

# THE USE OF INNOVATIVE METHODS IN STUDENTS' ECOLOGICAL AND HEALTH EDUCATION IN BIOLOGY

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*Abstract - The aim of the present study is to look into the effectiveness of applying certain innovative methods in teaching 8<sup>th</sup> grade students in the subject Biology and Health Education. The object of study is the process of teaching in Biology and Health Education classes in Ivan Bogorov High-school of Economics in Varna. The subject of study are some innovative methods (modeling, content analysis, creating a mind map, case studies, association methods, role play) for the ecological and health education of students. The study was conducted in Ivan Bogorov High-school of Economics in Varna in 2013/2014 academic year. The topics included: The Cell, Hygiene of nutrition and Digestive System, Epithelial and Connective Tissue. The article presents illustrated fragments of methodological model of lessons with the use of innovative teaching methods. The conclusions are made on the basis of the obtained empirical results. The study has a practical contribution to biology didactics in terms of using innovative methods for improving students' ecological and health education.*

**Keywords** - Innovative methods; Ecological and health education; Educational process; Students; Biology and health education

## I. INTRODUCTION

Achieving and maintaining high quality in education is the basis of our country's prosperity and its successful integration within European structures. This entails the necessity of creating favourable conditions and premises for effective organization of education in secondary schools in correspondence with the needs of modern society.

The implementation of these requirements suggests careful planning of the teaching process, modernizing the curriculum, using effective modern methods, forms of instruction and technology in education.

Interactive methods as part of innovation in contemporary education create positive motivation for studying, activate students, provoke their interest in acquiring knowledge, developing skills and study habits, and place the students at the centre of the educational process.

The school subject Biology and Health Education concerns fundamental aspects of human life - healthy lifestyle, rational nutrition, clean environment. These aspects are at the core of the good quality of life - a problem with a global significance in 21<sup>st</sup> century. This fact obliges educational institutions to actively work towards the creation of health and ecological culture in adolescents and achieving high quality of biological knowledge.

## II. METHODOLOGY OF THE STUDY

*The aim of the study* is to look for and present possibilities for using some innovative teaching methods for ecological and health education in teaching the compulsory subject Biology and Health Education to 8th grade students, with a view of improving the process of education.

### Research tasks:

1. Theoretical analysis of scientific and methodological literature on the nature, significance and functions of innovative methods in the pedagogical process, and on its basis to outline innovative tendencies in education.
2. Theoretical justification of the problem of ecological and health education of students; analysis of the subject matter in the subject Biology and Health Education in 8th grade with the view of a possibility for applying innovative methods in its teaching.
3. Selection of topics from the subject matter in Biology and Health Education for 8<sup>th</sup> grade and preparing methodological scenarios relevant to the aim of the study.
4. Organization, conducting, analysis and evaluation of the results of the pedagogical experiment.

*Object of the study:* the process of teaching Biology and Health Education to 8<sup>th</sup> grade students in Dr. Ivan Bogorov Professional High School of Economics, Varna, Bulgaria.

*Subject of the study:* innovative methods for ecological and health education of students in the subject Biology and Health Education in 8<sup>th</sup> grade.

*Research methods:* theoretical analysis, summary, conclusions, observations.

The study was carried out in Dr. Ivan Bogorov Professional High School of Economics, Varna, during 2013/2014 school year, and involved the following topics from the 8<sup>th</sup> grade syllabus: The Cell, Hygiene of nutrition and Digestive System, Epithelial and Connective Tissue.

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### III.RESULTS AND DISCUSSION

#### *Theoretical motivation of the use of innovative methods in education*

The development of social priorities and expectations, tendencies of globalization and intercultural communication, development of information and communication and digital technologies are among the main factors leading to a paradigm change in education. There are changes in the aims of education, the roles and functions of teacher and students, pedagogical and educational technologies. Didactic communication and interaction were introduced and motivated more than two decades ago as concepts, which reflect the communicative and interactive nature of education. In the last few years there it was agreed that the time had come to make these methods part of school education [1].

