Zh. T. Abrassulova et al /J. Pharm. Sci. & Res. Vol. 10(2), 2018, 416-419

ISSN:0975-1459
Journal of Pharmaceutical Sciences and Research
www.jpsr.pharmainfo.in

The Effectiveness of Knowledge Acquisition for Students Using Innovative Methods of Teaching Biology

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Abstract

The significant part of the plans to introduce innovative methods of teaching biology does not reach practical implementation. This is primarily due to the lack of elaboration of the proposed innovative methods in the Kazakh schools. Also, it is not known how the introduction of innovative methods will affect on the effectiveness of mastering the taught material by students. This study makes it possible to assess the effectiveness of the assimilation of the taught material by the pupils of the 10th grade by using innovative methods of teaching biology compared to traditional methods of teaching biology that are already used to teach students of biology in the school. The use of innovative methods of teaching biology expands the range of opportunities for teachers and students for individual and group development. The results of this study clearly demonstrate the effectiveness of innovative methods in comparison with traditional methods

Keywords: biological education methods of teaching, innovative methods, learning process

INTRODUCTION

Reforms and innovations conducted in preparation of future specialists in the field of education and science are undergoing significant changes. Under the circumstances, the main task of education in the 21st century is the training of highly qualified personnel, the use of new information technologies in the spread of knowledge.

The aim of the study is to determine the effectiveness of introducing new (innovative) methods of teaching biology in comparison with traditional methods in school.

The teaching of biology starts from antiquity, namely, at the time of its isolation into a separate science thanks to the contribution of Aristotle's "Father of Biology", whose works "Historia animalium", "De coloribus" and others became the first independent biological writings [1, 2]. This became notably on his students already. It is especially worth noting on his favorite students, such as Alexander of Macedon and Theophrastus, also called "the father of botany", to whom he left all his compositions and appointed successor to the school of peripatetic he founded.

However, until the second half of the XIX century, biology was taught in schools as part of the subject "Natural History", together with mineralogy, where it was divided into botany and zoology as independent disciplines.

Accordingly, over time, the methods of teaching biology (MTB) in the school have changed in accordance with the degree of scientific development and public opinion. Modern MTBs developed around the middle of the twentieth century when the materialistic worldview officially began to dominate the public consciousness. In contrast, for example, from the Middle Ages and the New Times, when the basic dogma of the public was the theory of creationism.

After this, the MTB in the school changed insignificantly, later becoming known as "Traditional Methods of Teaching Biology." But the process of development does not stand still, and new, innovative methods of teaching are developed, not only specialized for biology, but also applicable to other natural and humanitarian disciplines [3].

A sharp introduction of innovative MTB may cause rejection of the teaching material by students. Often, the differences between innovative and traditional MTBs are quite noticeable.

Our research is primarily aimed at comparing the influence of innovative and traditional BCHs on the degree to which they acquire new material.

MATERIALS AND METHODS

The research was arranged in KGU lyceum # 134 in Almaty for 14 days in 10th grades. Research was arranged in 3 classes where students were 3 separate groups. 2 of them - experimental and 1 - control.

Before the beginning of the study, check was carried out for the initial assessment of students' knowledge.

Consider the innovative MTBs that we used in our study

Indoor labs. These are structured studies and experiments with materials, models and other laboratory equipment. Duration - approximately - 1 academic hour. Indoor labs can be used to study objects collected in the field or by analyzing field data using a computer program in laboratories. This method also allows students and teachers to work less formally than in many classes. Indoor labs retain a prominent place in most scientific subjects.

Children are divided into teams of three to five people and receive a task prepared in advance by the teacher. After receiving the task, the children read and discuss in the group. Then they are provided with materials for laboratory work. They study the material, once again carefully read the purpose and reason of laboratory work. After that students in the group begin to make an experience [4].

