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METHODOLOGY OF TEACHING CHEMISTRY IN SCHOOLS BASED ON THE "5E" AND "4K" LEARNING MODELS

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Abstract
This article analyzes the main approaches to organizing the current educational process. Specifically, it discusses the education policies of countries leading in modern education - such as Hong Kong, South Korea, Singapore, Japan, and Vietnam - which are rapidly rising in educational rankings. The paper examines documents that define educational standards and explores the most common competencies, values, attitudes, and other educational outcomes that should be developed in students. The role and distinctive features of the "5E" and "4K" learning models are highlighted, with attention given to the issues surrounding their application.

Keywords: 5E learning model, 4C, collaboration, communication, creative thinking, critical thinking, analysis, evaluation, explanation, justification of one's viewpoint, hypothesis formation, regulation, dialogue, cooperation, creativity.

Introduction

When discussing the world's best education systems, Singapore, South Korea, Japan, Shanghai, and Finland immediately come to mind. For over a decade, these countries have been leading international rankings that assess schoolchildren's skills in reading, mathematics, and science. The successes of Asian schools have sparked great interest in the West and Uzbekistan.

Effective teaching of natural sciences plays a crucial role in the modern education system. Advanced pedagogical technologies, including the 5E approach, are widely used to consolidate students' knowledge, develop critical thinking, and enhance practical skills. This approach ensures students' active participation in learning natural sciences and helps them connect their knowledge with real-life experiences.

In the Singaporean education system, the 5E model is widely applied in teaching natural sciences. This approach helps develop students' independent thinking, cultivate scientific research skills, and connect theoretical knowledge with practical application. A brief description of the 5E model:

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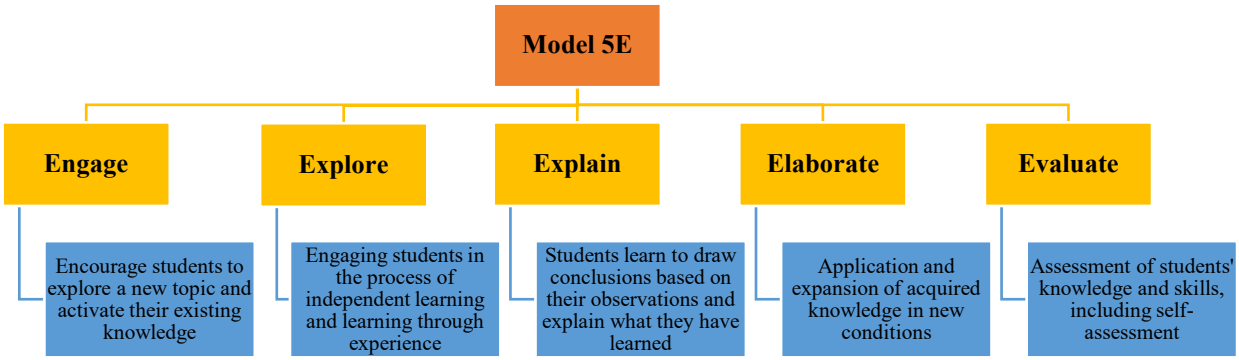

Table 1. Classification of stages of the 5E model.

Advantages of the 5E approach in teaching natural sciences:
1. Ensures active participation of students during the lesson process.
2. Develops independent thinking and problem-solving skills.
3. Creates opportunities to link theoretical knowledge with practical experiences.
4. Increases students' interest in the subjects.
5. Reinforces students' knowledge through the assessment process.

Organizing chemistry lessons based on the 5E approach: The 5E model for teaching the topic "Nitrogen" in the 8th grade:

Engage: Involve students in the topic in such a way that they cannot help but listen to you. For this, place the following products on the table; Refer to Figure 1.

Figure 1. Image of nitrogen-related products

Explore: Bags of chips are filled with nitrogen Many people believe that chip bags are inflated with air, but this is incorrect. Air contains oxygen, which is harmful to delicate and fragile products like chips. Under the influence of air, chips quickly lose their flavor and become rancid. Therefore, the bags are filled with nitrogen, not air. The nitrogen preserves the taste of the chips and also serves as a cushion for transporting the packages.