The teacher and students together create a school environment which offers a variety of learning strategies, so that each student can create their own individual learning style, which suits their needs in the best possible way. Priority is given to the student, and not to his or her education. Students go to school so that they can search and discover, with the help of the teacher, the things that are most useful for their personal development [2].

The new innovative practices in teaching, which correspond to students' development, require more efforts, energy expenditure and preliminary planning. Teachers should part with some manners of authoritative behaviour and to work together with students, to monitor and help, and take part in planning their study-related tasks and activities [3].

Priority is given to the requirement to abandon the strategy of acquiring knowledge through learning by hearth and use the strategy of students' active involvement and stance-taking instead, using dialogue and inter-personal interaction, and building a democratic type of relationships between learners and educators. These important tasks can be solved by using innovative forms and methods of education [4]. From the point of view of their usefulness and applicability, these methods are given different names and interpretations: active, interactive, modern, innovative. In fact, they are not new, but have a long history in the history of education. Their distinctive feature is the higher level of activity which they provoke in students. They promote autonomous search for information, learning by doing and emotional involvement.

*Interactive education* is a classroom innovation of the XXI century. It is defined as learning in the process of interaction between the teacher and students, and among the students. The teacher does not provide the new knowledge, but provokes and activates students so they can find the solutions to educational tasks themselves.

*Interactive methods* are all those methods which are based on the simultaneous acquisition of knowledge, development of skills and habits by placing students in situations, in which they can interact and discuss their experiences. According to Valchev, interactive methods entail on-going interaction, feedback, involvement and search for common solutions [5].

*The main characteristics of ecological and health education of students* Ecological education has a very important place in the whole system of education. It has kept

this place in biological education and widened its scope in other subjects from the sphere of sciences and humanities.

Ecological education is the core of biological education, and provides information and knowledge of scientific, social and legal nature. Ecological education is increasingly becoming the basis for students' intellectual, health, moral, legal and aesthetic education [6].

*Ecological education* is an organized and purposeful process of teaching, education and self-education as a result of this process. Kostova describes it as a social psycho-pedagogical process; obligatory and specialized, involving all ages, professions and layers of society; interdisciplinary and integrative; horizontally and vertically synchronized to form a holistic and balanced viewpoint; a process which involves socially-significant students activity in nature [7]. The process is aimed at developing the personality; reflection and control of needs and emotions, acquiring knowledge, developing skills and habits, building up motivation and capability of ecological activity.

*Ecological education* is motivated by the idea of harmonious interrelation between man and nature. It is aimed at forming views and convictions, attitudes and behaviour for reaching a harmonious whole in the system man-society-nature. As a pedagogical process it is purposeful, meaningful, subject-oriented, staged and organized [6].

Ecological education is aimed at creating *ecological culture, ecological consciousness, ecological ethics and ecological behaviour* [7].

Health education has a priority in the whole educational system. In the system of universal human values health and healthy way of life have a special place. In human's attitude towards him or herself an important position is taken by norms of behaviour which guarantee health. According to V. Ishev and Z. Kostova, cultural values have always included norms, aimed at the survival of individual in nature and its integration within society [8].

*Health education* is part of the overall education process and involves all stages, levels and forms of school education. It is an integral result from the education in many school subjects which are concerned with different aspects of health issues.

In a narrow sense health education in schools encompasses following areas: nutrition, body hygiene, clothes, home, general prevention of illnesses, medical prophylaxis, school hygiene, psycho-hygiene, safety instruction. Health education is first of all linked to the acquisition of knowledge about health, and developing skills for research and application of knowledge. A starting point in health education are issues related to human spirituality and mentality - morality, willpower, beliefs, inclinations, value orientation and behaviour, in correspondence with the norms and values in society and current health issues. Health education is a means for transmitting and appropriating social experience. It is a unity of teaching and learning, as a unified activity of social subjects - educators and learners, as a process in whose center is the student. The object and the subject of health education is the developing personality. The aims of health education are fostering health culture and responsible attitude to one's health, health competences, which lead to a healthy way of life in students [9].

