Determination of Teaching Strategies Considered Necessary in Teaching Biology[1]

Zarovshan Babayeva [2]

Abstract

The article talks about the necessity of defining a suitable strategy for teaching biology and other natural sciences with various experiments and research methods, which has a positive effect on the clear understanding of biological concepts in the teaching of biology for 21st century education. In addition to basic education, traditional methods and tools, methodology, application of methodology at the level of modern standards, new training technologies, and the use of rapidly changing digitalization opportunities have gained relevance in higher and secondary educational institutions. For this, the pedagogical staff's methodical approaches to the evaluation of the students' activities should be changed, and the transformation of biological education into skills should be at the centre of attention. It is known that various methods, tools, and technologies are used to study living things. Of these, observation, experiment, measurement, microscopy research method, etc. as a basic tool allows for more detailed learning. With these research methods, the researcher obtains broader scientific knowledge about the object or event he is studying. The article also includes interesting examples, tables, and schemes that can positively affect the formation of biological knowledge, skills, and habits in the teaching of biology. The importance of the research is to demonstrate the use of modern methods and technologies by biology and other science teachers in 21st century education, not only visually but also to demonstrate the necessity of improving students' biology science and skills with examples. In addition, the problems of creating creative skills in learners, generating new ideas, and raising a new generation according to new world standards were also included in the research.

Keywords: biological education research, modern learning environment, learning strategies, social contexts, experiment

Biyoloji Öğretiminde Gerekli Görülen Öğretim Stratejilerinin Belirlenmesi

Özet

Makale, 21. yüzyıl eğitimine yönelik biyoloji öğretiminde biyoloji kavramlarının net bir şekilde anlaşılmasına olumlu etkisi olan biyoloji ve diğer doğa bilimlerinin çeşitli deney ve araştırma yöntemleriyle öğretimi için uygun bir stratejinin belirlenmesi gerekliliğinden bahsetmektedir. Temel eğitimin yanı sıra geleneksel yöntem ve araçlar, metodoloji, metodolojinin modern standartlar düzeyinde uygulanması, yeni eğitim teknolojileri ve hızla değişen dijitalleşme fırsatlarının kullanımı yüksek ve orta öğretim kurumlarında önem kazanmıştır. Bunun için pedagojik kadronun öğrenci etkinliklerinin değerlendirilmesine yönelik metodik yaklaşımları değiştirilmeli ve biyolojik eğitimin beceriye dönüştürülmesi ilgi odağı olmalıdır. Canlıları incelemek için çeşitli yöntem, araç ve teknolojilerin kullanıldığı bilinmektedir. Bunlardan gözlem, deney, ölçüm, mikroskopi araştırma yöntemi vb. temel bir araç olarak daha detaylı öğrenmeyi sağlar. Bu araştırma yöntemleri ile araştırmacı, incelemekte olduğu nesne veya olay hakkında daha geniş bilimsel bilgi elde eder. Makale ayrıca biyoloji öğretiminde biyolojik bilgi, beceri ve alışkanlıkların oluşumunu olumlu yönde etkileyebilecek ilginç örnekler, tablolar, şemalar içermektedir. Araştırmanın temel amacı, biyolojik öğretim ve öğrenimde modern yöntem, araç ve teknolojilerin kullanımının sonuçlarına dikkat çekmek, gerekli görülen öğretim stratejilerine dayalıdır. Araştırmanın önemi, modern yöntem ve teknolojilerin 21. yüzyıl eğitiminde biyoloji ve diğer fen bilimleri öğretmenlerinin kullanımına sadece görsel olarak değil, öğrencilerin biyoloji bilimi ve becerilerinin geliştirilmesi gerekliliğini örneklerle ortaya koymasıdır. Ayrıca öğrenenlerde yaratıcılık becerilerinin oluşturulması, yeni fikirlerin oluşturulması ve yeni dünya standartları doğrultusunda yeni bir neslin yetiştirilmesi problemleri de araştırmalara dahildir.

Anahtar Kelimeler: biyolojik eğitim araştırması, modern öğrenme ortamı, öğrenme stratejileri, sosyal bağlamlar, deney

Introduction

One of the educational goals of the 21st century is to "get students out of the papka format in which knowledge is kept". The main aim is not only to transfer information but also to raise people who are useful to society, who can see the world differently, and who can dream and realise their dreams, thanks to the learned sciences. Biology is a field of natural sciences that is constantly updated, where old stereotypes become obsolete and are enriched thanks to new discoveries. The 21st century has made it necessary to make important changes in the field of education. Therefore, educators should build important strategies that are relevant to

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students by overcoming the difficulties associated with teaching research methods to learn and teach biology. The issue that will make the implementation of these strategies important is their discussion (Babayeva, 2016). More useful results can be obtained when it is jointly decided that the chosen strategy (Huseynov & Abdullayeva, 2012) will be effective for the learners and when the essence of these strategies is clarified. For example, creating context, discussing the more difficult parts of the research process, improving coding skills, capitalising on applied projects, diligently using development projects, knowing digitalization, using an action research approach, supporting the development of individual and team projects and ideas, defining a principle approach to the topic, defining strategies for the use of projects inside and outside the school, etc. (Babayeva, 2022; Polat & Kontaş, 2018).

