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The Use of Interactive Methods and Innovative Technologies in Entomology Lessons in the Study of Insect Morphology

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ANNOTATION

This article discusses innovative pedagogical technologies and ways of using them, mastering knowledge and mature skills, the role of various types of personality-oriented technologies based on the activation of students' activities and improving the efficiency of the educational process in the study of insect morphology of the subject of entomology in universities. The article is based on the idea that every activity should contribute to both the assimilation of new information and the formation of skills and processing of this information.

KEYWORDS: Interactive methods, innovative technology, problem-based learning, case technology, differentiated and individual technology, collaboration technologies, elements of psychological training, developing critical thinking, activity activation, colloquium, efficiency, synectic method, mini-conferences and group discussions.

Today, the teacher faces the task of training specialists who meet the requirements of the time and improving the education system. This requires our scientists and teachers to update textbooks in the field of education, taking into account the requirements of modernity, the introduction of innovative and pedagogical technologies in the educational process. Therefore, the role and importance of modern interactive methods and innovative technologies in the education process is very important.

Pedagogical technologies and their application ensure the availability of assimilation of knowledge and mature skills. It should be noted that at the moment, the role of various types of personality-oriented technologies based on the activation of students' activities and improving the efficiency of the educational process has sharply increased, which involve the use of various forms and methods of organizing educational activities, allow to reveal the subjective potential of both the student and the teacher. These are, first of all, the use of active learning methods, dialogical forms of organizing seminars, elements of heuristics, the synectic method, mini-conferences and group discussions, educational simulation and business games, elements of psychological training, master classes, group and independent work, and much more. Innovative learning, as a process and result of educational and official activities, is focused on the formation of a person's readiness for dynamic changes in society, through the development of creativity. One of such innovative technologies is modular training.

The methodology of the modular system is based on the idea that every activity should contribute to both the assimilation of new information and the formation of skills and

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processing of this information. Thus, it is logical to use a block (modular) organization of the material supply. Namely: lecture (lesson of learning new material), seminar, research, independent work (lessons of improving knowledge, skills, skills), colloquium, (control lessons – intermediate control, lessons of accounting and evaluation of knowledge and skills, final control).

Innovative technologies are not only a pedagogical approach to teaching a particular topic, but also innovations and changes in the activities of teachers and students, in the implementation of which interactive methods are mainly used.

Interactive teaching methods are a special form of organization of cognitive activity, in which students in the learning process have the opportunity to understand and think about what they know and think and want to learn. The role of the teacher in interactive lessons partially leads to the orientation of students' activities to achieve the goals of the lesson.

The use of pedagogical technologies in all areas of higher education, including problem-based learning; technologies that develop critical thinking; modular technologies; collaboration technologies; differentiated and individual learning technology.[1]

The system of application of innovative pedagogical technologies in the process of education

Learning technologies	Teaching methods	Graphic organizers
Technologies of teaching lectures	Blitz Poll	Clusters
Technologies for conducting seminars and trainings	Blitz game	Diagrams
Practical training technologies	Reasoned essay.	Working with tables
Technology case studies	Mental attack.	Definition of concepts, exchange of opinions.
Technologies of self-education	Written and oral tour Conversations.	Sequence of logical chains

Case technology - based on the problem situation on the topic, the student must find a way out of the problem situation or make the right decision. Before solving the problem, such activities as search, analysis, hypotheses using additional information, the use of theoretical knowledge and application in practice are carried out. Strategies used in the learning process.

- Increasing the knowledge base (search for information)
- Data analysis (business correspondence)
- Situational role-playing game
- Discussion

Instructions:

1. Enough to understand the essence of the keys.
2. Determine the factors that serve to find a solution to the problem.
3. Identify the factor (or two factors) that are most relevant to the problem among the identified factors.
4. Try to justify your decision based on these factors.

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5. Express your opinion

Case resolution process:

1. Students discuss the essence of the matter, getting to know them.
2. Students identify factors that set the stage for problem solving.
3. The identified important factors that allow solving the problem are considered.
4. Students describe the most important factors based on the general opinion.
5. Opinions are analyzed, a general conclusion is made.