In our study for this method, we prepared the laboratory work "Detection of carbohydrates in food". Used materials of potato, apple, sucrose and glucose were used. The pupils stained the products with iodine, observed the reaction and made conclusions in the group. Then they wrote the conclusion and fixed the material studied

Jigsaws. In this method, the class is divided into several groups, each group prepares separate, but related tasks. When all

members of the group are prepared, the class is redistributed to new mixed groups with one member of the previous group in the newly formed group. Each student in the group explains the material he has learned earlier to the rest of the group, and the group then engages in arranging fragments of the lesson material received from each member of the group. The meaning of this method is that students acquire the skills of collective and independent work by combining the material of the occupation into a single whole. Jigsaws is an effective method for attracting students to get acquainted with the materials of the program and acquire social communication skills. It is necessary for the teacher to make sure that each student correctly and completely understood the material of the lesson in order to teach his companions (individual accountability), and each member of the group must make a significant contribution to the group problem solving component (group goals). Studies of this and other methods of cooperative work show significant advantages for schoolchildren, not only in terms of the level of education, but also in terms of positive social and professional growth [5]. To apply this method, in practice, different, but coincident, team tasks and a significant group task are required, as well as attention to how students will effectively prepare for peer education and how the teacher will assess what individual students have studied.

In our study, we used this method to study the theme of "plant cells", the students were divided into groups, using textbooks and handouts prepared tasks, then the groups mingled with each other and the students began to ask each other questions. This helped them to better understand the material

Investigative Cases

In this method, students use the topics discussed earlier to study the topic they are just beginning to undergo. This allows students to develop their own logical thinking on the basis of logical techniques, such as conducting analogies, comparisons, etc. [6]. Also, this method can be used when considering one big topic or when moving from a theoretical to a practical part [7].This method is very useful to connect some similar topics for more in-depth study of the material, for example, the topic "nucleic acids" is directly related to the subject of "squirrels" and when the student begins to recall one topic with the help of logical reasoning another topic follows, so are the extended knowledge.

Socratic Questioning. The method is named after the ancient Greek philosopher Socrates. It is based on thoughtful questions that the teacher asks the students to smoothly bring them to the logical conclusion, which is the purpose of the lesson / conversation. The method can also be used to check the knowledge that students should have at the time of the survey;

In our work, we used the method of Socratic conversation to consolidate the knowledge of students. In the process of answering leading questions, the students remembered the material previously discussed in the lesson

*POGIL.*When applying this method, students cooperate in small groups (up to 4 people). Next, newly formed groups receive materials for work. As soon as the groups independently study new theoretical material, they get tasks and questions independent for each group, to which they are obliged to obtain a single, correctly formulated scientific answer independently with the help of collective calculations. If during the performance of the task (s) students have questions, the teacher can indicate to them the direction that will lead them to a logical answer;

This method teaches children to work independently, to search for the necessary information and develops the ability to use literature and handouts, for this children in the group discuss the given topic, look for information are shared with the guys in the group and identify only the topics needed for studying [8]

Interdisciplinary Approaches

When using this method, students apply practice knowledge that they have learned while studying other disciplines (social or natural). This allows students to develop their own skills through the construction of logical chain and other logical techniques;

This method is very widely used in biology, since biology is very closely related to other sciences, especially chemistry. While conducting laboratory work "Determination of carbohydrates in food products", the students recalled the knowledge gained in chemistry and actively used it in their work.

Concept Maps. Concept maps is a way for students to show the structure of their knowledge. They are useful both as learning tools and as assessments, and especially as formative assessments. Conceptual maps consist of nodes that are squares or circles (if you want to separate 2 different groups of terms) containing terms called concepts. Ideally, concepts should be single words or small groups of words; Nodes can not contain complete sentences. In addition, specific examples are not concepts, so do not have to be in squares or circles. Examples can still be included on the map (without squares), especially since they can add value to the student. The nodes are associated with the marked arrows. The connecting arrows illustrate the relationship between the two nodes. The label (along the line) accurately determines how the nodes are connected. Arrows are used for strings to show either the causal or hierarchical nature of the relationship. Two nodes and their connecting arrow determine the sentence. Nodes in very different parts of the concept map that are connected to each other can be stitched together. Some conceptual maps are hierarchical, while others are networks of concepts. Most of the concept maps in this module are the last;

Role-Playing method

This method applies to gaming. In most role-playing exercises, each student takes on the role of the person affected by the problem and studies the impact of human life problems and / or the consequences of human activities on the world around us from the perspective of this person. Less often, students take on the role of certain phenomena, such as part of the ecosystem, in order to demonstrate the lesson in an interesting and direct way [9].