What are the values that need attention and guidance on the path of "Examination of teachers' lifelong learning habits in terms of various variables" (Duygu & Buket, 2021)? We think that for the development of education levels in the 21st century, the modern education level should be taken as a basis and basic education should be developed. For this reason, giving importance to the quality of life of teachers and developing their modern skills can provide opportunities for them to be more productive in the field of education.

No matter how much knowledge a teacher with low social welfare, motivation, financial means, and technological skills has, we cannot get high results from students who cannot get positive energy from him. For this reason, increasing the quality of life of our teachers, who are lifelong knowledge carriers, should be the primary duty of society. Since the 21st century requires lifelong learning and renewal, it is the duty of educational institutions to support the development of society. One of the few possible options for improving biology teaching is educational research (Babayeva, 2021). This approach develops on the basis of three overlapping areas: biology, education, and research. That is, these sections are related to each other as in the Venn diagram. If we take into account that in the globalised world there are already students with different backgrounds and living standards (Dyachkova, 2016), we should also prepare ways to overcome the difficulties encountered in teaching subjects (Hua, 2022). In some cases, the difficulty of the research process is encountered when teaching and applying complex parts of the material. But how do we accept new challenges in education? (www.ustac.az, 2023) How to apply the most modern training, methods, ways, tools, and technologies in the teaching of biology to study biological science How to achieve useful visualisation when teaching biology Organising classes with multimedia does not attract or excite young people anymore. (UNESCO, 2021) We should apply such a method that we can teach without being annoying and with interest (Sahin & Sasmaz Oren, 2022). At this time, both the pupil and the student will eagerly join in mastering the secrets of science. Teachers' efforts to raise creative and inquisitive students in education (Jin, Su & Chen, 2021) lead to high success in biology teaching. For this, contemporary pedagogical technologies (ICT, VR glasses, electron microscopes, etc.) should be approached creatively.

Method

One of the educational goals of the 21st century is to "get students out of the papka format in which knowledge is kept". The main aim is not only to transfer information but also to raise people who are useful to society, who can see the world differently, and who can dream and realise their dreams, thanks to the learned sciences. Biology is a field of natural sciences that is constantly updated, where old stereotypes become obsolete and are enriched thanks to new discoveries. The 21st century has made it necessary to make important changes in the field of education. Therefore, educators should build important strategies that are relevant to

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Thanks to the innovations brought by various purpose technologies and technical equipment to the science of biology and the teaching of biology in recent years, educating the people of the 21st century requires special responsibility and skills from teachers. New technological tools help the pupil or student who studies any fact, object, or event, conducts observations and experiments on living organisms, and uses the most up-to-date training and technical tools to understand the essence of the object he or she is studying. For example, the prospects of using ICT, electronic boards, e-books, the STEAM method, VR glasses, an electron microscope, an X-ray microscope, other 3D technologies, various programmes, etc. in teaching biology are undeniable. Interactive and constructive training, which has been widely applied in the field of education in recent years, should not be overlooked, and the methods, principles, and possibilities of these trainings should be used. Interactivity in interactive mode can help break the monotony and give impetus to cooperation, leadership, self-confidence, etc., whether in the classroom or in the audience.

The first of the difficulties encountered during the implementation of innovations in most educational institutions is the personnel potential rather than the material and technical problems. Taking this into account, I attended various trainings, webinars, and courses before starting the application of the STEAM method at Nakhchivan State University. I tried to teach biology with the possibilities of this method. We were satisfied with the result; the students enthusiastically accepted this method, the programmes they could use, and the creative activity. Compared to previous years, the students prepared smart visual aids, both in seminar-practical and laboratory exercises, and, for free work, assembled the products of their dreams in TinkerCad and printed them on a 3D printer. They prepared electrically equipped models of organs, organ systems, cardiovascular systems, smart irrigation systems, seeders, etc. (Babayeva, 2021) and started making plans for the future. Although some of the presented works are imitations, some are simpler versions, and some are fantastic, as a result, the students managed to achieve the integration of the knowledge gained from several sciences by analysing and synthesising. Looking at the results obtained for the first semester gives us hope that new methods and technologies will bring great achievements to the fields of science and education in the near future.