### **Ecological and health aspects of the subject matter in Biology and Health Education for 8<sup>th</sup> grade**

Ecological and health education are part of the subject matter in teaching biology. The school subject Biology and Health Education is part of the broader area of study called Natural Sciences and Ecology. It builds on the knowledge, skills and relations which have been studied in the subject Man and Nature in 5<sup>th</sup> and 6<sup>th</sup> grades and Biology and Health Education in 7<sup>th</sup> grade.

The main areas in the sphere of biology it contains are:

- zoology of vertebrate animals with an emphasis on organism diversity and their preservation;
- anatomy and physiology of man with an emphasis on health education;
- ecology with an emphasis on man's responsibility for protecting the environment.

The syllabus for the subject Biology and Health Education for 8<sup>th</sup> grade has the subject matter for ecological/ health education subsumed under ecology/ health units, topics or segments of study material included in other topics concerned with biology science. The ecological approach is leading in constructing the macrostructure and microstructure of the subject matter in biology education. The subject matter is supplemented and enriched with elements of human ecology as a health aspect of ecological education. Human being is part of nature and, at the same time, the main factor in its sustainable development. He or she is a social creature, and their responsibilities and behaviour in nature are reflected in the aims of ecological education.

The concept of *human preservation* is formed by revealing the conditions for proper functioning of different organs and systems in human body. As early as in discussing the topic Organism - one whole, the teacher can initiate a discussion on the place of human beings in biocenoses and emphasize not only their dependence on nature, but also their ability to change it. The topic can also include information about the effect of ecological factors on the cell and the effect of harmful substances on cytoplasm.

The teaching of separate systems of human organism involves the following information: the way structure is suited to performing certain function; adapting the organism to the environment through its function, illnesses caused by environmental pollution (lung emphysema, silicosis, cancer, heart attack, tuberculosis, bronchitis, poisonings, etc.); prophylaxis and medical treatment of illnesses, work conditions and recreation.

One health education aspect are human disabilities and illnesses, rule of prophylaxis and norms of healthy way of life. Besides being presented as biological species, humans are social and rational beings, capable of looking after themselves and the society, and having responsibilities for their behaviour in society, topics which corresponds to the aims of health education.

Implementing the ecological approach in the syllabus is realized through including separate topics in ecology, which are studied at the end of the course of education. The approach allows for presenting the interrelation between organisms and the environment and the development of ecosystems at the level of species - populations and biocenoses. It emphasizes the role of humans in changing

ecosystems and maintaining the dynamic balance in them. Students are convinced in the need for a rational use of flora and fauna, their protection and reproduction based on the measures taken for protecting natural environment.

In correspondence with the syllabus, course books contain a significant amount of materials concerned with human's health, at the core of which is a system of health concepts - medicinal, sanitary-hygienic and prophylactic [9].

Although the subject matter is aimed at forming practical skills, connected with observations in nature, making measurements, discussing a system of rules for a healthy lifestyle and environment-conscious behaviour, the realization of these aims depends mostly on the teacher. The choice of appropriate didactic technology based on interactive teaching with the use of methods leading to increased cognitive, social and emotional involvement of students will lead to achieving the expected results stated in the curriculum, and the aims of ecological and health education.

### **Implementation of innovative methods for ecological and health education in teaching Biology and Health Education to 8<sup>th</sup> grade students**