This role-playing game is both interesting and useful for students, because it emphasizes the "real" side of science. He challenges them to solve complex problems without a single "right" answer and use different skills, besides those used in the usual lesson. In particular, the role-playing game presents the student with a valuable opportunity to learn not only the content of the program, but also other perspectives of the chosen direction

Method of data Simulations.

Learning through data modeling means giving students the ability to create models for data manipulation. This allows you to get an answer to a specific question or to solve a statistical problem. There are several ways to use models: physical modeling of the process, modeling a game or situation to evaluate the chances of certain results using probability models to simulate data to assess the likelihood of a particular outcome or to model data at various parameters to illustrate the concept or to deepen students' knowledge, understanding of the process [10]. Another use of modeling is to generate data within a particular theory to check whether a particular result is unexpected [11].

RESULTS AND DISCUSSION

The results of the control work in three classes were evaluated using a five-point system (Figure 1)

For each group, different methods were used, except for the control group, in which traditional methods were used. Themes of studies for studies are taken according to the school curriculum for 10 classes (Figure 2)

For the most convenient assessment of the degree of effectiveness of students learning new material, the type of exercise was chosen - laboratory work on the topic "Determination of the activity of carbohydrates in food". Based on the conducted laboratory work, to verify the effectiveness of the use of innovative and traditional MTB, a check was carried out. The results of the control work in three classes were assessed using a five-point system. The results of the control work carried out after a two-week application of innovative methods of teaching biology (Figure 3,4).

Operating data based on the number of students who have coped with the control work, we can find out and compare the degree of student learning (DSL), using the formula VP. Simonova: CU = ((1 * A + 0.64 * B + 0.36 * C) * 100) / N, where A is the number of pupils who received the grade "5", B is the number of pupils who received the grade "4", C is the number students who received an "3", N - the number of students who coped with the control work (Figure 5

