DEVELOPMENT OF THE SKILLS OF WORKING WITH DIFFICULT COMPLEX QUESTIONS IN PREPARING STUDENTS FOR THE SCIENCE OLYMPIADS FROM BIOLOGY

Bozormurod Abduvakhitov
Independent Researcher of Jizzakh State Pedagogical University
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Abstract. *It is known that science olympiads are the highest level of knowledge competition for students, and at the same time, a lot of practical work is being done to develop science olympiads. Gifted students clearly differ from their peers in terms of acquisition and logical thinking. In this sense, it is necessary to work with questions of different levels of complexity in order to further improve the knowledge of students. This article is devoted to the issues of developing critical thinking ability and problem-solving skills in preparing students for biology science Olympiads, along with scientific recommendations.*

Keywords: *Science Olympiad, talent, critical thinking, problem questions, creativity, IBO (International Olympiad of Science), multiple-choice tests, single-choice tests, implicit assumption, correlation, prediction, comparison.*

In the implementation of priority tasks defined in the "Strategy of Actions" for the further development of the Republic of Uzbekistan, "in-depth study of other important and high-demand subjects such as mathematics, chemistry, biology and informatics" is defined as an urgent task [1]. It is known that students have a high interest in one or another subject. Evaluating their interests correctly, taking into account the physiological and hygienic characteristics of students, and educating them step by step will be highly effective. Science olympiads are the most complex and difficult part of the system of working with gifted students. In order to further develop the talent of students, it is necessary to form critical thinking skills in them[2]. The main reasons for this are:

- Tasks in science olympiads are mainly based on testing students' thinking ability, not memorizing ability.
- The stronger the ability of critical thinking is developed in students, the higher the ability to summarize and conclude information based on the knowledge they have acquired.
- Reduces the time spent on understanding the question and solving the problem.

The system of working with gifted students in the educational system is characterized by its own complexity. Talented students have the ability to quickly assimilate large amounts of information, a creative approach to problem analysis, and the ability to integrate the acquired knowledge at a high level. Taking into account that gifted students are distinguished from their peers by many abilities and they are few in number, it is an urgent issue to apply a system of working with them and effective ways to the pedagogical process.

It is known that how to remember information from the biology Olympiad is one of the biggest problems of teachers and students. This may be due to the size of the topics. Biology Olympiad is designed to test the ability of students to apply knowledge in different unfamiliar situations, to understand the data, to interpret the results of scientific experiments and to draw rational conclusions from the given data, not the level of how much information the students have

mastered. In fact, most of the exam questions in IBO (International Biology Olympiad - translated from English as International Biology Olympiad. But since the term IBO is accepted as system units, it is preferred to use this abbreviation in the article) mainly focus on thinking, problem solving and understanding directed. Therefore, prior knowledge is not required and IBO exams encourage participants to learn new knowledge during the competition. Pupils are given the opportunity to participate in the IBO only once, sometimes twice (if accepted into the national team).

Everyone knows that it is impossible to become a ballet dancer by studying theoretical information about dancing, reading books. Students need to be able to think critically and solve problems on their own, rather than trying to find a list of strategies that are ultimately available by studying scientific information about critical thinking. In the process of preparing for the Olympiad, if students are engaged in a special test with a medium level of complexity in the field of science and a set of complex questions, their critical thinking ability will gradually develop [4].

In the Olympiad, students are tested on their ability to understand and apply biological concepts. Thus, it is necessary to practice and learn to draw and analyze graphs, diagrams, pictures and tables. Here are the most important aspects for developing critical thinking:

Read and understand the question. It is necessary to collect all the information in the question and think openly. Highlight, circle, or underline important parts of the question. The worst thing to do when solving problems is to read the question passively and miss the key details. Thus, it is necessary for the student to develop the skills of working with a felt-tip pen or pencil.

It is important to understand all terms and words. For this, the student must have a solid foundation of biology knowledge. If the student does not understand the general and more specific terms and phrases, it will be difficult for the student to choose the correct answer. In fact, wrong conclusions in solving problems usually arise from insufficient knowledge of biology. Therefore, it is necessary to review biology textbooks and strengthen knowledge on all subjects. As a good example, question 12 of the IBO 2012 Theory Test Part 2 tests knowledge of the acid growth hypothesis in plants.