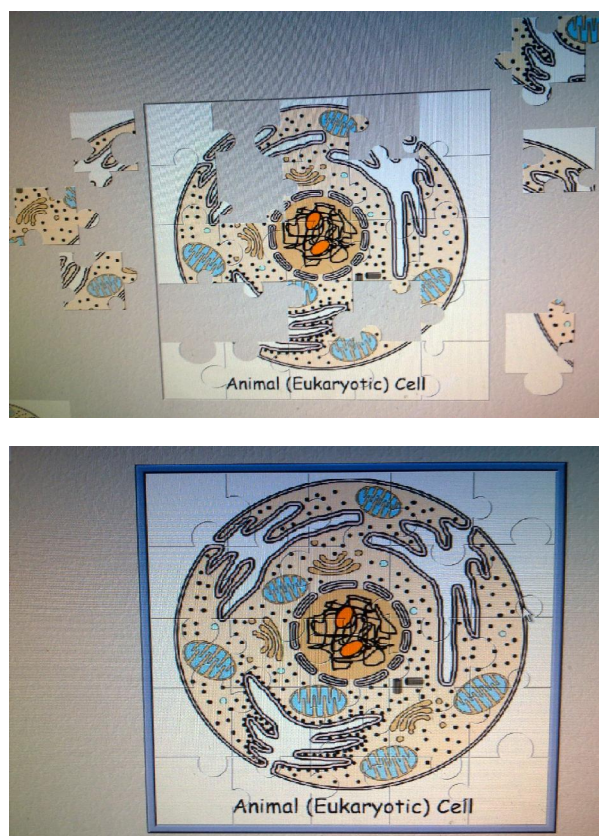
The achievements of the study aims is realized through topics selected from the course book in Biology and Health Education for 8<sup>th</sup> grade, published by "Bulvest 2000" Publishing house, Sofia, 2009. In the process of teaching is used a variety of innovative methods in combination with traditional ones, which are suited to the subject matter and the needs of the students. Due to publication limitations, we have included only some fragments of methodological designs of lessons, which illustrate the didactic aspects of the used innovative methods of education.

#### *A fragment of methodological design of a lesson on the topic of Cell with the use of the innovative methods Modeling, Content Analysis and Ming Mapping*

The interactive product *Mini-atlas in cytology* is used for consolidating students' knowledge of cell structure. Students identify and select cell structures with the help of a Cell navigator. The next activity is a game called Puzzle. Students are given instructions and timing - 5 minutes - for the game. They are given different modules prepared in advance, which differ in their shape, to be used for assembling a model of the cell. The class is divided into small groups, consisting of 4 - 6 students each. The teacher monitors students' work, and at the end gives students' feedback on the results, evaluating the models by means of established criteria - accuracy, correctness, and time for their construction (Fig. 1).

In order to consolidate students' knowledge about the phases of nucleus division and their specifics, students work on a task for modeling the phases of the mitosis process. They are divided into groups of 3 - 4, instructed and given 10 minutes for work. The models are made on cardboard with the use of coloured threads, wool, paper, glue and felt-tip pens. The use of these materials, cutting and gluing makes the task fun and allows for an easier acquisition of the subject matter. When the work is done, students from each group presents in turn present the model of a given phase of mitotic division. The other groups have to identify the phase. Then the students describe the processes taking place in the cell at the given stage of its division. The teacher analyses and

evaluates the models according to the agreed criteria - correct representation, accuracy, aesthetic qualities, originality of the model.



**Fig. 1. Arranging modules for the didactic game Puzzle**

For homework students have to do content-analysis on the topic of Cell and make a mind map. The teacher gives instructions how to make the map. In doing their homework students have to use the knowledge they have acquired in solving the previous task. At the beginning of the next class, while checking the homework, the teacher receives feedback on how well students have understood and learned the new study material.

*A fragment of methodological design of a lesson on the topic of Hygiene of Nutrition and Digestive System with the use of innovative methods Associations and Case study*

The use of the Associations method aims to focus students' thinking towards the stage of presenting the new study material. Students are given the task to list for 3 minutes as many factors as they can which affect the process of nutrition and the digestive tract. Each student writes their ideas in their notebook, after which a group discussion is held. This technique aims to sift identical suggestions and thus gather more ideas. During group discussion students have to divide the suggestions into two groups: factors which are beneficial to the process of nutrition and the digestive organs, and factors, which negatively affect the process of nutrition and the digestive organs.

The spokesperson of each group reports on the results of the task. A discussion with prompting questions is held in order to clarify the suggestions: the negative factors are

identified as bad habits, whereas the beneficial factors are the hygienic rules and norms of behaviour for a healthy lifestyle.

In order to consolidate, summarize and systematize students' knowledge, at the lesson students work in groups on the following case studies:

*Case study 1:* Tanya is an 8<sup>th</sup> grade student at a choreography class of an arts school. She is planning to take part in an international competition. She is a good dancer, but has recently put on a lot of weight which makes her stand out compared to other dancers in the group. Using your knowledge of foods and nutrition, help Tanya restore her original weight within the remaining 30 days.

