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APPROACHES TO DEVELOPING STUDENTS' SCIENTIFIC AND SCIENTIFIC THINKING

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Abstract

This article examines the scientific, methodological, and practical aspects of developing the scientific thinking of secondary school students based on achievements in national pedagogical science and accumulated pedagogical experience. Particular attention is paid to analyzing methodological approaches developed by leading pedagogical scientists aimed at developing students' skills in scientific cognition, logical analysis of natural phenomena, establishing cause-and-effect relationships, and applying acquired knowledge in academic and daily activities.

The work examines the potential of the school textbook as one of the primary tools for forming scientific literacy and developing students' research thinking. Based on the analysis of the 6th grade "Natural Sciences" textbook, the possibilities for developing cognitive activity, critical thinking, observation, comparison, generalization, and scientific explanation of environmental phenomena are determined. The didactic components of the textbook contributing to the formation of a holistic scientific picture of the world in schoolchildren, the development of research competencies, and the improvement of the quality of natural science knowledge acquisition were investigated.

The research results confirm that the purposeful use of textbook content and pedagogical national heritage, based on modern pedagogical principles and teaching methods, contributes to the effective development of students' natural-scientific thinking, the formation of a sustainable interest in studying nature, and the preparation of students for further mastery of natural-scientific disciplines.

Key words

natural-scientific thinking, natural-scientific literacy, natural sciences, natural science, universe, nature, cognitive activity, research competencies, critical thinking, methodological approaches, pedagogical heritage, national heritage, being, animal world, natural science.

Аннотация

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В данной статье исследованы научно-методологические и практические аспекты развития естественнонаучного мышления учащихся общеобразовательных школ на основе достижений национальной педагогической науки и накопленного педагогического опыта. Особое внимание уделяется анализу методических подходов, разработанных ведущими учеными-педагогами, направленных на формирование у обучающихся навыков научного познания, логического анализа природных явлений, установления причинно-следственных связей и применения полученных знаний в учебной и повседневной деятельности.

В работе потенциал школьного учебника рассматривается как один из основных инструментов формирования естественнонаучной грамотности и развития исследовательского мышления учащихся. На основе анализа учебника "Естественные науки" для 6 класса определяются возможности развития навыков познавательной активности, критического мышления, наблюдения, сравнения, обобщения и научного объяснения явлений окружающей среды. Исследованы дидактические компоненты учебника, способствующие формированию у школьников целостной научной картины мира, развитию исследовательских компетенций и повышению качества усвоения естественнонаучных знаний.

Результаты исследования подтверждают, что целенаправленное использование содержания учебника, педагогического национального наследия, основанного на современных педагогических принципах и методах обучения, способствует эффективному развитию естественнонаучного мышления учащихся, формированию устойчивого интереса к изучению природы и подготовке учащихся к дальнейшему освоению естественнонаучных дисциплин.

Ключевые слова

естественно-научное мышление, естественно-научная грамотность, Естественные науки, естествознание, Вселенная, природа, познавательная деятельность, исследовательские компетенции, критическое мышление, методические подходы, педагогическое наследие, национальное наследие, бытие, животный мир, естествознание.

Uzbek national pedagogy has its own rich heritage. This pedagogical national heritage encompasses many centuries of rich and rare works. Therefore, here we focus on analyzing approaches to developing students' natural-scientific thinking directly through examples of pedagogical national heritage.

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Pedagogical national heritage describes approaches to forming students' natural-scientific thinking from an early age in accordance with the needs of their time. In particular, according to the teachings of the Avesta, a child must have a complete understanding of nature and the surrounding world by the age of 15. Based on this, the child must possess sufficient knowledge and skills regarding the harmony between nature and man, as well as the significance of the animal world in the life of nature [1]. For this purpose, children were trained by the Master in special schools. In the educational process, attention was paid to developing skills such as feeling nature, its preservation, and an aesthetic attitude toward the animal world. For example, children gained deep knowledge about the four elements. This emphasizes the primacy of the element of fire, the compatibility of the element of earth with human nature, creative abilities corresponded to the element of water, and the element of air was explained as a necessity for life [3]. As a result, by the age of 15, a child's natural-scientific thinking was formed, encompassing natural perception of reality, a correct understanding of its essence, and an individual experience of communicating with the surrounding world.