Explanation: When we breathe, we inhale nitrogen from the air. However, unlike oxygen, nitrogen is not absorbed by our lungs at all, and we exhale it back out. Nevertheless, the presence of nitrogen in the atmosphere helps prevent us from inhaling too much oxygen. Excess oxygen is just as dangerous as its deficiency. As for other living organisms, they also obtain nitrogen in the form of compounds with other elements: plants from the soil, and animals from plants or other animals. Nitrogen interacts with other elements with great difficulty. For example, in nature, it only reacts with oxygen during thunderstorms, when lightning strikes produce very high temperatures.

Elaborate: Ammonia is used to produce many chemicals. It is used to clean oily spots on fertilizers, paints, perfumes, silver, and fabrics. Ammonia can relieve intoxication when mixed with a few drops of water. It is recommended to apply light ammonia to the skin against the bites of insects such as scorpions, bees, and spiders. In addition to this, it can be applied to the area damaged by insect bites.

What role does ammonia play in hair dyes? Ammonia reacts with melanin in hair and contributes to the strength of the color, promotes better absorption of hair dye, and stays in hair longer.
Ammonia is an alkaline (basic) substance that opens the outer layer of hair (cuticle). This allows coloring substances (pigments) in the dye to penetrate into the hair - the cortex. When ammonia works together with an oxidizing agent (usually hydrogen peroxide), it destroys the natural pigment in hair - melanin. This process helps to lighten hair or adopt a new color.

Why do plants need nitrogen fertilizers? Nitrogen is a component of chlorophyll and plays a key role in the process of photosynthesis. As a result: The leaves are green and healthy, the plant grows quickly. Nitrogen is a component of essential compounds such as proteins, enzymes, amino acids, and DNA. It increases seed and fruit yields (indirectly). It improves both the quantity and quality of the harvest. It is especially necessary for wheat, corn, potatoes, and other high-yielding crops.

When we touch $NaNO_3$ -sodium nitrate fertilizer with our wet hands, it freezes severely - how does this process occur?This process is called an "endothermic reaction" - meaning heat is drawn from the surroundings for dissolution.If your hand is wet or the air is humid, the fertilizer begins to dissolve with this moisture.Then it absorbs the heat from your hand and creates coldness on the surface.As a result, your hand cools down, even feels frozen and hard. If you touch the ice in the refrigerator, you will feel cold. In this process, the ice takes the heat from your hands and melts. The same applies to nitrogen fertilizers - they absorb heat during the dissolution process. Stored at very low temperatures (for example, liquid ammonia -33°C). When touching the skin, it's not just ice, but cold can cause chemical burns. In this case, the skin appears pale, hardened, or "frozen" - this is called "cold burning."

Let's test this experimentally: Demonstrate how fertilizer reacts with moisture to cool hands.
Moisten your hands a little (with a pipette or sprayer).
Sprinkle a pinch of urea on your damp hands.
Wait (10-15 seconds) - you:
• You feel cold.
• A feeling of hardening or cold "freezing" is felt on the skin.
Compare to the other hand in gloves - there will be no cold.If there is a thermometer, you can place it on the urea and show how the temperature drops.
• urea dissolves in water (i.e., moisture in a wet hand).
• The melting process is endothermic - that is, it absorbs heat from the surroundings.
• This heat comes from the temperature in your hand, so your hand gets cold.
• It feels like ice, but it's chemically cold.

Evaluate: Written or oral questions for students:
• What did you learn most in today's lesson?
• Explain where you have seen the importance of nitrogen in your life.
• What do you think should be paid attention to when working with nitrogen fertilizers?
Evaluation through practical tasks: the role of nitrogen in the safe storage of food products, the effect of nitrogen fertilizers on plants, the effect of ammonia in hair dyes.
In conclusion, the 5E approach is one of the effective methods of teaching natural sciences and serves to increase students' interest in the subject, develop independent thinking and practical skills. The widespread use of this approach in the modern educational process further improves the quality of teaching natural sciences. Teachers will have the opportunity to use the 5E model in the lesson to increase students' interest and develop their scientific knowledge and practical skills. This, in turn, serves to increase the effectiveness of teaching natural sciences, in particular chemistry. Thus, the 5E model serves to organize the educational process of students interactively and effectively. The successful application of this model in the Singaporean education system serves as an example for other countries and plays an important role in improving the quality of education.

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