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THE METHODOLOGY OF FORMING NATURAL-SCIENTIFIC CONCEPTS IN TEACHING NATURAL SCIENCES

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ABSTRACT

This article includes the analysis of theoretical and practical projects on Science subjects taught in primary classes in Uzbekistan. It demonstrates the unique aspects of forming a scientific worldview in students through physical concepts in the natural sciences (Science) textbook. It also highlights the process of mastering elementary physical concepts and developing the ability to apply this knowledge in familiar and unfamiliar situations, as well as in practical contexts.

KEYWORDS

Natural science, competence, intellectual capacity, integration, project work, scientific awareness, initiative, creativity, tendency, XXI century skills.

Introduction

Many researchers have proposed the idea that it is necessary to form foundational knowledge of natural sciences in primary school students. Studies have discussed the formation of primary knowledge and concepts from geography, inanimate nature, biology, history, mathematics, and the development of physical concepts in textbooks for general secondary education. The issues of forming initial knowledge of natural sciences in primary school students, including stimulating interest in these subjects, have been specifically addressed by many theorists and methodologists.

"The sooner the process of forming students' interest in scientific knowledge and their ability to conduct scientific research begins, the quicker our youth will embark on the path of independent creative and scientific work"[4] is a well-founded idea. Developing students' interest in scientific knowledge helps to raise the scientific level of teaching, intensify the focus on studying physical theories, and use them to explain physical phenomena and the properties of objects. Creating the conditions for forming a system of initial natural-scientific concepts without the relevant connections makes it difficult to assimilate the laws and phenomena of physics, chemistry, biology, and other scientific fields in practice. However, a number of biological, physical, and chemical processes and phenomena are studied in primary classes before delving into physics, chemistry, and biology. In this way, some concepts are supplemented by others and systematically linked. This requires the formation of initial knowledge of natural sciences during the study of natural science, mathematics, and technology courses in primary education.

Teachers working in primary education often do not always have the opportunity to explain the essence of natural-scientific concepts to students, identify their significance and role in science and technology, establish the characteristics and laws of the processes being studied, and clarify and explain initial natural-scientific concepts. In some cases, teachers face difficulties in choosing and

using instruments for demonstrations, conducting practical sessions, and utilizing didactic materials and modern teaching aids. There is limited time allocated for practical exercises to familiarize with and consolidate studied natural-scientific concepts, especially working with experimental apparatus and instruments, determining physical quantities, and developing skills and competencies. Situations also arise where many concepts need to be clarified because they are presented without demonstrative exhibitions. Therefore, students do not fully develop a deep understanding of natural-scientific concepts.

Forming professional skills in students through natural sciences - taking advantage of modern educational laboratories to assist in navigating scientific information, significantly enhances the opportunities for successfully developing their worldview and personality. However, the potential of natural-scientific subjects in personality formation is not always fully utilized due to various factors. Primarily, from the early days, primary school students studying natural sciences need to grasp new concepts and information, but this assimilation poses certain difficulties for some students. In some instances, understanding and assimilating the essence and content of certain concepts can be challenging for students, forcing them to memorize the study material mechanically, which subsequently diminishes their interest and leads to a negative attitude towards the subject.

In correctly understanding and assimilating initial knowledge of natural sciences by students, unveiling the physical content: forming definitions, including the essential characteristics of the concept being studied, conducting demonstrative experiments, utilizing didactic materials, and connecting them with life and practice are crucial. Forming initial knowledge in natural sciences cannot be achieved instantly. These concepts are gradually integrated and assimilated during the teaching process of natural and mathematical sciences, through the acquisition of various scientific and everyday information, observations, and analyses. The effectiveness of forming initial knowledge in natural sciences depends on the teacher's ability to express the essence and content of the concept or phenomenon being studied, the methods and approaches of teaching, and the consistency and sequence of material presentation. Based on the stated ideas, the current natural sciences textbook for primary classes is designed to form elementary concepts of physics, chemistry, biology, zoology, mathematics, and technology through theoretical and practical exercises.

The primary school natural sciences textbook presents elementary concepts that serve as the basis for the subject of physics. For example, chapter 11 of the grade 2 natural sciences textbook is titled "Energy. Heat and Light. Sound." This chapter offers theoretical information on "What is energy?", "Light and heat", "Sounds around us", and practical exercises like "Studying the effects of heat on objects", "Generating sounds", "Unique phone". To what extent do these topics help form elementary concepts of physics in students? At this point, students are asked the following problematic question: Are you familiar with the word energy? After listening to all of the students' responses, they begin to be introduced to the concept of energy as follows. "Energy" is a Greek word meaning "action" [5].