Of the above innovative technologies, I consider it expedient to use several technologies for effective teaching of the subject of entomology. The advantages of this application are as follows. For example, when studying the topic "Morphology of insects", the teacher gives a lecture on the topic using IT presentations as a visual aid. During the explanation of new material, special attention is paid to important points that need to be paid attention to. To consolidate the material, you can use work in groups or individually on cards, a blitz survey, a cluster, etc. Performing a practical task, students not only learn new material, but also the skills to use new knowledge. [1]

The use of innovative technologies in the educational process increases the effectiveness of training. When creating educational technologies for disciplines, it is advisable to proceed from diversity, creativity, non-standard approaches, taking into account the specifics and patterns of each discipline. In this process, it is advisable to take into account the specifics of subjects, forms of education and topics. [2, 3]

Morphology of insects

Insects make up a special class (Latin name Insecta) in the arthropod type of animals (Arthropoda). Insects are closest to the classes of millipedes (Myriapoda) and crustaceans (Crustacea) and together with them form a natural group, isolated into a separate subtype of mandibular (Mandibulata). Insects, millipedes and crustaceans are united by such signs as the presence of one or two pairs of antennae and the transformation of three pairs of limbs following the antennae into oral organs, of which the upper jaws, or mandibles, are especially strongly developed. The body of insects is covered from the outside with a dense chitinized cuticle forming an external skeleton, or exoskeleton. The main functions of the exoskeleton are protective, biomechanical, barrier (prevents evaporation of water from the insect's body), support (internal outgrowths of the cuticle serve as a place of attachment of skeletal muscles). In the cuticle there are various pigments that provide a variety of insect coloration. Insect coloration can also be structural; in this case, the smallest cuticle plates on the surface of the body refract light, also providing a variety of coloration. The cuticle itself has a non-cellular structure and consists of three layers: the outer one - the epicuticula, and the exocuticula and endocuticula underlying it (combined into a procuticula); the cuticle is secreted by the hypodermis located under it, consisting of a single layer of cells. Various structures are also formed from hypodermic cells on the surface of the insect body: hairs, bristles, scales, external structures of mechano- and chemoreceptors, various hypodermal glands, etc. Insect growth occurs only at the larval stage and is accompanied by periodic molting: passing from age to age, insect larvae molt (in the imago stage, growth and molting occur only in primary-winged insects). In the process of molting, the endocuticle completely dissolves, and the old

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cuticle (the so-called larval skin, or exuvium) is discarded; at the same time, the hypodermic secretes a new cuticle. [1,2,3]

The head and its appendages. The structure of the head.

The head (sarut) is a strongly compacted cranial box formed from fused five, and according to some morphologists, even six to eight segments. It carries a pair of compound eyes, often up to three simple eyes, or eyes, and movable appendages – antennae and mouth organs. The surface of the head is divided into separate sections, sometimes separated by seams. There is a forehead (frons) between the eyes, which goes up into the crown (vertex) and then back into the occiput (occput); there is a platypus (clypeus) located down from the forehead, bordering the upper lip (labrum) at the bottom; on the side under the eyes are the cheeks (genae), the upper jaws (mandibulae) are adjacent to them from below.Форма головы насекомых разнообразна:

Rounded (flies), compressed from the sides (locusts, grasshoppers),

Elongated in the form of a head tube (weevils).

There are also different types of head placement:

prognathic,

hypognathic

opistognathic.

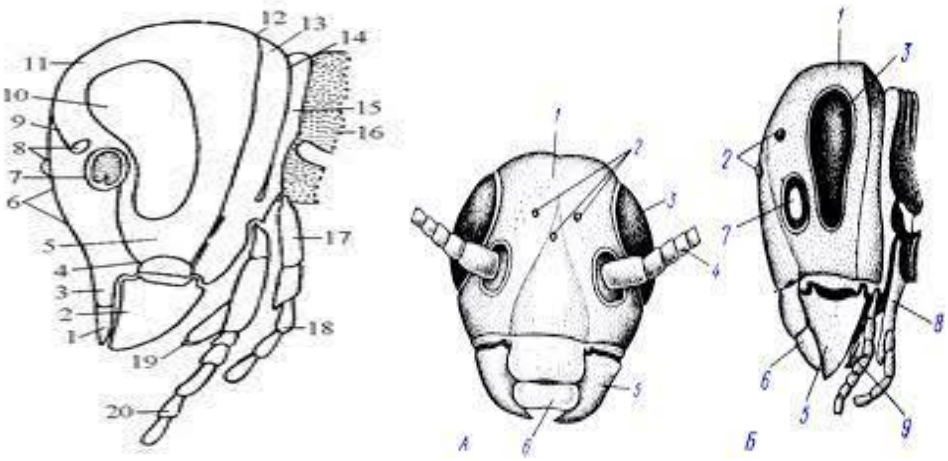
With the prognathic head type characteristic of predatory insects (ground beetles, staphylines), the oral parts are directed forward; with the prognathic head type characteristic of predatory insects (ground beetles, staphylines), the oral parts are directed forward.[1,5]