- What diet would you prescribe to Tanya?
- What requirements should the dance teacher impose on Tanya?

*Case study 2:* A close relative of yours has been diagnosed with liver cirrhosis. You had known him since you were a child, and know that he was a compulsive drinker. In the hospital he promises that he won't drink any alcohol again. However, after the treatment he starts drinking again, explaining that small amounts will not do him any harm. What would you do to help him?

*A fragment of methodological design of a lesson on the topic of Tissues. Epithelial and Connective Tissue with the use of the innovative method Role play*

Role plays are used at the stage of consolidating new subject matter with the additional purpose of motivating students. They require advance preparation and role distributions among students.

The first role play focuses on discussing the features of epithelial tissue. The participants are: the patient, the dermatologist, the endocrinologist, and a laboratory assistant. The role play is conducted in the following way:

*The patient (student)* complains of problems with the skin of his face - a problem typical of students at this age.

*The dermatologist (student)* describes the types, structure, functions and location of the covering epithelial tissue. His diagnosis is irritated and polluted as a result of improper treatment. He prescribes disinfectants and tells the patient to maintain good personal hygiene.

*The endocrinologist (student)* adds to what the dermatologist said about the types, structure, function and location of gland epithelium. To the first diagnosis he adds increased oily secretion and possible disruptions in the functioning of the endocrine glands. He prescribes treatment with degreasing substances which do not irritate the skin, and a diet to regulate the function of sebaceous glands.

*The observers (the other students)* decide which of the two specialists has diagnosed the patient more precisely and has prescribed more appropriate treatment.

As a result of using this method students, together with the teacher, discuss the specialist information and fill in a table with the following columns: tissues/ types of tissue, structure, functions, location in the body.

Next in the doctor's office comes the *laboratory assistant (student)*, who brings the results of biopsy from the clinical laboratory. The students have to study samples of loose and blood connective tissue under microscope and describe what they see.

The laboratory assistant (student) shows electronic-microscopic pictures of the studied tissues. Students' attention is drawn to the location of cells and the matrix. The interdependence between different types of connective tissue and their functions are emphasized. Students look at a poster depicting the structure of different types of tissues, their functions and location.

The next role play consolidates students' knowledge about connective tissue with supportive function. The participants are an adult patient and an orthopedic doctor. Students are divided into two groups one of which studies conditions linked to connective tissue with supportive function; the other - its characteristic features. The role is carried out in the following way:

*Adult patient (student)* complains of pains in his legs. His legs are curved below the knees in the shape of O letter.

*The orthopedic doctor (student)* tells other students about connective tissue with supportive function: its types, structure, functions and location. On the basis of patient's complaints the doctor diagnoses the patient with having curved bones as a result of decreased thickness of the matrix and the bone tissue. He points out the precautions which can be taken when the patients are younger. He discusses the need for a healthy way of life and the precautions against this condition.

Another participant is the *laboratory assistant (student)*, who gives students microscope samples of bone and cartilage tissues. The assistant shows them electronic microscope pictures.

The information received from the participants and the discussion allows students to fill in table about connective tissue. The class ends with a summarizing discussion and a comparison between epithelial and connective tissues. Students prove the link between their structure and function.

#### IV.SUMMARY AND CONCLUSIONS

Theoretical research in the area of study and the observations of students' work during the pedagogical experiment allow us to summarize our findings and draw the following conclusions:

1. Innovative methods of education can be used at different stages in the macrostructure of the lesson in combination with traditional (classical) methods. This increases students' interest and motivation in studying the subject matter, engages their attention and provokes their active participation in study tasks and activities, and also facilitates their understanding and permanent acquisition of knowledge, skills and habits.
2. Group work, typical of innovative methods of education, develops essential personal qualities such as communicative skills, tolerance, cooperation, acceptance of other opinions, argumentative skills and assertiveness, abiding by rules and algorithms, etc.
3. Students' increased interest and motivation to study the subject matter and their improved cooperation in doing the study tasks and activities in class are the result of the application of innovative methods, which is a prerequisite for improved effectiveness in teaching the subject Biology and Health Education to 8<sup>th</sup> grade students.

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