One of our great thinkers, Abu Rayhan Biruni (XI century), describing natural and scientific knowledge in his works, focuses primarily on the issue of mastering it. In particular, he outlined the Islamic teaching on the structure of the Earth, the diversity of nature in each region, and the relationships between Earth's inhabitants and nature. His views were specifically studied during the middle school (secondary education) stage in the Middle Ages [8]. As a result, a natural-scientific mindset is formed in students aged 15–18. It should be noted that Beruniy's natural-scientific views were accepted in connection with the Islamic religion, i.e., from the perspective of the creation of nature and existence by Allah. Thus, students develop a natural-scientific mindset that possesses its own unique characteristics.

The thinker Mirzo Ulugbek (XV century) outlined the foundations of the universe and existence in his work “Zychi Koragoniy” (The Star Map of Koragoniy). At the same time, he paid special attention to understanding the foundations of the universe, the influence of the change of seasons on human life and natural activity. These natural-scientific views of Mirzo Ulugbek were assimilated by 15–16-year-old students of junior madrasas [4]. As a result, students developed a natural-scientific thinking regarding the foundations of the universe and existence. Most students observed the stars using an astrolabe, which indicates their unique natural-scientific mindset.

Mahmudhoji Behbudi (1874-1919), one of the Jadid enlighteners, developed a methodology for teaching natural sciences in Jadid schools in his works. In particular, his work “General Geography” provides scientific and methodological

coverage of the structure of nature, continents, countries, and the lifestyle of the Earth's population [5]. His work is a unique textbook on natural sciences that was taught in Jadid schools [6]. As a result, students develop a natural-scientific mindset based on pedagogical principles. In this sense, the problem of developing students' natural-scientific thinking originates from the modern pedagogy of our education system.

From these examples, it is evident that one of the main directions in our pedagogical heritage was the development of students' natural-scientific thinking. The most important thing was the special assimilation of this science through the views of thinkers. Therefore, it is important to emphasize that in the history of our pedagogy, natural science discoveries have acquired a traditional character.

Based on domestic pedagogical heritage and approaches in our pedagogical scientific research, several stages of developing students' natural-scientific thinking can be identified today. We present our approach to this matter.

The development of this thinking in students occurs in several stages. The main stages of this process are:

a) the initial stage of education. At the same time, students acquire basic concepts about existence, things, phenomena, nature, and the surrounding reality, and form a certain independent opinion about them.

The goal of this learning stage is to provide an initial understanding of the natural sciences. Meanwhile, the State Program provides that the current academic subjects “The World Around Us” and “Science” will be renamed “Science” starting from the 2023-2024 academic year. This is based on the “National Program for the Development of Public Education for 2022-2026”, approved by Decree of the President of the Republic of Uzbekistan No. UP-134 dated May 11, 2022. The National Program approved by this Decree provides for the teaching of geography, physics, chemistry, biology, and astronomy within the framework of the “Natural Sciences” course in general secondary schools. However, an analysis of textbooks published in 2022 shows that natural sciences continue to be taught under the same names, and textbooks continue to be published under these names. Such diversity can sometimes confuse students. In this sense, we consider it appropriate to publish textbooks for general secondary schools under the title: “Natural Science: Chemistry”. This approach can be found in the experience of foreign countries. For example, in secondary schools in the UK, the term “Sciences” is used, which provides knowledge and skills on the basics of these subjects [2]. It should be noted that in our country's general education schools, the types of natural sciences are selected by students, and specific natural sciences are studied in depth on a

competitive basis. Therefore, the experience of any foreign country in this regard cannot serve as a unified model.

In our country, as part of the implementation of the National Program for the Development of Humanitarian Education for 2022-2026, the foundations of teaching natural sciences in general education schools are being reformed. In this sense, starting from the 2023-2024 academic year, the methodology for teaching natural sciences is changing. According to this, a specific natural science subject was introduced for teaching as an elective rather than a mandatory subject. In this sense, in our country's general education schools, a specific academic subject is taught as an elective subject based on the students' choice. The achievements of this methodology include the following:

first, it is the in-depth teaching of certain natural sciences;

secondly, general secondary schools with a natural science orientation operate in districts and cities;

third, it provides broad opportunities for the purposeful formation and development of students' natural-scientific thinking.

At the same time, it should be noted that this methodology has the following shortcomings:

firstly, it will not be possible to develop students' general scientific thinking;

secondly, there is a shortage of teachers with higher education in the field of natural sciences in the regions of our country;

thirdly, there is a problem of orienting students toward specific natural sciences.