We must create conditions to increase interest in this subject and make it more attractive among those learning about the application of new technologies in teaching, especially in

teaching biology. Teachers should more responsibly develop strategies that can serve to increase the understanding, assimilation, and accessibility of biological knowledge for everyone. For example,

- The role and problems of scientific language in teaching biology to learners should be taken into account.
- Knowledge should be taught in an understandable language, not with abstract ideas;
- The socio-cultural level of the students should be raised.
- Visualisation should be given a special place in the teaching of the anatomical-morphological
- structure of living things, physiological processes;
- The problems encountered in solving the assigned tasks should be clarified.
- to create the necessary conditions for students to conduct experiments and to be open to innovations.

For the application of this type of methodology, all three parties—teacher-pupil, teacher-student, and school-parent cooperation—are needed. For this, it is necessary for parents to participate in some courses and trainings, like those for secondary and higher school teachers. Education and training should not be limited to schools; all members of society should work together in this work. During the teaching of the material, organising the question-and-answer interactive mode can also be considered an important strategy. How do I achieve this? First of all, keep in mind that asking questions with direct answers will only lead to repetition. When asking questions, both the integration of subjects and the development of logical thinking in the class and the audience should be taken into account.

The solution to this problem can be organised in a simple way in secondary school and in a more scientific and practical way in high school. For example, in secondary school, a table about the composition and importance of blood can include schemes that include the coagulation process, a picture of erythrocytes, a scheme of blood groups and blood transfusion, a microscope, micropreparations of leukocytes, schemes that reflect a leukocyte analysis of human blood, a multimedia presentation covering the topic, and video material. During question-and-answer and commentary, by showing charts and diagrams, the teacher can ask students who answer questions related to previous topics to use visual aids.

By listening to the teacher's explanation, students should acquire the habit of making independent observations on the pictures on the board. Questions can be about the following topics: The importance of blood circulation Characteristic features of the circulatory system at the lowest stage of evolution; Lymphatic system: the development observed in the circulatory system at the highest level of evolution; The importance of lymph in the body Changes in blood composition in large and small blood circulation Mechanism of large blood circulation Why does the human heart have two chambers? The reason for the exchange of gases in the small circulation, etc. Depending on the age and knowledge level of the class, the logical level of the questions can be increased or decreased. In higher school, of course, questions and assignments should be more complex, more logical, based on interdisciplinary communication, directed towards creativity, as required by the STEAM method, and prepared according to the highest level of student thinking.

Image 1.
Training on using VR glasses with high school teachers.

One of the most effective ways to learn and teach biology is through knowledge gained through experience. We discussed these issues during our meetings with teachers in high and secondary schools. They often complain that they don't have time to do practical lessons due to the large number of school hours and responsibilities required by the school. But when we suggested some ways to solve this problem, the teachers eagerly agreed. One of these ways, they agreed, is to assign experiments and observations as homework or as summer vacation assignments, which can also be scheduled at the end of the year when lessons are repeated.
One of the main conditions for the teaching of subjects is motivation. Interesting, surprising questions asked before teaching new material increase interest in the subject, the teacher, and the learning process. For example, before going over the topic of "digestion,", instead of "drawing an imaginary map" starting directly from the oral cavity to the intestines, it is possible to create a problem situation and convey interesting facts and events related to the topic as motivation. For example:

- Women like sweet food; men like salty food.
- The longest period of hiccups occurred during the life of Charles Osborne (1894–1991); he hiccupped for 69 years and 5 months from 1922. He was married twice and had eight children. He hiccupped every 1.5 seconds until he died.
- The longest endurance limit without food and water is 18 days. Once, the policemen forgot a prisoner in the cell on 01.04.79–18.04.79. He was already in mortal condition when he was found.
- The lightest person, L. Sarate, was 1.1 kg at birth, 5.9 kg at the age of 20, and 67 cm tall.
- The thinnest man—Edvard Hagner Pijon—was known as Skeleton, height 170 cm, weight 22 kg.

Creating more advanced, interactive methods of using electronic textbooks in classes and improving existing opportunities are also important strategies in the modern era. In addition to new information, electronic textbooks increase visualisation by widely using images and animations, creating ample opportunities for understanding, mastering, comparing, and repeating lessons. One advantage of e-books is that they have unlimited possibilities for use (Babayeva, 2020; Dyachkova, 2016). Interdisciplinary integration, the use of tables and

diagrams, histograms, diagrams, and anagrams, which we consider necessary strategies in teaching, are important in learning biology and in making connections between biology courses and topics. The use of interactive teaching methods (insert, Venn diagram, cluster, Bloom's taxonomy, etc.) removes the monotony of the learning process and raises the level of logical thinking. Teaching complex topics in biology with tables, schemes, etc. strengthens memory and develops critical thinking.