With hypognathic, characteristic of herbivores (locusts, many species of bugs, beetles) – at right angles down.

With opistognathic (cicadas, copperheads, thrips) – the oral parts are directed at an acute angle down and back, approaching the front legs.

Complete the task:

(Students together with the teacher determine the parts of the insect 's head and sign under the drawing)



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1._____ 1._____

2._____ 2._____

3._____ 3._____

Complete the task:

(Students work together with the teacher on drawings)

Work with drawings, drawings are distributed. (According to the scheme, students recognize insects by the general appearance and structure of the head

The organs of vision are represented by complex and simple eyes – dorsal and lateral. Complex, or faceted, eyes (oculi), among one pair, are located on the sides of the head and consist of many (up to several hundred or even thousands) visual units, ommatidii, or facets. In this regard, some insects (dragonflies, male flies and bees) have eyes so large that they occupy most of the head.

Compound eyes are present in most adult insects and in larvae with incomplete transformation from a subclass, with the exception of some groups of parasitic, cave species and inhabitants of anthills, in which they have disappeared for the second time. Of the representatives of the subclass of primiptera, only bristletails have compound eyes.

Simple dorsal eyes, or ocelli, in a typical case, among three are arranged in the form of a triangle on the forehead and crown between complex eyes. Sometimes the middle eye disappears, and only two lateral ones remain, less often the disappearance of paired ones is observed while maintaining the middle eye. As a rule, eyes are found in adult, well-flying insects, but they are absent in many lepidoptera and diptera and are found in the larvae of mayfly dragonflies.

Simple lateral eyes, or 11 stemmata, form two paired groups located on the sides of the head. The number of eyes varies from 6 to 30. They are inherent mainly in insect larvae with complete transformation; they are less common in adult insects devoid of faceted eyes (order podura, fan-winged, fleas, etc.).

Antennae. Antennae, or antennae, are represented by one pair of segmented formations located on the sides of the forehead between or in front of the eyes in the antennal pits. They serve as organs of touch and smell. The tendril consists of a thickened main segment (scapus), a pedicellus (pedicellus) and a flagellum (flagellum). The structure of the antennae is diverse in individual species and groups, and this feature is used in the determination (diagnosis) of insects. Thus, bristle–like antennae with numerous segments, gradually thinning towards the top, are characteristic of representatives of the order cockroaches, the suborder long–whiskered in straight-winged, etc.; mace-shaped - with several thickened or expanded segments to the top, forming a mace - for representatives of the group of families of diurnal, or mace-whiskered lepidoptera; lamellar-mace–shaped – with a mace of plates elongated to one side - for May and other crunches, etc. Often the structure of the antennae is different in males and females of the same species. The number of antennal segments also varies depending on the type or age of insect larvae with incomplete transformation. So, in representatives of various suborders of the order equidoptera, they range from 3 segments in cicadas to 11 in some coccidae. The antennae of adult locusts consist of 33 segments, and in larvae the number of segments ranges from 13 to 23-26.

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Complete the task

(Make a sequence of logical chains)

(Words describing the structure of insect antennae are heard, students need to arrange the words correctly to get a description of the mace-shaped or lamellar-mace-shaped antennae. The work can be performed both individually and in small groups.) Ротовые органы.

The oral organs have undergone significant changes from the gnawing type when eating solid food to various modifications of the sucking type when taking liquid food (nectar, plant juice, blood, etc.). There are types of oral organs:

- gnawing-licking,
- pricking-sucking,
- sucking,
- Licking.