Thus, it would be appropriate to name and teach the subjects “Natural Sciences: The World Around Us” and “Natural Sciences: Natural Science” in the primary grades of general secondary schools. Because students deeply internalize a source of knowledge presented in clear and purposeful terms.

b) the main classes stage. In it, students in grades 5-9 master a complex of basic knowledge about existence, things, phenomena, nature, and reality, and acquire the skills of independent natural-scientific thinking.

According to the Law of the Republic of Uzbekistan "On Education," grades 5-9 of general education schools are the foundation of general secondary education. It is in such classes that it is advisable to develop the natural-scientific thinking of students. For this reason, it is advisable for textbooks on natural sciences to be in a unified and standard form. In this regard, it is necessary to transition the teaching of natural sciences in general education schools to primary methodology. Utilizing national experience in this regard will yield the expected results. For example, the textbook “Natural Sciences” (6th grade) prepared and published by K. Suyarov and

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others demonstrates the existence of a unique methodology in this regard [7]. The content of this textbook is as follows:

Chapter 1. "The Study of Nature". This chapter presents knowledge on the fundamentals of natural science across four topics.

Chapter 2. "Matter and Its Properties". This chapter presents the basics of chemical knowledge across 10 topics.

Chapter 3. "The Diversity of Living Organisms". This chapter provides knowledge on the fundamentals of organic chemistry.

Chapter 4. "The Structure of Living Organisms". This chapter is a logical continuation of Chapter 3. Therefore, it is advisable to combine Chapters 3 and 4.

Chapter 5. "Ecology and Sustainable Development". The foundations of natural science are fully revealed in 5 topics.

Chapter 6. "The Solar System and the Universe". This chapter provides a basic introduction to the foundations of astronomy.

Chapters 7, 8, and 9 cover the basics of geographical knowledge, while chapters 10, 11, and 12 cover knowledge and skills related to physical properties, energy, and electrical phenomena.

If you pay attention, the textbook outlines the general foundations of natural sciences. In this sense, it is advisable to develop students' natural-scientific thinking through textbooks of this type.

c) high school. In it, students in grades 10–11 will gain comprehensive knowledge and skills about the surrounding reality, objects, phenomena, nature, and reality, as well as the opportunity to perform various experimental work and projects. The "National Program for the Development of Public Education for 2022-2026" provides for the vocational orientation of students in grades 10-11 of general education schools, and this task is being implemented today. In this sense, it is advisable to base the development of the natural-scientific thinking of students in these classes on the educational directions they have chosen. Therefore, we consider it important to approach this issue as follows:

1) students in the biological sciences group;

2) students of the astronomy club.

To form the scientific-scientific thinking of students in the biological sciences group, it is advisable to use forms such as circles and additional classes in the process of teaching these subjects.

The use of additional classes and practical experiments is of great importance in the formation and development of the natural-scientific thinking of students in the astronomy science club.

With proper attention, students will have the opportunity to purposefully develop their natural-scientific thinking in the process of teaching natural sciences. This approach is based on pedagogical research and experience. In this regard, it is necessary to study approaches to developing students' natural science thinking.

In conclusion, it can be said that various aspects of developing students' natural-scientific thinking have been highlighted by domestic pedagogical scientists. The primary objective of these approaches is to equip students with scientific thinking. In this regard, it is necessary to develop mechanisms for developing students' natural science thinking based on these approaches.

REFERENCES:

1. Авеста. Перевод М.Исакова. – Т.: “Fan”. 2001
2. Бордовская Н., Реан А. Педагогика. – Санкт-Петербург, 2001
3. Изведать пути проведных. Сборник. – Т.: “Фан”. 1991
4. Кари-Ниязий Т.Н. Астраномичская школа Улугбека. – Т.: “Фан”. 1971
5. Mahmudxo‘ja Behbudiy. Tanlangan asarlar. – T.: “Ma’naviyat”. 1998
6. Namozova N. Educational and pedagogical views of Mahmudkhoja Behbudi. – Doctor of Pedagogical Sciences. – Tashkent, 2017.
7. Suyarov K.T. [and others]. Tabiiy fanlar [Matn]: Textbook for the 6th grade. – Tashkent: Respublika ta’lim markazi, 2022. – p.192
8. Yuldashev U. Eski maktablarda ta’lim tizimi. – T.: “O‘qituvchi”. 1990