The sun, stars, wind, air, fuels, and water bodies possess energy. Energy causes rockets, airplanes, trains, and cars to move, lights to shine, and living organisms to develop. The movement of plants, animals, and humans, performing physical exercises, ships sailing in water, the flight of a hot air balloon, and lifting and lowering loads with a crane all consume energy. In our daily lives, we utilize the energy of the sun, fuel, wind, and water. Through these topics, students gradually form initial concepts about what heat is, how it is produced, and sources of heat.

In the topic "Light and Heat," students begin to form a concept about light. What is light? What significance do light and heat have for living organisms? How do you protect yourself from heat and cold? These questions are addressed to the students, who then try to find the answers.

Light is radiation; it comes to us from the sun. Light travels in straight lines. We see objects when light is reflected off them. Light reflects well off smooth and shiny surfaces. If the path of light is blocked, a shadow is formed. The sun is a source of light and heat. Heat is a form of energy [6].

Light is necessary to see objects. In this experiment, we will observe how heat affects balloons with and without water. If a balloon without water is brought close to a flame, it will burst. If water is poured into a balloon and then it is brought close to a flame, it will not burst. This shows that water absorbs a significant amount of the heat from the flame and prevents the balloon from bursting. This experiment demonstrates that light and heat affect objects differently.

Students in 2nd grade get acquainted with "Natural Phenomena." Changes in nature are called natural phenomena. They often occur with changes in weather or the seasons. Snow, raindrops, leaf fall, birds migrating, droughts – these are all seasonal phenomena. Dew and fog depend on the weather, as well as the movement and humidity of the air.

The alternation of day and night, the sunrise are some natural phenomena we observe so frequently that they seem ordinary to us. Some phenomena, however, occur only occasionally. For instance, snowfall in the scorching deserts of Africa is a rare event. If it suddenly snows there, people would call it a miracle [5].

We can see that the primary school natural sciences textbook comprises interconnected, complementary integrated topics from several subjects. Particularly, the textbook extensively utilizes the principle of multi-level integration in natural sciences. The principle of multi-level integration is based on the integration process going through several stages. These levels show the formation of new integrated aggregates from previously autonomous components. They are characterized by an increase in organization, strengthening of their interconnections, unity of parts, and the emergence of new systemic properties. This concept is introduced in the subject as "concentrism." In concentrism, a part of the study material is revisited repeatedly, through sources of varying complexity, across several stages of education...

In the 1st-grade natural sciences textbook, the topic "States of Water" is introduced. Through this topic, students learn that water is a remarkable natural substance that turns into snow and ice in the cold. In the 2nd grade, students are taught elementary concepts about how snow or ice melts back into water, how water turns into steam when heated, and how water can exist in three states in nature: liquid, solid (ice), and gas (steam). In the 3rd grade, information about the water cycle in nature, as well as underground and surface waters, is presented. This demonstrates how a topic, considering the age characteristics of the students, is presented in stages, each with increasing complexity.

In the 3rd-grade natural sciences textbook, the chapter "Climate and Weather" includes topics like "Weather, Types of Precipitation," "The Water Cycle in Nature," "Cold Places on Our Planet," and "Hot Places on Our Planet." What is weather? Weather is the state of the atmosphere at a particular place and time. It depends on many factors, such as the season, the location where the weather is being observed, wind direction, air temperature and humidity, air pressure, and the weather in neighboring areas. "What's the weather like today?" refers to the air temperature, wind, and types of precipitation on that day. Precipitation is water falling from the atmosphere to the ground in various forms, including rain, snow, hail, dew, and frost. In winter, the sun's rays heat the earth less, causing the air

and ground to cool. The sky is often cloudy. If it rains from the clouds in the warm season, in winter, the raindrops freeze in the cold air and turn into snowflakes. Weather phenomena include clouds, changes in temperature, wind, thunderstorms, and fog.

Wind is the movement of air. It can be strong or weak. A very strong wind is called a storm.

What is humidity? There is always vapor in the air, resulting from the evaporation of water from rivers and water bodies. A part of the vapor is also released by plants. Therefore, places with many plants have humid air. A small portion of water becomes vapor after evaporating from the soil and also as a result of human activity.

Humidity is the amount of vapor in the air, represented by numbers from 0 to 100. The higher these numbers, the more water vapor is in the air. On sunny, clear days, humidity is low because the heated water vapor rises. Conversely, when the sky is cloudy, humidity is high [8].

