

# Application of 7E Teaching Methods in Classroom Teaching under the Background of the New College



## Entrance Examination Reform—Taking High School Biology "Active Transportation" Teaching as an Example

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**Abstract:** The reform of the new college entrance examination has put forward brand-new requirements for the teaching of current disciplines. The new college entrance examination not only requires students to be able to master knowledge, but also requires students to learn to learn in the process of learning, to master the method of learning, and to improve the core qualities of disciplines. This paper explores the 7E teaching model, taking the teaching of "active transport" in high school biology as an example, and practices teaching based on the 7E teaching model, through stimulation (creating a situation to stimulate students' desire for knowledge), participation (guiding students to participate in the learning of new knowledge), exploration (carrying out exploration activities to create new models), explanation (summarizing knowledge to deepen the concept), refinement (understanding examples, agreeing with the meaning), evaluation (sorting out and summarizing the return to the core concepts), and extension (connecting the theory with the reality to promote the extension of the concept), to help students stimulate the learning process. Concept extension, to help students stimulate the desire to learn, actively participate in the new knowledge, explore new activities, explain new concepts, speech simple hack, clear organization, learning, thinking and using coherent, knowledge, action, and belief in unity. This deepens students' understanding of knowledge and concepts, guides students to discover, explore, and solve problems in real situations, and students pay more attention to the process of knowledge formation, the knowledge structure of the series, and the generalization of the knowledge system. It fully improves the classroom effect and learning efficiency, promotes the overall development of students as a whole, and enhances the core literacy of students in the discipline of biology, to realize the purpose of the new college entrance examination reform.

**Keywords:** 7E teaching mode; new college entrance examination reform; high school biology; active transportation

### 1. New College Entrance Examination Reform

In recent years, China's new college entrance examination reform is constantly advancing, and the new curriculum reform has been promoted in some areas, some areas have adopted the "3+2+1" model, which sets the college entrance examination subjects as mandatory and optional so that students can

combine their willingness to develop as well as their strengths to flexibly choose their subjects and ensure that their strengths can be maximized (Chen, 2020). Under the background of the new college entrance examination reform, the teaching strategy of high school biology has also been transformed in different directions. From the knowledge content of high school biology, it is closer to reality, making the teaching content vivid, which can be easily

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understood by students and easier for teachers to give lectures; from the perspective of cultivating students, combined with the actual situation of students, the purpose of teaching is more challenging, so that they can memorize, understand, and improve their ability to think at an advanced level (Li, 2023); and from the evaluation of teaching, it pays more attention to the process evaluation. Under the new college entrance examination reform, the purpose of education is not only to improve students' scores but also for students to be able to learn on their own and obtain comprehensive development.

## 2. 7E Teaching Model

In foreign research on the status of the 7E teaching model, Arthur Eienkraft believes that a good teaching model should keep pace with the times, he will be highly successful 5E teaching model to expand, by Elicit (stimulate), Engage (participate), Explore (explore), Explain (explain), Elaborate (migrate), Evaluate (Evaluation), Extend (Extend) composed of 7E teaching mode came into being, and its change is to ensure that the teacher in the teaching process did not miss, they complement each other, interlocking, in teaching each of their respective roles, but also with the flexibility of the specific situation (Arthur, 2003). 7E teaching mode compared to the traditional teaching mode, showed obvious advantages. Darihastining et al. considered the 7E teaching model as one of the student-centered teaching methods that emphasize the effectiveness of communication and language interruption. Through the study, it was found that communicating with students can understand their existing knowledge structure and thus reduce their misunderstanding, in addition to that, it was also found that students were more innovative in expressing language content during the teachers' use of the 7E teaching mode (Darihastining et al., 2021). Chen Jinling, a domestic scholar, conducted a practical study on the application of the 7E teaching mode in junior high school biology, and proposed to break the traditional teaching mode of "teachers teach and students learn", and build a student-oriented, two-way interaction between teachers and students with the help of "7E" teaching method, Students cooperate and explore the innovative teaching mode (Chen, 2020). Huang Jiao for 7E can transform students' pre-science concepts,

the results show that teachers can according to the students' conceptual level, with the help of 7E teaching mode will be students accumulate pre-science concepts into scientific concepts, and 7E teaching mode can fully mobilize the students' curiosity, to increase the interest in students' learning, and focus on the development of students' exploratory ability (Huang, 2019).