For example, in "Characteristics of Higher Nervous Activity" in the Biology teaching speciality at the university, before starting the teaching of "speech, consciousness, memory, and thinking", we created a problem situation by asking what the qualities of the mind are. Among the answers we received—independence, criticism, creative initiative, selectivity, etc.—we considered such qualities important. Then, as motivation, we discussed the main features of attention: concentration and resilience, which characterise passionate, enthusiastic people.

We also drew attention to:

- learning to work carefully in different conditions;
- the ability not to be distracted by external stimuli;
- the role of attention in the development of the continuity of attention in the upbringing of the will characteristics of a person;
- the role of attention in the formation of a person's internal discipline;
- learn the material in different ways, and Giving homework in different formats in the teaching process is considered important in developing students' intelligence.

For example, after we covered the topic of "interphase sharing of chromosomes, DNTs, and chromatids" during mitosis and meiosis, we gave them an assignment: instead of explaining what they learned verbally, students should explain the subject using different methods. Students who completed this assignment used tables, figures, and other methods. For example:

Issue 1. Graphs showing the phase distribution of chromosomes, DNA and chromatids during mitosis and meiosis:

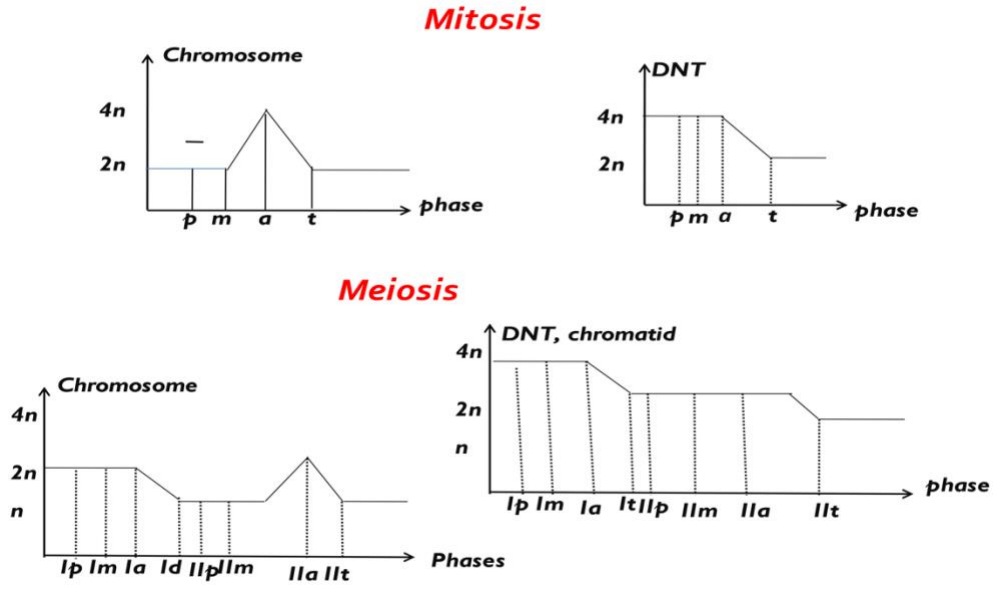

İmage 2.

Phase distribution of chromosomes, DNA and chromatids during mitosis and meiosis

Issue 2. After starting the presentation of the new material with this method, special interest in the subject and topic was awakened in the audience, the teaching process became more attractive. We continued the lesson with a scheme that allows us to explain the topic in detail:

