

## INCREASE THE EFFECTIVENESS OF EDUCATION IN BIOLOGY CLASSES USING A DIGITAL MICROSCOPE

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### ABSTRACT:

**This article focuses on the role of digital microscopes in the organization of biology lessons today using modern information technology, digital technology tools and components to ensure the effectiveness of teaching techniques and technology in the process of rapid growth.**

**KEYWORDS: digital microscope, digital technology, digital economy, information technology, object, motivation, extracurricular activities, small group work, independent study, laboratory classes**

### INTRODUCTION:

At present, a new education system is being established in Uzbekistan, focused on entering the world educational space.

One of the powerful resources of transformation is the informatization of education - a purposefully organized process of providing the education sector with methodology, technology and practice for the creation and optimal use of scientific and pedagogical, educational and methodological developments focused on the implementation of the possibilities of information and communication technologies (ICT) used in comfort and health. Saving conditions.

Without the use of modern ICT tools, it is already impossible to imagine an educational process that meets the requirements of the modern information society. According to the Ministry of Higher Education of Uzbekistan, a number of requirements for educational outcomes are directly related to the need to use information technology.

Further development of education is associated with a deeper introduction of ICT technologies for the development of the cognitive ability of schoolchildren. Supporting the child's desire for independent activity, promoting the development of interest in experimentation, creating conditions for research activities are the tasks that the school sets itself today.

Working with a digital USB microscope helps to accomplish these tasks in biology lessons. Using a microscope in the classroom allows students to form and develop such key competencies as educational, cognitive, informational, communicative, and general cultural.

When studying natural sciences in a modern school, the clarity of the educational material is of great importance, which makes it possible to quickly and deeper assimilate the topic being studied, helps to understand difficult issues for perception, and increases interest in the subject. Often, equipment for laboratory work in biology is limited to light microscopes and a set of ready-made preparations or reagents. Therefore, most of the works are only descriptive. The availability of film and video materials on the topics studied also does not solve the problem, since it does not allow children to take part in the work.

The use of multimedia information resources makes it possible to significantly expand the training base, since it becomes possible to show the most complex biological, biochemical and physiological processes that occur in real time at high or low speed. At the

same time, an activity-based approach to teaching biology requires laboratory and practical work using living objects.

As can be seen from the requirements of the state standard, the subject of biology is quite complex and clear, it requires demonstration of processes, systems and patterns, which complicates the assimilation of the subject of biology by schoolchildren.

For several generations of schoolchildren and teachers, the principle of clarity was provided by a light microscope. One of the biggest difficulties in laboratory work with its help is the almost absent opportunity to understand what students actually see in the field of view of the microscope. The information revolution has also affected this educational technique. The use of new information technologies in the course of the natural science cycle significantly raises the level of learning with low motivation of students. But in the modern information space, the amount of information is huge, and the content does not always correspond to reality. The use of digital educational resources allows you to: radically change the organization of the learning process of students, forming their systemic thinking:

- To rationally organize the cognitive activity of schoolchildren during the educational process;
- To use computers to individualize the educational process and turn to fundamentally new cognitive means;
- To study phenomena and processes in the micro- and macroworld, within complex technical and biological systems, using computer graphics and modeling;
- To represent, on a convenient scale for study, various biological processes that actually occur at a very high or low speed.

Today, under the informatization program, schools receive digital microscopes that allow students to see something new, and

help the teacher competently organize a modern lesson. The indisputable fact is that the use of this device will significantly improve the visual-figurative base of the biology course. Working with a digital microscope allows you to penetrate into the world of small objects and their details invisible to the armed eye and realize the creative activity of children. The next generation microscope is an excellent tool for exploring the environment and your own scientific discoveries.

Digital microscopes are new, modern equipment for carrying out a variety of school research in the natural sciences. With their help, it is possible to carry out work, both included in the school curriculum, and completely new research. The use of laboratories significantly increases the visibility, both during the work itself and in the processing of results thanks to new measuring instruments.