## 3. Analysis of Teaching Materials

This lesson is selected from the 2019 Humanistic Edition of Biology - Compulsory I - Molecules and Cells, Chapter 4, Section 2, which mainly describes the transmembrane mode of transport in which the cell actively selects substances to and from the membrane - active transport, covering the conceptual characteristics, examples and significance of active transport. Passive and active transport are both transmembrane transport of small molecules, before this, students have mastered the structure and function of the cell membrane, to understand the principles and conditions of osmosis, passive transport, which are for students to learn and understand the mastery of active transport to lay a solid foundation, and at the same time, the active transport of energy and "ATP". At the same time, active transport is related to energy "ATP", and the fifth chapter of the study of "cellular energy" lays a conceptual foundation, which can be called a conceptual bridge. Concepts need to be built with facts, so the textbook and life examples can be fully utilized, so that from the facts to the facts. At the end of the study, students should be able to master the defining characteristics and meaning of active transport, as well as compare and contrast passive and active transport in their memory.

## 4. Teaching Objectives

Based on the content requirements, academic requirements, and academic quality standards of the curriculum standards, and centering on the requirements of cultivating students' core literacy, the following teaching objectives are formulated:

- (1) Through data analysis and inquiry activities, master the characteristics of active transport, state the concept of active transport, and form the view of structure and function.
- (2) Based on the types and characteristics of

transmembrane transport of different substances, state the similarities and differences between passive and active transport, and explain the physiological significance of active transport to cells, to understand and agree that active transport is the guarantee for maintaining the normal operation of life.

(3) Develop the ability to analyze, generalize, and summarize information through reading different backgrounds and scenarios.

## 5. Teaching Process Using the 7E Teaching Model

### (1) Stimulation (creating a situation to stimulate students' desire to learn)

Before the beginning of classroom teaching, the teacher first leads the students to recall and summarize the passive transport studied in the previous lesson: there are two types of passive transport: free diffusion and assisted diffusion. Whether it is free diffusion or assisted diffusion, substances are transported from high concentration to low concentration. At this time, the teacher put forward the question: "Is it true that substances can only be transported from high concentration to low concentration? Is there a material transport mode from low concentration to high concentration?"

**Design intention:** review the knowledge learned on the one hand, so that teachers can understand the basis of student learning, on the other hand, can be introduced into the teaching. Present students with a new problem situation, cause cognitive conflict, stimulate students' desire to explore, and then follow to the introduction of the new class.

### (2) Participation (guide students to participate in the learning of new knowledge)

Students are asked to read the textbook "Problem Inquiry" and think about the following questions according to the information given in the question stem.

- ① "Is iodine uptake by thyroid follicular epithelial cells by passive transport?"
- ② "Associated with a boat traveling against the current, does iodine uptake by thyroid follicular epithelial cells require energy from the cell?"
- ③ "Is it common for cells to transport substances against a concentration gradient?"

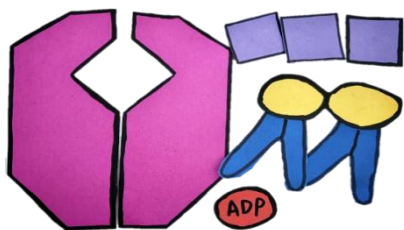
Students work in small groups to discuss, students in the teacher's guidance prompts to conclude: thyroid follicular epithelial cells against the concentration gradient to absorb iodine ions in a way that requires the cell to provide energy for it, at the same time, this kind of transport of substances against the concentration gradient is universal. The transport of substances down the concentration gradient is called passive transport, so what does this mode of transport of substances against the concentration gradient name it? This is the active transport we are studying in this lesson.