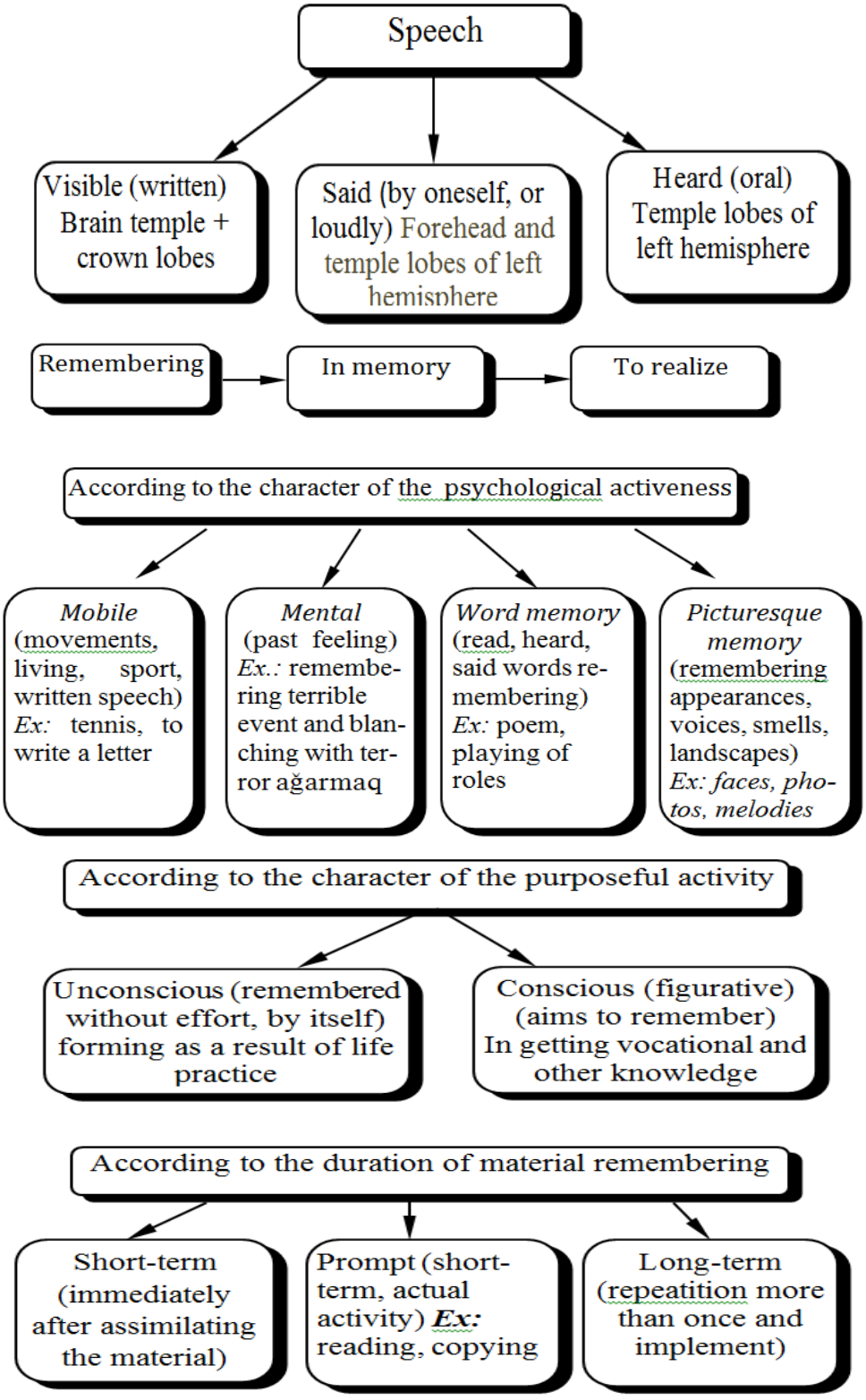

Figure 1.

Figure to explain the topic in detail

At the end of the lesson, the students had already confirmed the effectiveness of the new topic and method. It is known that the human brain has a system that performs many tasks at the same time. For example, a person can turn on a tape recorder while driving a car and control the steering wheel with ease thanks to the perfect structure in his brain. When listening to the radio, he fully understands what is being said and continues the conversation from where we left off. The most important thing is that we manage all these processes perfectly at the same time. These facts encouraged the audience to do further research on the given topic. Thus, the correct application of methods will lead to the training of researchers and new discoveries in educational institutions. Interdisciplinarity in teaching biology is important in the synthesis of knowledge in the learning process, in addition to developing the knowledge that learners receive from other sciences. It would be interesting to inform the students with interesting examples (Huseynov & Abdullayeva, 2012) of the existing communication possibilities in the process of teaching biology and to investigate the connection with natural sciences in other subjects.

Table 1. Interdisciplinary opportunities available in the teaching of biology

Topic	Chemistry	Physics	Geography
On the plants course: Flowering plants, their protection	Air and its composition. Air pollution		Consequences of anthropogenic impact on natural conditions and natural resources. Homeland and distribution of plants
On the course of man and his health: Cell, its structure and chemical composition	Organic and non-organic compounds, salts, acids, carbohydrates	Diffusion, osmosis	
Bone structure,composition	Calcium phosphate	Strength, mass, friction, flexibility, fragility, plasticity	
Digestion, study of the digestive process.	Organic and non-organic substances, isotopes. Labeled atoms	Isotopes, radioactivity, X-ray machine, optical devices - endoscope. Diffusion, osmosis, filtration	
General biology The first conditions for the creation of Darwin's teaching	Living and non-living nature consist of the same chemical element	Conservation and law of energy	Plants and animals of continents and natural zones
Geographical zonation of biogeocenoses.		The law of conservation of energy	Geographical zoning and altitude zones, the concept of "landscape"
Photosynthesis	Formation of H_2 and hydroxide ions, formation of carbohydrates, orbital, electron, free radical	Light quantum, photon, chemical effect of light, potential energy	

