences and the willingness to take an interest in natural science ideas. People with natural science literacy seek to engage in reasoned debate about issues related to natural science and technology. This requires the ability to explain phenomena scientifically, evaluate and plan scientific research, interpret data scientifically, and present evidence (PISA survey).

In 2018, representatives of CIS countries participated in the international achievement survey PISA.

PISA assesses the level of knowledge of 15-year-olds in key competencies and also contributes to improving the quality and effectiveness of education systems In 2018, some 600,000 youth from 79 countries participated in this international survey.

PISA offers a definition of scientific literacy that includes three core competencies

- Scientific explanation of phenomena
- Application of natural science research methods
- Interpreting data and using scientific evidence to draw conclusions.

Equally important, and this is reflected in the definition, these competencies are necessary for a person to take an interest in natural science ideas as an active citizen and to participate in discussions of issues related to natural science and technology.

One of the most important issues accompanying the publication of the main results of the well-known Programme for International Student Assessment (PISA) is the classification of countries according to student attainment. However, this ranking does not take into account some highly relevant factors, such as the different resource endowments of each education system or the heterogeneous context in which schools operate. This study aims to provide a fuller picture of education system operation worldwide by assessing the managerial efficiency of secondary schools in a cross-country framework. To do this, we use data from OECD countries participating in PISA 2015 and apply a robust nonparametric approach that accounts for the fact that schools were operating under heterogeneous conditions before the efficiency measures of performance were estimated. Our results suggest that the consideration of both school resources and environmental factors significantly modifies the country ranking based solely on student results.

Using the recent PISA for Development (2017) learning survey, we offer new evidence on whether there is a private–public schools efficiency gap in Latin America and the role of distinct barriers and inequality on efficiency. We obtain school efficiency scores using Data Envelopment Analysis from 705 schools in four countries – Ecuador, Guatemala, Honduras and Paraguay. We find that the private schools efficiency is 0.88 whereas it is lower for public schools (at 0.82). Thus, there is a positive efficiency gap for private schools, with the lower efficiency in public schools may be explained by the additional obstacles they face (such as higher prevalence of student work). However, there is a greater scope in public schools of boosting efficiency by decreasing inequality

and the provision of remedial classes. Whole sample results seem to be driven by two countries: Ecuador and Paraguay.

The key areas of PISA research are reading, math, and science literacy.

General characteristics of natural science literacy and tasks of the Kazakh system of pedagogical education The task of increasing the level of natural science literacy of Kazakhstan students is to modernize the content and methods of teaching natural subjects, change or improve the educational programs of schools and pedagogical universities.

The formation of natural science literacy is one of the main tasks of general secondary education in the Republic of Kazakhstan. Students should acquire the following abilities

- Explain phenomena scientifically
- Understand the characteristics of natural science research;
- Interpret data and use scientific evidence.

All these competencies lead them to possess natural science literacy. As a result, students tend to participate in research in the natural science field, discuss problems, etc.

The most important resource in improving students ' natural science literacy is practice-oriented tasks that allow them to teach them to solve life problems using subject knowledge.

Practice-oriented tasks – the content of which is close to real life-are the main tool for developing students' functional literacy. Development of practice-oriented tasks for the formation and assessment of students ' natural science literacy should meet the following requirements:

- the task block must contain story tasks with a creative title.
- the subject of tasks must have a different context.
- the content basis of tasks should be based on the material of scientific knowledge;
- practice-oriented tasks should have different levels.
- tasks should aim to develop the competencies that constitute natural science literacy;

-tasks can be diverse in form (with the choice of one or several possible answers, matching two sets, with a short answer, with a detailed answer) and must be accompanied by criteria for evaluating their performance.

Characteristics of the assessment of the level of natural science literacy formation From the pedagogical point of view, the development of students' pedagogical and cognitive competence is characterized primarily by practice-oriented learning. From this perspective, the prerequisites of the methodological principles of natural science literacy formation of students of the Republic of Kazakhstan are the acquisition of the ability to scientifically explain problems related to natural science and technology at their own level, to understand the main features of scientific research, to summarize scientific data, etc.

Each of the three core competencies that make up the ENG contains specific skills that can be developed directly or tested through separate assignments. Paragraph 1 provides an approximate description of these skills that identify the content of each core competency and the training tasks that can be used to form or assess the corresponding skills.

Table 1 - Skills that reveal the content of ENG and a description of the tasks in the following areas: Formation/evaluation of these skills

	Competencies and Skills	**Description of training assignments designed to Formation/evaluation of skills**
Competence: scientific explanation of phenomena		
1	Apply relevant natural science knowledge Apply knowledge of the natural sciences Explain phenomena	A fairly standard description of the situation is suggested, and program materials can be used directly.
2	Recognize, use, and create Explanation. Models and Ideas	On writing non-standard situations for which the student is not prepared to provide an explanation. In order to obtain an explanation, one must either