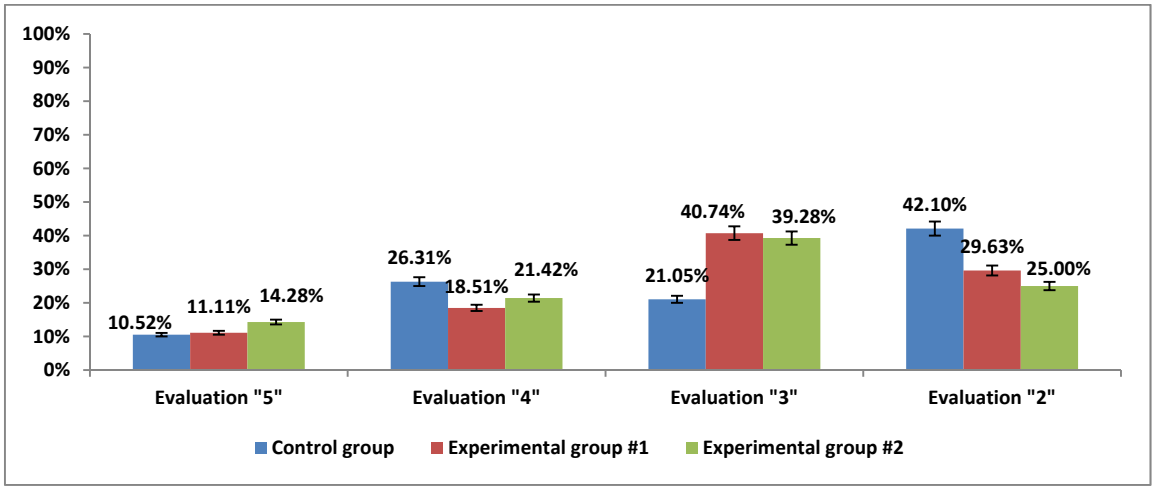

Figure 1. Assessment of knowledge of students before the experiment

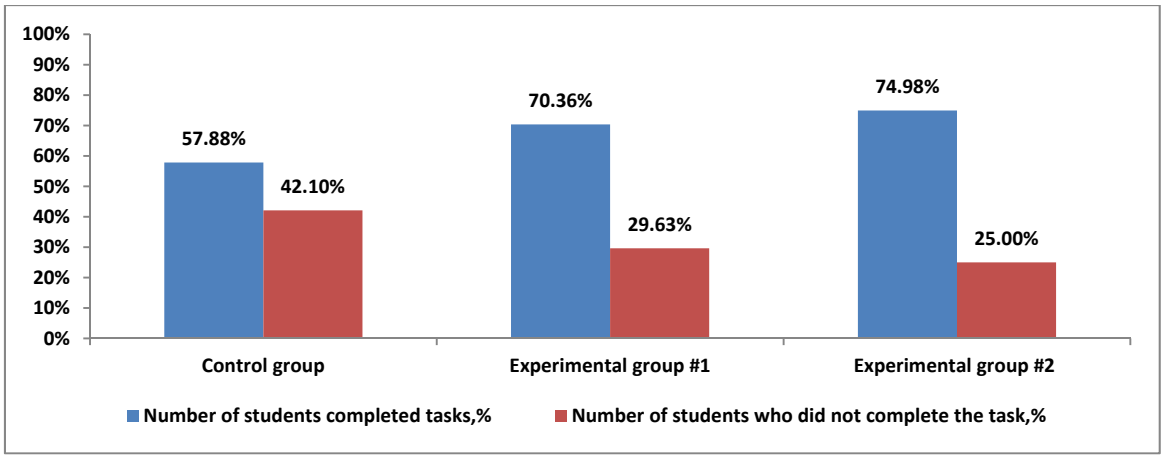

Figure 2. Analysis of students' results after the primary test

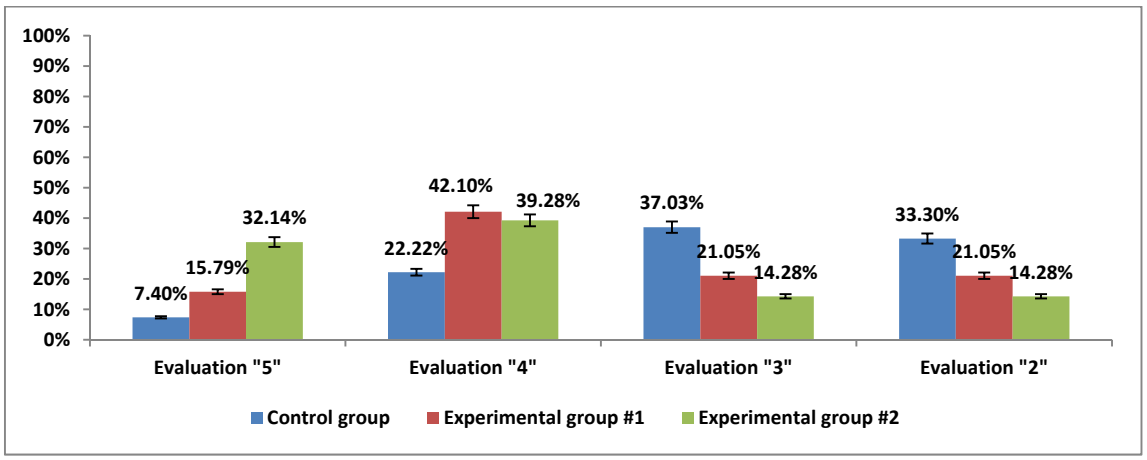

Figure 3. The results of the control work carried out after a two-week application of innovative methods of teaching biology