Students who use these examples will be more interested in learning new material compared to other subjects. We sometimes get interesting results by setting up a mind map for a given topic and preparing opportunities for interdisciplinary communication as free work or as a seminar assignment. The STEAM method is the most popular method of freelance work among students. With the multidisciplinary possibilities created by this method (TinkerCad, MikroBit, etc.), students prepare interesting works using 3D technologies related to various biology courses (Babayeva, 2023). Forms of interdisciplinary communication can be carried out with previous and current subjects and with those in related natural sciences. This connection performs the following functions in training:

a) the methodological function of training: to form modern ideas in learners by mastering the methodology about the unity and development of nature and the existence of objects of living nature (cell, tissue, organism, biogeocenosis, biosphere, etc.) as a self-regulating open system;

b) educational function: to systemically develop universal and special concepts in all sections of biology based on students' current knowledge of nature;

c) developmental function: reflects the role of systematic and creative development of students' thinking, activation of their mental activities, "analysis through synthesis" (S.L. Rubinstein), and generalisation of their knowledge;

d) educational function: to implement love for ecology, nature, sexuality, morality, labour, aesthetics, nationalism, and patriotism in the teaching of biology;

e) practical function: to improve the existing educational process, etc.

Specific methods in the teaching of biology also correctly direct the experiment to be carried out on living things as a research method. It refers to specific methods: Observation of biological objects and events; Measurement of organs and organoids; the effect of various factors on the body; Physical and chemical analysis of studying organisms; classification of organisms, etc.

In addition to higher schools, in secondary schools, different types of tasks should be provided to improve the knowledge of those who study outside of school or during extracurricular hours. Assignments to be given in biology should be specially selected and should arouse the interest of students. It is appropriate to include tasks for observation, practise, and experimentation. The results of the tasks given as homework must be checked and evaluated, and the most interesting tasks must be shown as examples.

The student will rightfully not take seriously the next task of the teacher who does not check the assignment. As the personalities of students continue to be formed during adolescence, encouragement plays a special role in their development and self-confidence. Teachers should always keep this fact in mind. He may be discouraged because his work is not appreciated. When assigning homework, opportunity, time, season, and conditions should be taken into account. Tasks that will develop thinking and repeat materials from various subjects can be given. For example, in the subject «Dicotyledons» (Babayeva, 2023), students can be asked to complete the following table in class as a free task:

Table 2. The main characteristics of some families of (dicotyledons) bivalves

Family	Flower formula	Fruit	Flower group	Representative
The cruciferous	$K_4L_4E_{2+4}D_1$	Acorn	Bunch	Cabbage, turnip, wild radish
The flower The aubergine The angiosperms				

During the filling of this table, students have to repeat the various topics of the Plants section and conduct research in virtual encyclopaedias (internet link). At this time, he is directed to study, gains new knowledge, repeats the lessons he has passed, and strengthens his memory by encoding the information he collects in the table through the visual analyzer. It should not be forgotten that teacher-student studies should be carried out in an interactive manner. In other words, it should lead to new, different, and controversial ideas. It is imperative that students respect that all educational programmes, examples, and presentations we use are not considered etalons.

Analysis

The most important task facing 21st century education is to train human potential that builds the future of society, solves the problems they face quickly and creatively, can compete with artificial intelligence, thinks about the fate of the planet Earth, has technological skills, programming skills, coding skills, and manages digitalization. Today's biology or medical students are already using digital resources as visual aids, learning biology through virtual and augmented reality.

Studying the body on a 3D model of the human body and learning knowledge of subjects in the virtual world with VR glasses cannot be compared with traditional methods. Experiments show that the organisation of the teaching-learning process based on the simulator of technology and the use of innovative methodologies in assessment and the teaching-learning relationship bring vitality to teaching and new achievements in the fields of science.

In order to successfully complete the research, the set goal should be clear, appropriate questions should be defined, and the problem-solving strategy should be chosen correctly. But what is the main way to do this? It is known that the answer to any question comes through research. That is, teaching methods in biology and research methods in biological science require special biological knowledge and skills for conducting experiments and observations. Conducting research should result in patience, responsibility, consistency, recording of facts, and comparative study of objects, along with knowledge and skills. In our modern era, the application of learning technologies in teaching has a positive effect on students' academic achievements and critical thinking tendencies.

We learned the value of technologies in the pandemic; online education, conferences, symposiums, forums, and webinars became priorities. With the help of technology, all areas of our lives have been saved from the danger of remote paralysis. In addition to clearly seeing the importance of programmes, the Internet, and digitalization during all our activities from a

distance, it also made it necessary to solve the problems we faced. Important education events and webinars were useful for all education professionals.

In the field of education, technology should mainly serve pedagogy, that is, learning. However, a proper strategy should be prepared in this direction as well. Because it is formal, template use will not be good for the quality of the work. Educational institutions in this field, being both educational and unifying as the centre, should strive for reconciliation between the parties and be open to the demands and suggestions of society.