#### **DIGITAL USB - MICROSCOPE - KIND OF INTERACTIVE EQUIPMENT:**

In the field of information and communication technologies, a new approach to laboratory and practical work is the use of a digital USB microscope (Appendix 1). The use of such a microscope in conjunction with a computer and a multimedia projector makes it possible to diversify biology lessons, making them more interesting and effective, it became possible to conduct lessons of higher quality and more interesting, especially laboratory work, interest in biological science and research activities has increased, since working with a microscope is one of the most favorite activities of students.

A digital microscope is an optical device adapted for use in school conditions, equipped with a visual-to-digital converter. It provides the ability to transfer to a computer in real time the image of a micro-object and a micro

process, its storage, including in the form of digital video recording, display on the screen, printout, and inclusion in a presentation.

The use of a digital microscope in school biological research gives a tangible didactic effect in terms of motivation to study educational material, systematize and deepen knowledge, develop students' abilities to acquire and assimilate knowledge. Using a digital microscope in conjunction with a computer allows you to obtain an enlarged image of the object under study (micropreparation) on the monitor screen (when working in a group or in classes with a small number of students) or on a large screen (when working with the whole class) using an external projection device, connected to the computer. Using the appropriate software, the subsequent work with the image is carried out: increasing and decreasing, changing the contrast and brightness, focusing on individual areas of the object under study, the ability to take a picture, a video clip. A multimedia projector allows you to display an image from a computer monitor on a screen, which makes it possible for everyone to observe the object of study.

Kena-a-vision digital microscope device.

The kena digital microscope I use for my work is a reliable product made by Ken-A-Vision.



#### **MICROSCOPE DIAGRAM:**

1. Shutter button
2. Head with camera
3. Foundation
4. Revolver (Objectives: 2x; 4x; 10x and top LED illuminator - incident light)
5. Battery compartment cover
6. Center bottom illuminator (transmitted light)
7. Silicone stage
8. Focus knob
9. Bottom LED light (button)
10. Top LED illuminator (button)
11. Handle and cable reel
12. USB - cable
13. To USB – connector

User-friendly classroom software with digital zoom, easy document orientation, drawing and annotation tools, and multi-camera support. AV4 is designed to work with Windows 7, Vista, Windows XP SP2 (or higher), Macintosh and Linux operating systems.

#### **Interactive whiteboard interface:**

The kena microscope can easily be paired with an interactive whiteboard (IWB) or tablet. Kena is compatible with both the included Applied Vision 4 software and IWB software.

#### **Characteristics**

Magnification: camera = 10x equivalent lens, lenses = 2x, 4x and 10x

Focusing: Combination knob with coarse and fine adjustment

Lighting: Ken-A-Vision® cold (LED) lighting above and below the stage

Weight: 1.5 kg

Silicone surface (slides remain in place, no need for clamps on the stage)

Using the camera

Although the kena is manufactured as a digital microscope with nominal magnification, it requires precise focusing when moving

objectives on the revolver from 2x to 4x and up to 10x.

#### **BASIC OPTIONS FOR INSTALLING A HEAD WITH A CAMERA:**

1. On the base as a compound microscope (for viewing glass slides). With a head with a chamber on the base and without a probe tube on the revolver, the program starts and the chamber functions.
2. On the base as a stereomicroscope (for viewing the surface of objects).
3. Using kena without base as a stereomicroscope / probe.

The kena can be used as a handheld microscope or "probe" outside the classroom or laboratory with a laptop, or while moving around the classroom to study objects not on the stage. This is possible due to the fact that the upper part of the microscope is removed, and when brought to the object, it works like a camera, giving magnification. In this case, focusing is carried out by tilting and approaching - removing. When you press a button on the microscope, we get a photo, when you press and hold it, a video is taken.

#### **USING A DIGITAL MICROSCOPE IN A BIOLOGY LESSON:**

One of the biggest difficulties that teachers face in biology lessons when working with a school microscope is that it is practically impossible to understand what the students actually see. As a rule, during the lesson, the microscope is in the middle of the desk, and students work with it in pairs. At the same time, it cannot be shifted - otherwise all the settings for sharpness and light get lost, and time and interest are lost.