The water cycle in nature involves the sun heating water in rivers, lakes, seas, and oceans. A part of the heated water evaporates and turns into water vapor. This vapor rises into the sky. At high altitudes, the air cools, and the water vapor condenses back into water droplets, which fall back to the ground.

How is the amount of precipitation measured? A special device called a rain gauge has been invented to determine the amount of precipitation. This device consists of a simple bucket divided into compartments inside a special cup. Around the bucket are funnel-shaped metal plates that protect the collected water from being blown away by the wind. To measure the amount of precipitation, the bucket is mounted on a pole two meters high. During rainfall, the drops fall into this bucket, and the water collected over two hours is poured into a special cup. The amount of water is measured in millimeters. Up to 15 millimeters of precipitation is considered light rain, up to 50 millimeters is heavy rain, and more than 50 millimeters of precipitation indicates very heavy rain or a downpour. For snow, a 10-millimeter indicator signifies heavy snowfall.

Today, humans have learned ways to artificially induce rain or disperse clouds. If cloudy weather threatens a planned event in a city, special airplanes are deployed towards the clouds. These planes disperse special substances into the clouds, such as dry ice, liquid nitrogen, or silver iodide. As a result, the water vapor and droplets in the clouds cling to these particles. The particles become heavier and gradually fall, dispersing the clouds and preventing rain.

Through the topic "How is Temperature Measured?" in the 3rd-grade natural sciences textbook, students learn about special instruments for measuring temperature - thermometers. A thermometer is a device that measures temperature. The word thermometer is composed of two parts: "thermo" meaning heat and "meter" meaning to measure. The simplest thermometer is a glass tube with liquid inside. The tube has indicators on or next to it, and the temperature is determined by the level the liquid reaches. Additionally, there are now special electronic thermometers with sensors that measure the object's temperature and display it on a special screen.

Temperatures are measured in degrees, represented by the special symbol "C." Thus, through various topics, students become acquainted with subjects related to physics, which in turn serves as a foundation for physics classes in higher grades.

We can conclude that in the newly introduced natural sciences textbook, students often work in groups, striving to understand rather than merely memorize concepts related to the topic. Their activities are based on various sources, and students see themselves as young researchers with their perspectives on the surrounding world. They become direct participants in the interactive learning environment created by teachers, laying the foundation for the process of assimilating natural-

scientific knowledge. Based on the initial natural-scientific material, it is possible to organize students' independent work on some topics. Therefore, some of the most important materials should be duplicated.

The main criteria for collecting, selecting, and systematizing natural-scientific material elements for use in primary grades include its consistency, systematic nature, and the ability to clearly distinguish between primary and auxiliary materials that are logically consistent with the topic being studied and capable of forming a comprehensive understanding of the world in the minds of primary school students.

The ability to correctly collect, select, and systematize natural-scientific material for use in primary grades gives the primary school teacher the ability to properly approach other pedagogical problems of using natural-scientific material in the teaching process of primary school subjects.

CONCLUSION

The process of integrating natural-scientific knowledge into the primary education curriculum emphasizes the importance of selecting appropriate materials for both classroom and extracurricular activities. This task, inherent to the pedagogical science, demands careful consideration to ensure that the content not only aligns with the educational objectives but also caters to the cognitive and developmental levels of primary school students. The transition to utilizing natural-scientific materials necessitates a methodological approach where materials are meticulously chosen and organized to facilitate an engaging and informative learning experience. This approach fosters a learning environment where students are encouraged to explore, inquire, and develop a deeper understanding of natural sciences through interactive and participatory methods.

The collaborative efforts between natural sciences teachers and primary school educators are crucial in crafting a coherent educational strategy that bridges foundational knowledge with exploratory learning. Through group activities, discussions, and hands-on experiences, students embark on a journey of discovery, viewing themselves as young researchers who actively contribute to the learning process. This pedagogical model not only enhances the students' grasp of scientific concepts but also stimulates their curiosity and fosters a lifelong appreciation for the natural world.

In conclusion, the careful selection and systematization of natural-scientific materials play a pivotal role in the successful integration of scientific knowledge into the primary education framework. By nurturing an inquisitive mindset and providing students with the tools to explore the complexities of the natural world, educators lay the groundwork for a comprehensive understanding of science that students will build upon throughout their academic and personal lives. The ultimate goal is to equip young learners with the knowledge, skills, and enthusiasm to pursue scientific inquiry, underscoring the significance of a well-structured and methodologically sound approach to science education in the primary grades.

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