It is necessary to analyze the collected data and create a question. It is necessary to analyze the set of facts, to find out whether it is necessary to include or exclude data, to check the methods by which the facts were obtained. Depending on the question, one has to check whether the facts are the result of a well-controlled experiment or just random observations. It is also necessary to verify that the experiments are performed correctly and that the experimental method can lead to valid results. In biology, different environmental conditions (e.g., temperature, salinity, sunlight), habitat, or species sample can alter experimental results.

Graphs and tables should be analyzed. In fact, tables and graphs can give readers a lot of information, so it's important to pay attention to different trends (increase/decrease/unchanged numbers). For example, a bell-shaped curve usually indicates a random sample and a normal distribution. The sigmoidal curve determines the change of the environment, and the logistic curve determines the degree of dissociation of oxygen. A hyperbolic curve indicates that the ferbs are saturated or that some environmental limiting factor is required to maintain the constancy limit. As occurs in the log phase of bacterial growth, concave curves with continuously increasing functions are used. Sine wave-like curves are usually associated with negative feedback mechanisms. The reader needs to guess why such lines appear and what they might mean in the question paper. It is not appropriate to use personal feelings when analyzing graphs and tables with

specific data. It is necessary to draw conclusions only from the given information. To find out where to apply this recommendation, you can analyze question 12 in part A of the IBO 2014 theory test[5].

It is necessary to connect the given facts by drawing models, diagrams and lines. The fact is that the participant of the Olympiad must understand what the data actually shows. In the Olympiad, the questions are very complex (especially biochemistry and molecular biology), so it's enough to take a few minutes to make a model from the given data or write down a way to work. This makes it possible to piece together the scientific puzzle. This recommendation can be reinforced by applying question 13 in Part B of the IBO 2008 theory test[6].

Conclusions should be evaluated. Analyzing the conclusions, the reader should ask himself whether the given data supports them or not. For each idea, you need to find data to support them. It is necessary to think about the conclusions based on the same facts.

It is necessary to be careful of hidden assumptions and misconceptions. Some common notions or misconceptions should not be allowed to confuse the mind. The simplest or most obvious option should be critically evaluated, as it serves as a trap for those who like to guess. A common misconception in biology is that if two species are morphologically similar, they are evolutionarily related. However, this is not the case, as species from different ancestors can become similar due to convergent evolution. The main concept that the reader should know in such questions is the concept of biological species, if two organisms exist, they can be classified as the same species as long as they produce viable and reproductive offspring, despite any morphological similarities. .

It is necessary to think about causes and consequences. It's easy to do, but the most obvious answer is usually not the right one. When submitting an Olympiad paper, one should stop being simplistic and consider all possible factors and their contribution to the conclusion. One should avoid looking at the questions from two perspectives like good or bad. Biology is a vast and very diverse field, so you should always look for a third or fourth opinion or opportunity.

Beware of misleading information! The structure of the questions asked in the Olympiad, using excessively luxurious, voluminous and misleading information, in many cases confuses the student. That is, during the reading of the sentence from the beginning to the end, very long sentences, numbers or formulas also cause loss of time in some cases. (some scientific information and evidence can also be asked as a misleading question in an illogical situation).

When analyzing some data in the tasks, it is necessary to pay attention to distinguishing the correlation relationship. It is known that Correlation represents the interrelationship of signs in a whole organism. But in many cases there is a private separation at the root of this unity. The reader can easily be distracted by some obvious correlations, but it is worth remembering how changes can occur in biology as a result of the influence of several factors. At one time, the idea that HRT could reduce the risk of coronary heart disease (CHD) was praised. However, subsequent randomized trials have not found an association between cardiovascular disease and HRT. So why did people think differently before? It found that HRT was generally prescribed to women of higher socioeconomic status, who had better diet and exercise, which helped reduce their risk of cardiovascular disease.

Learning to critically analyze some of the information given during assignments. In order to critically analyze the student, first of all, it is necessary to master critical thinking. Critical thinking is a special type of thinking that creates conclusions by analyzing facts. The concept is

complex and has various definitions, including rationality, skepticism, objective analysis, and fact-checking. Critical thinking is a form of thinking that is self-directed, self-disciplined, self-monitored, and self-correcting. Its prerequisite is to agree to strict standards of consciousness improvement and to apply them with vigilance. It requires the acquisition of effective communication and problem-solving skills through critical thinking and critical analysis[3].

The reader can often rule out certain statements or narrow down the answer options using the information in the given question. Be careful with the following statements in options:

- It is required not to be distracted by additional information that contradicts the basic concept or the information in the graphs and tables, is not proportionate, that is, beyond the question, does not show reality.