**Design intention:** this relief in guiding students to make assumptions based on the teacher according to the situation to set up a doubt, theory, and practice, to guide students to participate in the new knowledge, for the exploration activities and concept building ready. At the same time, it leads to the theme of this lesson: active transportation. This teaching method can improve students' ability to summarize and make assumptions in teaching activities.

### (3) Inquiry (conduct inquiry activities to create new models)

The teacher provides each group with a copy of the materials needed for the transport of substances (as shown in **Figure 1**), and asks the students to work in groups to try to construct a schematic diagram of the process of active transport by ions or molecules, and to think about the question, "What conditions are needed for these substances to realize the transmembrane transport from a low concentration to a high concentration?" Each group recommends a representative to present and report the results of the discussion on the stage. After the presentation, the teacher shows a video of the transport process of the sodium-potassium pump through PPT, and students summarize the process of active transport according to the video. Some students may make mistakes in the process of summarizing, the teacher needs to guide, supplement, correct, and encourage students to think to come up with the correct concepts in the process of students' presentation and summarization. Finally, the teacher summarizes: "Active transport is a mode of transport in which substances are transported from the side of low concentration to the side of high concentration with the assistance of carrier proteins and the consumption of energy released by intracellular chemical reactions".

**Figure 1. Materials needed for substance transportation**



**Design intention:** This link is the core link of the "7E" teaching mode so that students can infer the process of active transport through watching the video and group discussion. Students can build up their knowledge of the new content through communication, summarization, and reporting. This teaching method can make students turn passive into active in teaching activities, deepen their understanding of active transport, and cultivate the ability of cooperative inquiry.

#### **(4) Explanation (summarize knowledge and deepen concepts)**

After the teacher summarizes, then the teacher asks the students, "Can you summarize the characteristics of active transport according to the process and definition of active transport?" Students discuss and show the results of their discussion, and the teacher finally summarizes, "The characteristics of active transport can be summarized into three points. First, transport against the concentration gradient; second, it requires a carrier; and third, it requires energy consumption." After the summary of the characteristics of active transport is completed, the teacher presents a picture of a little man riding a bicycle uphill on the PPT, asking students to analogize active transport and say what the bicycle and the little man represent respectively, deepening students' understanding of active transport. Teachers and students summarize: "The process of the little man riding a bicycle from the bottom of the slope to the top of the slope is similar to the process of active transport in transporting substances from a low concentration to a high concentration, the bicycle represents the carrier, the little man represents the transported substance, and the process of its cycling uphill requires the consumption of energy, which is equivalent to the process of active transport that requires the consumption of energy."

**Design intent:** by analogizing the scene of cycling uphill, it can deepen students' understanding of the active transport process, and the process of thinking about the problem and analogy can help build students' knowledge framework, but also cultivate students' analogical thinking, and effectively break through the teaching key points.

#### **(5) Exquisite (understand the examples and recognize the meaning)**

Teachers show the significance of active transportation through PPT, and let students think: "The thyroid follicular epithelial cells that have been learned to absorb iodine ions in the blood embody the selection of absorbing the needed substances through active transportation, so how is active transportation to discharge metabolic wastes and substances that are harmful to the cells embodied?" After giving students some time to think, the teacher shows information and pictures through PPT: "Seagulls living on the seashore, after eating food inside the sea, the concentration of salt in the body rises, and they discharge the excess salt to maintain the normal life activities of cells in the body through the active transportation of salt gland cells. Many plants that live by the sea or in saline soils have also developed this ability, such as the tungwar tree." Through understanding the important role of salt glands in plants and animals such as seagulls and tungwar trees, active transportation, a way of transferring substances, is an important cytological basis for organisms to adapt to a wide variety of environments and survive, so active transportation has a very important significance for our organisms.

**Design intention:** Teachers introduce life cases to explain the knowledge, on the one hand, to deepen students' understanding of active transport, on the other hand, it also allows students to understand that active transport is important for the normal life activities of plants, animals, and microorganisms, and ultimately understand and agree that active transport is a guarantee of normal life, and to achieve the teaching objectives.