Here we have to think deeply before making the final decision. How will the decisions made affect society? Opening discussions on these questions will benefit the common cause:

- What is currently happening between technology and humanity?
- Is innovation important in education?
- Will humanity be able to take great steps towards the future in this way? and so on.

It will be more useful for the interaction of the teaching and learning parties to solve the challenges and problems discussed in educational institutions in the form of debates, webinars, online and interactive surveys. In modern times, there are a number of qualities that are in demand in the field of education:

- Memory - that is memory problem;
- Application of new technologies in all areas of our activity;
- Creative, critical-logical approach to scientific activity, creative way of thinking, different application;

Politics in action, strategy waiting, research;

Parent-school cooperation, i.e. giving priority to working together;

Need for new energy, renewable energy, search for alternative energy sources;

Attachment to the land, studying the land, etc.

Having all these skills requires the ability to adapt learning environments to today's requirements, update them, reduce outdated methods, and predict tomorrow. Currently, the most important task of educators is to target the transformation of the given knowledge into ideas and production. We must teach the younger generation that the higher the goal, the higher the result. You don't need memorization to learn science, the idea we always say is: "learners need to be removed from the folder format where knowledge is copied" - to achieve this goal, updating in all areas is necessary. Since the 21st century is the age of speed and technology, we need people who do not learn information, but who creatively apply what they learn, who have the ability to reconstruct and deconstruct.

Especially in the teaching of biology, teachers should learn the essence of the STEAM method, which has gained relevance for the teaching process, and take care of the formation of 21st century skills in students. For this reason, in the class and homework assignments in secondary schools, issues such as developing their imagination, fantasy, creativity, and creating conditions for the realization of their free ideas have become relevant. Higher school biology and medical education opportunities should be of a higher research nature, in the implementation of free and course work, in the organization of seminars and practical exercises, in the Student Scientific Societies, the current problems of the time should be discussed, and the most modern technologies, methods and tools should be used to prepare works that will lead to the realization of a new idea.

Discussion and Conclusion

In order to both teach and learn the field of experimental science such as biology, it is important for biology teachers and teachers of natural sciences in general to know the methods and methods of teaching subjects, new training and teaching technologies, and to make maximum use of visualisation in teaching. Because non-traditional methodology develops creativity in the learning process, In the course of the research, when we took a long break while using new methods and technologies, we observed increases and decreases in different groups (Figure 1). This fact shows that when using any method, it is important to take into account the consistency and novelty of the method and methodology in the teaching process.

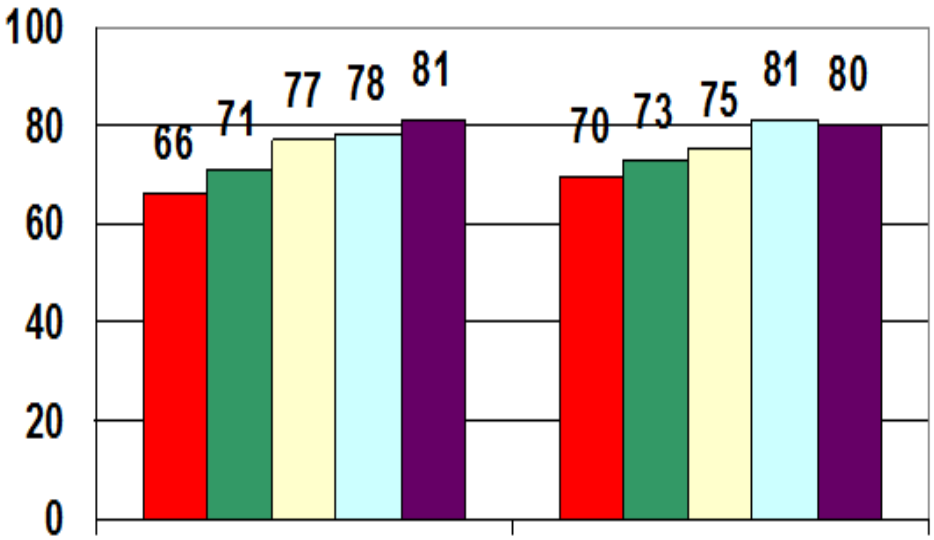

Figure 2.

Performance indicator in groups

As can be seen from the figure, the innovation applied in a few cases was not effective in teaching. During the research period, unlike a student who gets information from a textbook, like the structure of DNA and RNA, location of nucleotides in them, structure, etc., the knowledge and outlook of a student who learns physiological processes, structural features that cannot be seen by the eye from video material, multimedia from an electronic board, and using VR glasses cannot be the same. We determined through experiments that learning with new opportunities makes a fundamental difference in students' levels of mastery and biological knowledge, skills, and habits.