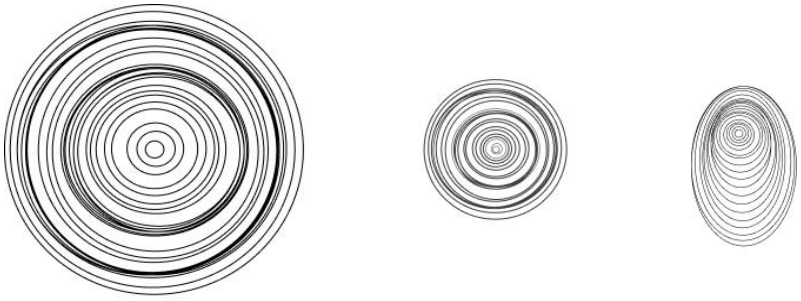
- Simple, i.e., illogical concepts whose answers seem too obvious or too simple, contradict vague or general biological truths.

In the Olympiad, in some cases, options for problematic questions with a high level of complexity for the student are given. The student should think, analyze and guess when solving the information presented in the question using his knowledge and skills. In the next step, they are asked to sort out the wrong answers and think about the options that are supposed to be correct. Only then, there may be opportunities to find solutions to new, not yet encountered, problematic questions. To implement all these recommendations, it is necessary to take previously used Olympiad questions and analyze each question step by step. The next skill, Problem Solving Skills, is closely related to the recommendations on critical thinking. In fact, these two skills are inseparable and complement each other in the biology science Olympiad, and at the same time, they serve to effectively solve the problems given to the student to develop critical thinking.

Often, it is not difficult to notice that it is difficult for students to answer multiple-choice questions in the biology Olympiad. If we look at the Olympiad questions given in recent years in the science Olympiad in biology, it is possible to know that the questions are designed to determine the knowledge level of the students.

In this sense, there is a special base of scientific resources to prepare students for complex questions. Medical College Admission Test (MCAT), Graduate Record Examination (GRE), applied biology tests, IBO old questions, various biology olympiad old questions in English, MIT Open Course Ware exams and assessments, International Baccalaureate (IB) biology, Advanced Placement (AP) and Biology A-Level information is a good resource for developing problem-solving skills[7].

Consider the following example*: Imagine we have a cross section of three trees of the same species. All are cut to the same height. Determine which statements are true or false by observing the cross-sections of the tree trunks shown below.*



A. Trees 1 and 2 can grow in the same area, and tree 3 can grow in a different area.

B. Trees 2 and 3 were life-threatening for the first fifteen years and thus grew slowly.
C. The area where tree 3 grew has had more climate change than the area where tree 1 grew.
D. Tree 3 is larger than tree 2 because it has a larger cross-section.

Before considering the following explanations, the reader should choose his answer. Gifted students look for deep, conceptual features when faced with a difficult question and connect them to what they already know. Meanwhile, others focus on some superficial features that are unimportant. We know that annual tree rings allow us to determine the age of a tree and the conditions under which the plant grew.

Option A is correct because the figure shows that trees 1 and 2 have the same growth ring shape (they both have two darker rings indicating poor growing conditions), while tree 3 and there are no black rings, the difference is that the shape of the ring of the 3rd tree is different. (This means that tree 3 has not been in unfavorable conditions for the past 2 years.)

Option B is also correct because it can be seen that trees 2 and 3 are smaller than tree 1. This means that they lack water or nutrients, or that the trees grew in a shaded area, so they have less biomass than tree 1.

Option C requires problem-solving skills. It can be seen that the rings of tree 3 are arranged quite differently, i.e. its rings are further away from the center than the rings of tree 1. Superficially, the reader may think that this option is correct. You need to think deeper to solve the real problem. Notice that the rings of tree 1 are very dense and have two areas. A problem solver looks for the cause. Perhaps the trees are not getting enough sun or nutrients are lacking. Or maybe the climate was too dry? Now you need to look at the shape of the ring of the 3rd tree. What do you see? All rings are the same thickness and shape, indicating that Tree 3 has not experienced the same bad periods as Tree 1 and Tree 2. The strange appearance of the 3rd tree ring may be caused by some external force. An object may be leaning against a tree and so the tree may have grown in the opposite direction to counteract this stress, or the wind may only be blowing from one direction and the tufa tree may have grown faster further away from the wind than in a windy location. Thus, we can conclude that the C-variant statement is actually incorrect.