The type of damage to the plant depends on the method of nutrition and the structure of the oral organs, according to which it is possible to diagnose pests and choose a group of insecticides to combat them. Thus, insecticides of internal or intestinal action can be used to destroy insects with gnawing oral organs, whereas insecticides of external or contact action or fumigants are used against insects with sucking oral organs.[1,2,10]

Gnawing oral organs consist of paired undifferentiated upper jaws (mandibulae), paired dismembered lower jaws (maxillae) and unpaired dismembered lower lip (labium). From above, the oral organs are covered by the upper lip (labrum), which is a fold of skin. The upper jaw consists of a main segment (cardo), a stem (stipes), a pair of chewing blades – external (galea) and internal (lacinia). The stem bears a maxillary palpus (palpus maxillaris) consisting of 1-7 segments. The lower lip has merged along the median line at the base and is divided into a sub–chin (submentum), a chin (mentum), two pairs of tongues homologous to the chewing lobes of the lower 12 jaws - internal (glossae) and external (paraglossae). Lower-lipped palps (palpi labiales) also extend from the chin. The upper lip, both pairs of jaws and the lower lip are located around the mouth and close the pre-oral cavity. A tongue–shaped fleshy organ - the hypopharynx (hypopharynx) is pushed into this cavity. It is located under the pharynx and divides the pre–oral cavity into two sections - anterior and posterior. The mouth opening opens into the anterior part, i.e. the beginning of the digestive tract, the salivary gland duct flows into the posterior. Oral organs of the gnawing type are most widely distributed and are found in representatives of the superorder orthoperoid, colepteroid, neuropteroid, in some hymenopteran insects, etc. [1,11]

Gnawing-licking mouth organs have undergone significant changes due to the sucking or licking of nectar from plant flowers (bees, some wasps). The lower jaws and lower lip turned into a proboscis and their separate parts – the stem, the outer chewing blade of the lower jaws, the chin, the tentacles and the tongue of the lower lip merged into one – greatly lengthened. At the same time, the mandibular palps and external tongues were reduced. At the same time, there are still common features of the oral parts of the main gnawing type – expanded upper jaws and the division into segments of the lower jaws and lower lip. [12,13]

Piercing-sucking mouth organs are characteristic of insects that feed on the cellular juice of plants (hemiptera, equiptera) and animal blood (lice, fleas, some diptera) with a puncture of

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the substrate. So, in the bug turtle, the upper and lower jaws are represented by thin and long spiny bristles enclosed in a long jointed proboscis formed by the lower one. When feeding, the proboscis rests against the substrate, undulates back, and the first pair of piercing bristles (upper jaws) pierces the integument and penetrates into the plant tissue. The second pair of bristles (lower jaws) on the inner side has two longitudinal grooves. When both bristles come into close contact, two internal channels are formed. According to one of them, saliva is injected into the plant tissue, according to the other, food is absorbed.[1,2]

Sucking mouth organs are characteristic of lepidoptera, which feed on liquid food without puncturing the substrate. Their upper jaws are absent; the lower ones form a long non-jointed spirally coiled proboscis. The lower lip in the form of a small unpaired plate bears long, usually 3-segmented tentacles.[12]

Licking or mucoid mouth organs are found in round-necked diptera that feed on liquid food, including flower nectar, also without puncturing the substrate. They lack upper jaws. The main cone–shaped part of the oral organs – the rostrum - is an outgrowth of the head, which includes the remains of the lower jaws. The rostrum is followed by a retractor, or gaustellum, corresponding to the lower lip. At the top of the gaustellum there are two movable flaps of the sucker, or labellum, on the end surface having a filtering organ – pseudotrachea. Depending on the position of the labellum flaps and the extension of the teeth, flies can eat liquid or solid food or drink water. [13]

Complete the task:

(Students work with the teacher with the table)

Gnawing mouth	Gnawing-licking oral organs	Piercing-sucking oral organs	Sucking mouth	Licking, or mucoid, oral organs

Working with the table (we fill in the table with the information that we received during the lesson)

The use of innovative technologies in the educational process increases the effectiveness of training. When creating educational technologies in disciplines, it is advisable to proceed from diversity, creativity, non-standard approaches, taking into account the specifics and patterns of each discipline. In this process, it is advisable to take into account the specifics of subjects, forms of education and topics. [20, 21, 22]

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