The main feature of modern methods is the development of educational technologies, including the inclusion of pedagogical technologies, computer technologies, audio-video recording, and modern computer programmes in education. The inclusion of such programmes and technologies in education in recent years has led to new discoveries in the field of science. Synthesising audio, video, and texts and actively using all kinds of activities in a single programme are among the achievements of today's world. This contributes to the development of high-level abstraction in students.

The use of ICT as a targeted project-oriented method through the use of computers and other ICT tools helps students more fully assess their own scope of consumption and responsibilities in the educational process. Visualisation methods such as mind maps, figures, tables, etc. are of great importance. A large part of the human brain is actually involved in the processes of vision and visual analysis (Babayeva, 2011). The use of multimedia presentations in biology lessons contributes to a deeper and more meaningful study of the presented topic. When using a multimedia presentation in the classroom for a biology lesson, the following methodological techniques can be applied: Starting from the topic "Plants," students should present general information in a comparative form and develop independent thinking and comparison. A multimedia presentation is not done automatically but under the guidance of a teacher, allowing you to steer learning in the right direction.

The use of educational technologies ensures the effectiveness of multimedia presentations and teaching methods. Experiments show that in the traditional teaching method, the information presented by the teacher during the lesson is assimilated by 11% of auditory analyzers, 83% of visual organs, and only 6% of sense organs. It should be noted that when different methods and technologies are used compared to traditional education, the load on the visual sensory organs increases, and auditory analysts practically do not participate in the learning process. The use of figures, tables, drawings, and formulas that enable us to present information in a compressed form in higher education helps teachers convey information.

During the long period of training biology teachers in higher education, we witnessed that this work is very responsible. For a modern school, a modern teacher, and a modern student, creative, flexible activities are required every year, different from the previous year. Realising this, the teaching staff is obliged to take care of their activities, the teaching process, and improving their knowledge and skills, realising that 21st century education is not only about teaching knowledge. In addition, the fact that different science teachers discuss some topics, do not use the same examples in classrooms and auditoriums, give preference to the exchange of experience, or organise open classes will lead to an increase in the level of scientific knowledge and skills and the number of researchers in that school.

Thus, 21st century education requires the training of a new generation of pedagogues and methodologists who possess the skills of digitalization, the application of 3D technologies to teaching, the promotion of design thinking, the formation of 21st century skills, and technological literacy.

The data used in this study were obtained from the studies of academics from different countries (Tümkaya & Ulum, 2019; Shaughnessy, Brazzolotto & Phelps, 2022; Gardiner, 2017; Langley, 2018). Most of these studies consisted of research articles, schoolbooks, and media publications. Our aim in all our research has been to process the teaching strategies required in biology teaching and to identify different and creative uses of technologies in education. In this study, the purposes of using visual, experimental, and modern technologies in biology education and the results obtained are discussed. We have achieved positive results in the use of modern technologies and modern education methods in biology education in universities and high schools, as teachers and researchers.

During the research process, it was determined that the teachers working in different education fields could not adapt to the new education level, technologies, and other innovations. In the research, we witnessed that students adapt to new technologies and methods more quickly. Of course, technology that is considered new these days is now considered obsolete in the morning. For this reason, it was determined that the technological skills of academicians and teachers should be perfected.

Our research and observations have shown that it will not be easy to keep up with rapidly changing technologies and different usage methods. For this reason, it has been determined that it is obligatory to participate in webinars, seminars, conferences, and online and offline tutorials in order to increase the technology usage skills of middle school, high school, and university faculty members. When the available data are examined, no study or factor has

been found regarding the access of the entire education sector to all modern technologies in education. It has been determined that the problem of the renewal of school technologies and natural sciences cabinets also exists in the whole sector. In this study, the changes in important education methods that emerged as a result of the analysis were also taken into account.

The recommendations and limitations of the study are as follows:

- One of the limitations of the study is that educational technologies are visualized rather than used in science teaching in some schools, and some teachers have conservative attitudes.
- Another scope of the research is that, as a result of the analyzes made, it has been determined that although some educational environments are modern technologies, this does not affect teaching. This is because teachers lack new technology skills to consider and educational strategies are underestimated.

The following suggestions were made within the scope of the research:

- In the study, it was deemed appropriate to monitor teachers' renewal of modern education methods and technological skills by the authorities in order to determine the necessary teaching strategies in biology teaching.
- It was deemed appropriate to discuss the views of educators with their colleagues from other education sectors with superior skills and to create a vision for the renewal and development of new education strategies through experience sharing.
- New generation educator-researchers can analyze the reasons for new education strategies in depth. Thus, foresight is created in the studies to be carried out to increase the knowledge and skills of the new generation teachers in the education sector.
- In order to support the education sector and to reach the educational innovations that started in the world, high councils, education guides and other relevant authorities should invest in faculty members. We need these investments to achieve new world-class performance from 21st century education.

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