According to our intuition, the idea in option D seems logical. Tree 3 has a slightly larger cross-section. If a tree grows for a long time, its diameter will be larger than that of a young tree, right? Before making a final decision, a real problem solver always asks "Why?", "How?", "If not?", "Does this always work?" he asks himself. What if tree 2 and tree 3 are the same age? But isn't there enough nutrients or light in the area where tree 2 and tree 3 grew? How to test it? By counting the annual rings, you can see that they are the same age. This means that Tree 3 grows in areas with plenty of light, minerals, and water, while Tree 2 grows in areas with less. So option D is wrong.

Have a problem-solving strategy for a given task. In the process of studying tasks and questions, it is first necessary to solve the problem during its understanding and analysis. Problem solving consists of two components:

- knowledge of problem solving strategies;
- knowledge of biology (in our case).

The second component can be developed by reading textbooks and forming basic biological concepts. It should be noted that it is important not to memorize knowledge, but to understand and understand it. Here, it is not about how many books or information the student learns, but about having the ability to retain the acquired knowledge.

Problem solving is knowing strategies to solve problems. The hours spent solving past Olympiad questions and worksheets will help the student build a variety of test banks for Biology Science Olympiads. It develops the student's ability to solve problems. It is necessary to teach the student to find strategies that help to find the correct answers by solving previously used Olympiad problems. In this case, it is necessary to gradually prepare for the development of written descriptions of ideas on how to solve the question. This is a time-consuming strategy, but it works wonders for the student. Before analyzing the example, below are the steps that will usually help you find the correct answer.

1. *You need to analyze the question!* First of all, read the question carefully and highlight, underline or circle key words. The reader should make sure that he really understands what the question is about and what is being asked. If necessary, read it a second time. Many mistakes are caused by misunderstanding the question.

2. *It is necessary to analyze and evaluate the data*. All the graphs, tables, line diagrams, pictures given in the question should be paid attention to and studied. This visual method helps to distinguish the main points in the images. Pay attention to patterns, relationships, and trends.

3. *You have to guess the answer*. Before considering the given options, it is useful to use logic and biological knowledge to guess the answer. When reading a question, it is important to determine what biological object is being investigated. Then, on the basis of the acquired knowledge, it is necessary to remember the main facts and concepts related to this topic. If there is an answer, it will be easier to go through the options and find the right answer. In fact, thinking about the answer before considering the options fires up neurons and helps you understand the question.

4. *It is necessary to find evidence for the answer options.* For each multiple-choice option, check the evidence:

I. Application of learned concepts and facts. It is necessary to use only biological knowledge, not personal opinion or vague assumptions (for example, humans evolved from chimpanzees, which in fact is not the case, because although chimpanzees may be our closest relatives, we are directly descended from them We are not developed). These scientific facts can support or contradict the given options. You should always try to identify what object is being tested in the question, as this increases the chances of finding the right answer.

II. Look at the given information and find evidence for each option. It's not just about guessing, it's about finding the right information to rule out or accept an option. If this work is not done, the thoughts will not be true.

III. Questions should be created. For example, What? How? Why? Are there any suitable options for this? It is necessary to have a critical attitude to the information read and seen. In addition, it is necessary to try to think holistically.

5. *A decision must be made*. This is the easiest part, and at this point it's important to understand what the question is about, what each picture means, what concepts are being tested, and what each option is about. Mastering all the evidence, focusing on each option if it's a single-choice question, or separately if it's a TRUE/FALSE question it is necessary to determine separately and come to a decision in the end. Be careful if the question asks you to choose one or more answers.

Based on the application of the above recommendations, we will consider the technique of performing the task given below.

A newly discovered species of frog, Biologicus olympiadicus, is found in various habitats around the world. Two forms of this species are especially common, these are tropical and Mediterranean frogs.

What conclusions can be drawn using the data in the table?

Year	**Total number**	**Tropical**	**Mediterranean Sea**	**Hybrids**
1	1023	0.48	0.50	0.018
2	899	0.48	0.50	0.019
3	905	0.50	0.49	0.009

A. From the phylogenetic species concept, Tropical and Mediterranean frogs are the same species.

B. Based on the morphological species concept, Tropical and Mediterranean frogs are considered the same species.

C. Based on the ecological species concept, Tropical and Mediterranean frogs are different species.

D. From the concept of biological species, tropical and Mediterranean frogs belong to different species.

E. More information is needed to make a conclusion about the given two types of frogs.

Now you need to write down your thoughts. Below are some examples that you should read aloud and think about. By reading the question, you need to find the key words (these are 'common', 'different habitats', 'tropical', 'Mediterranean' and 'proportions in the table').