#### **(6) Evaluation (summarize and return to the core concepts)**

The teacher presents a set of tables comparing active transport and passive transport (**Table 1**) and lets students complete the tables according to their existing knowledge. After completing the table, the

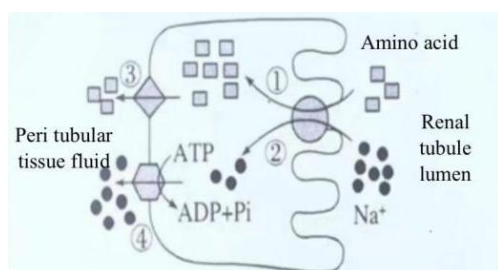
teacher evaluates the student's completion. And through the exercises training to understand the students' application of knowledge.

**Table 1. Comparison of transmembrane transport modes of small molecule substances**

The way things move in and out of cells	Passive transport		Active transport
	Simple diffusion	Facilitated diffusion	
Transport direction	Along the concentration gradient	Along the concentration gradient	Inverse concentration gradient
Transport proteins	Without	Need	Need
Energy	Without	Without	Need
Examples	O <sub>2</sub> , CO <sub>2</sub> , glycerin, Ethyl Alcohol, benzene	Glucose entry into erythrocyte, K <sup>+</sup> exits the cell, Na <sup>+</sup> enters the cell	Glucose and amino acids enter the epithelial cells of small intestine, K <sup>+</sup> enters the cell, Na <sup>+</sup> exits the cell

**Small Test:** Figure 2 for the amino acids and Na<sup>+</sup> in and out of the epithelial cells of the renal tubule schematic, the following options are correct (D)

- A. ① process is assisted diffusion B. ② process needs to consume ATP  
C. ③ process for active transportation D. Na<sup>+</sup> in and out of renal tubular epithelial cells need carrier protein



**Figure 2. Amino acids and Na<sup>+</sup> enter and exit renal tubular epithelial cells**

**Design intention:** to detect the learning of students' knowledge in this class, the teacher based on the completion of the form evaluates the students, appreciates their good performance, and at the same time puts forward suggestions for improving their poor performance, under the role of diagnostic evaluation, students check the omissions and make up for the shortcomings, deepen the understanding of the classroom content learned, and improve the classroom cognition (Luo, 2023).

#### (7) Extension (linking theory to practice, promoting conceptual extension)

After students have constructed the correct concept of knowledge, teachers set new questions for

students in the students' recent development area to deepen students' understanding of the concept: "From the perspective of the conditions of active transport, what are the organelles that have a direct relationship with active transport?" "Plants need to absorb large amounts of inorganic salts from the soil to grow. Please explain why it is necessary to loosen the soil for crops in agricultural production?"

Students discuss and exchange in small groups, and are asked to use what they have learned to explain the active transportation content, and the teacher adds and improves after the students' answers are finished.

**Design intention:** to deepen the understanding of the concept based on the content learned in this lesson and the life of the actual connection, to cultivate the ability of students to use the knowledge of biology to solve practical problems, so that students know the validity of the new concepts, to stimulate the interest of students in learning biology, and to cultivate students' awareness of the social responsibility to be able to learn and think together, and to know and act in unity (Sang, 2022).

#### Summarize

Under the background of the new college entrance examination, the classroom teaching of high school biology should make corresponding innovations according to the actual situation and relevant requirements to fully improve the classroom effect and efficiency (Shi, 2023). This lesson is designed with the help of the 7E teaching mode,



which can cause conflict between new and old knowledge of students, expose wrong concepts, and let students learn with problems, which can stimulate students' interest in learning and make classroom teaching more efficient (Zheng, 2020). 7E teaching mode has changed the drawbacks of the previous "duck teaching", and allows students to carry out inquiry-based learning, changing the teacher's identity from the dissemination of knowledge into a servant or helper, and the students become the masters of the classroom. Finally, it can also link the content of this section with the student's existing knowledge to build a knowledge network and achieve the teaching objectives. This teaching mode allows students to fully participate in teaching and focuses on the process of knowledge formation, which not only allows students to learn new knowledge, but also allows students to master new learning methods, promotes the overall development of students, and improves students' core literacy in the discipline of biology.

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#### Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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