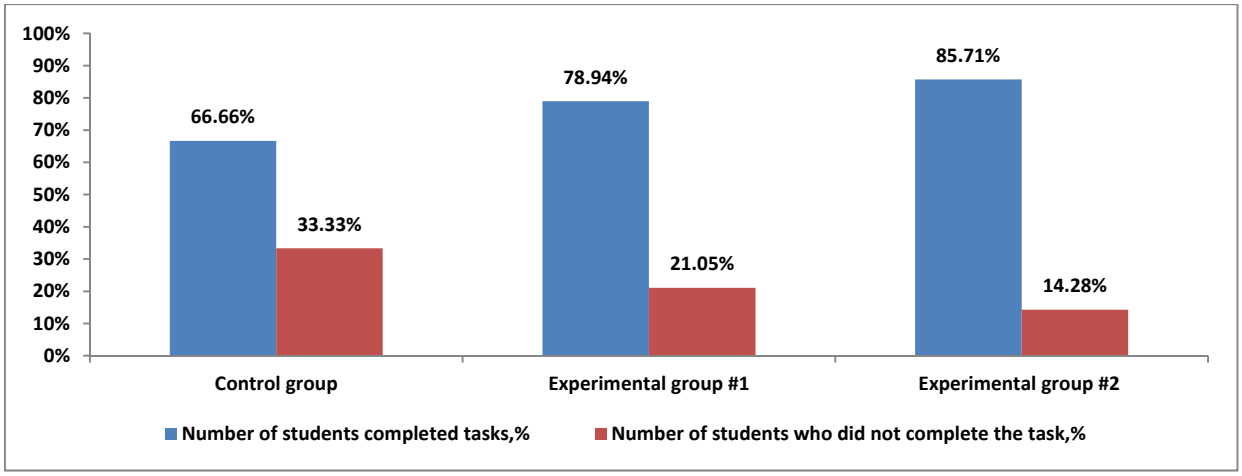

Figure 4. Percentage of students who passed the control work carried out after a two-week application of innovative methods of teaching biology

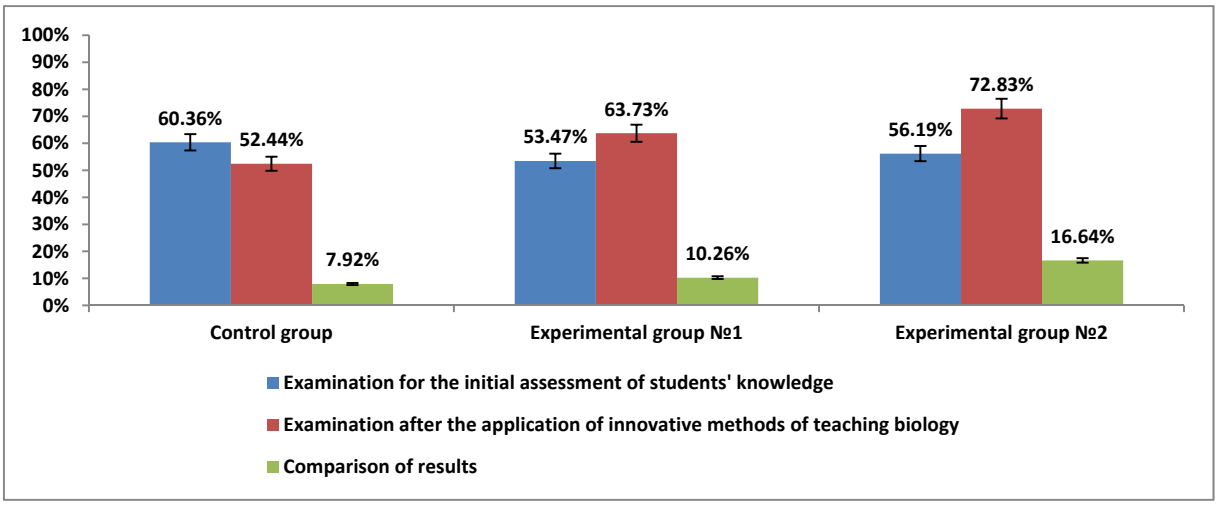

Figure 5. Comparison of DSL results

Comparative analysis of the results of primary SDL and final assessments of students' knowledge in 10 classes shows that: In the control group, the result worsened by 7.92%; In the experimental group # 1, the result improved by 10.26%; In the experimental group #.2, the result improved by 16.64% (Table 1).

Table 1. Comparative results

Class	Amount of students who have successfuly completed the task, %	Amount of students who have failed the task, %
Control group	66,66%	33,33%
Experimental group No. 1	78,94%	21,05%
Experimental group No. 2	85,71%	14,28%

CONCLUSION

These results show that the application of the first group of innovative methods demonstrates an increase in SDL by 18.18%, and the application of the second group of innovative methods demonstrates an increase in SDL by 24.56% relative to traditional methods of teaching.

This allows us to affirm the high practical effectiveness of the application of both groups of innovative methods of teaching biology in comparison with the traditional ones in 10 classes.

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