The reader will have difficulty in determining the correct answer due to insufficient information about the feeding, reproduction, development and competitors of frogs, as well as about the stages of evolutionary development or other characteristics specific to each species of frogs. is distracted. (we only know that they are tropical and Mediterranean frogs).

Let's look at the solution of the problem from another side. Before complaining about insufficient information in the first place, it is important to determine exactly what information is missing. Pay attention to the schedule! The figures given in it mainly show the number of frogs in the Mediterranean and the tropics over a three-year period. A small number of hybrids are also found between the first and third year. Viability or fertility of these hybrids have not been demonstrated. We're guessing the correct answer is very vague because we don't have much evidence that frogs are related.

Now we will consider the options and apply what we have learned from biology. Since the answers do not provide information about the ecological concept, we remove option C from the list of correct answers. As we do not have enough information about the phylogenetics, common ancestors and genetic similarity of frogs, we also abandon option A. The answers in option B are far from the truth, because it was not possible to determine the morphological difference between the frogs. In the answer in option D, there is little information about the viability and fertility of hybrids, it should be filled in, because the concept of a biological species means two organisms that have the opportunity to interbreed in nature, and are able to give viable and fertile offspring. Groups of organisms that do not have this characteristic are considered different species. So, this option is also far from reality. Due to the lack of relevant information among the questions, it is appropriate to accept option E as the most appropriate answer.

Visualizing, describing, and organizing thought processes is a powerful way to learn how the brain works. In addition, the only way to overcome this problem is to develop techniques for working with a lot of information. A good result can be achieved only with sufficient knowledge and skills. Also, thinking aloud helps to find solutions to problematic questions and creates a perfect strategy. That is, in order not to be distracted by hasty thoughts and analysis, knowledge in a broad sense is required (for example, in finding an answer to the above question about frogs, we considered the need to use the knowledge gained in biology about different definitions of the concept of species). Below is a list of common mistakes made by students and recommendations on how to avoid them.

Another good way to learn how to solve problems is to analyze and study the mistakes made by Olympiads during the competition. The table below shows the most common troubleshooting mistakes. Many errors may seem familiar, so it's worth paying attention to them and learning how to fix them.

Error	**Note**	***In order not to make a mistake!***
Ignoring the facts and information in the question	*Sometimes not using some or all of the information in the question*	*It is necessary to carefully read all the information in the question. Underline the key words in the table, diagram and figure.*
Reading comprehension	*Misreading questions due to time constraints and stress in the Olympics.*	*To avoid this, it is advisable to highlight the main concepts in the questions and options by circling or underlining them.*
Answer based on the concept in the question	*Getting into the habit of choosing an answer based on some misconceptions or assumptions rather than our knowledge of biology.*	*You need to find ideas that support your chosen answer using your knowledge of biology or the information in the question*
Making false assumptions about data	*Misrepresentation of graphs or data presented*	*Highlight the numbers and circle the main concepts in the table or graph using a ruler and pencils.*
Misapplication of knowledge acquired in biology	*The content of information in biology can be mistaken or not fully understood, due to not having full information about them or misinterpreting the concepts in them.*	*It is necessary to read all biology textbooks, thoroughly study the content of the concepts in them, and make sure that they are really understood correctly. It is necessary to relearn information that is not understood.*
Choosing options that have no basis	*Sometimes using gut feeling to find the right answer. Not trying to find a reason for the given options and choosing the information that seems logical.*	*Choosing answers based on gut feelings is not the right thing to do. It is necessary to find biological concepts that support the data in each option. Next to the option, you should write facts or concepts that you know. If no evidence is*

		found for an option, it is likely that the option is wrong

Based on the above-mentioned methods, it is possible to effectively form students' critical thinking skills and problem-solving skills. Of course, such characteristics cannot be developed in the minds of students in a short period of time. For this reason, it is appropriate to gradually develop differential assignments in the process of working with students, that is, in preparatory classes. In the preparation process, it is recommended to take into account the level of knowledge and thinking of students, the possibilities of admission, intellectual potential and, most importantly, the age characteristics of the student.

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