		transform it (explicitly or mentally) into a standard, well-known model, or into a model in which the necessary relationships can be clearly traced. An inverse problem is also possible: use the model presented to discover and explain the phenomenon.
3	Scientifically Justified Scientific Justification About a process or phenomenon	It is suggested that further development be justified based on an understanding of the mechanism (or cause) of the phenomenon or process.
4	Describe and evaluate the methods scientists use to ensure the reliability of data and the credibility of explanations. Reliability of Explanation	It is suggested that the purpose of certain elements of the study (control group, control sample, large statistics, etc.) be clarified to increase the reliability of the results. Alternatively, to investigate the issue, a more reliable It is suggested that we select.
Competence: Application of Natural Science Research Methods		
1.	Recognize and concretize the objectives of this study Objectives of this study	By briefly describing the course of the study or the actions of other investigators, it is suggested to clearly formulate its purpose.
2.	Scientific Research Methods Proposal and Evaluation Scientific Research Methods of this issue.	For each problem described, we suggest a brief formulation or evaluation of the research idea that seeks to solve it, or to describe the main stages of such a study.
3.	Present an explanatory hypothesis and Present a hypothesis and suggest ways to test it Verify	It is proposed not only to formulate hypotheses that explain the described phenomenon, but also to propose possible ways to test them. A set of hypotheses can be proposed in the task. They can also be proposed in the task itself.
4.	Describe and evaluate the methods scientists use to ensure the reliability of data and explanations.	It is suggested that the purpose of special survey elements (control groups, control samples, large statistics, etc.) be clarified that would increase the reliability of the results. Alternatively, to investigate the issue, a more reliable It is suggested that we select.
Ability to interpret data and use scientific evidence to Draw conclusions		
1.	Analyze and interpret data and draw appropriate conclusions Draw conclusions	It is suggested that conclusions be based on the interpretation of data presented in a variety of formats, including graphs, tables, diagrams, photog-raphs, geographic maps, and verbal statements, Data may be presented in a combination of different formats.
2.	Transform one form of data representation into another	It is proposed to transform one form Of scientific information presentation into another, for example: a wordform into a schematic drawing, a tabular form into a graph or diagram, etc.
3.	Recognize assumptions, proofs and arguments in scientific texts	It is proposed to identify and formulate assumptions on which a particular scientific study is based They can also describe the types of scientific text themselves: proof, reasoning, and assumption.
4.	Evaluate from a scientific point of view arguments and evidence from various sources	It is proposed to evaluate from a scientific point of view the correctness and credibility of statements contained in various sources, for example, scientific and popular texts, media reports, and people's statements.

These competencies include the following:

components of science literacy:

knowledge of basic natural science concepts, facts, laws and their effective use in educational activities;

understand the main characteristics of the methods of perception of the natural sciences, acquire the basics of natural science practice, and obtain, select, and analyze data from the natural sciences;

determine the scientific meaning of problems that arise in the course of everyday activities, including social and political situations;

understanding natural science publications, analyzing and evaluating the information provided; formulating your own arguments on natural science issues and evaluating other people's arguments., etc.

These components make it possible to select the content of natural science knowledge, this is the foundation for the development of students' natural science literacy, and create practical tasks in academic subjects.

Conclusion. Competence is realized through a practice-oriented teaching methodology in the educational process by performing specific practical tasks and exercises.

The degree of actualization of the task of developing natural science literacy in education primarily depends on the position of a particular teacher, methodologist, or head of an educational organization regarding priorities in determining the educational outcome. And this position is determined by the solution of the dilemma: what is preferable - knowledge of facts and ability to solve typical educational tasks, or the ability to act in a real-life situation.

To fix the primary importance of the educational result associated with the ability to act in a real-life situation is already beginning to gather like-minded people around them, consciously subordinating the educational process to the actual task under consideration.

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ӘОЖ: 37.378.4
ҒТАМР 34.15.45 **https://doi.org/10.51889/1728-8975.2023.77.3.006**

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БОЛАШАҚ БИОЛОГИЯ ПӘНІ МҰҒАЛІМІНІҢ ФУНКЦИОНАЛДЫҚ САУАТТЫЛЫҒЫН ДАМЫТУ

Андатпа

Бұл мақаланың мақсаты – функционалдық сауаттылық туралы түсінік беру. Болашақ биология пәні мұғалімін дайындауда олардың функционалдық сауаттылығы туралы зерттеудің өзектілігі мен олардың әртүрлі практикалық контексттерде тілді тиімді пайдалану және түсіну қабілетін талдау болып табылады.

Мақалада функционалдық сауаттылық күнделікті өмірде, білім беру мен еңбекте әртүрлі тапсырмаларды сәтті орындау үшін қолдана білуді қамтиды. Әртүрлі әдістерді біріктіру мақсатты функционалдық сауаттылықты дамытудың ең тиімді жолдары қарастырылған.

Бұл жұмыста болашақ биология пәні мұғалімдерінің функционалдық сауаттылықты өлшеу әдістері мен жаратылыстануда функционалдық сауаттылықты дамытуда студенттердің қолдана алатын дағдыларының тізімі мен болашақ мамандардың биология саласында қарым-қатынас жасап, жұмыс істеуі үшін олардың функционалдық сауаттылығын дамыту маңыздылығы анықталады.

Функционалдық сауаттылық мыналардан тұрады: биологиялық құбылыстарды түсіну қабілеті, деректерді түсіндіру қабілеті, биологиялық экспериментті орындау қабілеті. Функционалдық сауаттылықтың инвариантты компоненттерін ескере отырып, біз студенттердің жеке басына биологиялық білім алу процесінде құндылықтарды іздеу деп аталатын жағдай тән деп тұжырымдаймыз. Функционалдық сауаттылықтың қалыптасуы жеке тұлғаның пассивті сапасы емес, керісінше жеке тұлғаның белсенді бөлігі болып табылады.

Мақалада функционалдық сауаттылық деген ой негізделеді және биологияны оқыту әдістемесіндегі негізгі құндылық нұсқаулығы болып табылады. Негізгі мазмұнында функционалдық сауаттылық ұғымына талдау жасалды.

Функционалдық сауаттылықты дамыту болашақ мұғалімдерге өздерінің кәсіби міндеттерін тиімді орындауға және оқушыларын биология мен ғылыми ойлауды үйренуге шабыт-