The use of a digital microscope in conjunction with a computer allows you to obtain an enlarged image of a biological object on the screen of a personal computer monitor

or on a large screen using a projection device connected to a computer

The USB microscope can be used in the educational process at all stages of the lesson.

At the stage of knowledge control, the digital microscope makes the survey interesting and productive for students and teachers. This can be achieved if the known factual material is viewed in a new light, and theoretical knowledge is applied in practice. You can invite the student to identify a specific micro-preparation (for example, "Onion skin skin", "Geranium leaf skin"), choose it from several ready-made ones, consider and explain their choice to the whole class, which can check the correctness of the choice, since the results of the work are displayed. You can complicate the task by moving it from the object selection level to the comparison level. For example, determination and subsequent comparison of micropreparations of frog and human blood, micropreparations of epithelial and connective tissues, micropreparations of cells of the main tissue of the leaf pulp and the integumentary tissue of the leaf skin. This is how collective cognitive activity is realized, in the process of which the knowledge of all students is improved and several people have the opportunity to immediately receive marks.

At the stage of learning new material, demonstrating an object works much more efficiently than a drawing in a textbook or a table on a blackboard. For example, when examining the mouth apparatus of an insect, its limbs. When organizing laboratory work in a lesson, students working with light microscopes can compare the results of their work with the results of the work carried out by a teacher with a USB microscope in demonstration mode. The student sees on the screen the same picture as in the working field of the light microscope with which he works in the lesson. If the lab assignment involves the

preparation of a temporary remedy, several remedies from different students may be considered. At the same time, note the quality of their implementation, explain together with the children why some drugs did not turn out well enough and how you can correct mistakes, teach you to see the object (not to confuse it with air bubbles and other drug defects). This option is also possible: the teacher evaluates the quality of preparation of the preparations by all students from photographs taken with the help of a USB microscope, as well as evaluates the performance of various works when checking exercise books. At the same time, the teacher controls and directs the activities of the students.

At the stage of consolidating knowledge, students can be offered to compare the objects studied in the lesson to determine similarities or differences, systematize drugs from particular to general and vice versa, prepare the drug, photograph it and save it. The digital microscope not only allows students to see something new, but also helps the teacher to organize their activities competently.

#### **USING A DIGITAL MICROSCOPE IN LABORATORY WORKS:**

The objects of study can be parts of a flower, leaf surfaces, root hairs, seeds, their seedlings, various fungi (mucor, penicillus), and cells of various types of plant tissues. In invertebrates - any organs: limbs, antennae, mouthpieces, eyes, integuments (for example, scales of the wings of butterflies). For chordates - fish scales, bird feathers, fur, teeth, hair, nails and much more. Human biology - different types of tissues, structural features of cells. General biology - cells of prokaryotic and eukaryotic organisms, cells of different stages of mitosis and meiosis, germ cells. This is not a complete list of those objects that can be considered in the lessons. The use of a digital

microscope in biology lessons allows you to increase interest in the subject, improve the quality of education, reflect the essential aspects of biological objects, implementing the principle of clarity, highlight the most important (in terms of educational goals and objectives) characteristics of the studied objects and natural phenomena.

Laboratory work is usually carried out on an instructional card. The proposed instruction is a template that, when carrying out a certain work, is saturated with specific content corresponding to the object under study.

#### **INSTRUCTIONAL CARD:**

1. Turn on the computer
2. Connect the digital microscope to the computer and run the microscope program.
3. Test the backlight operation with the buttons of the upper and lower LED illuminators.
4. Consider slides at low and high magnification.
5. Take pictures of preparations at different magnifications (20, 40, 100 times).
6. Save the picture in your folder.
7. Present the results of your work to the whole class using a digital microscope.
8. Compare photographs taken with a digital microscope with photographs from Internet resources.
9. Make a conclusion about the possibility of using a digital microscope in laboratory work in biology.

#### **THE USE OF A DIGITAL MICROSCOPE IN OUTSTANDING ACTIVITIES:**

Research activities can be implemented not only in biology lessons, but also in extracurricular activities. Programs of elective and elective courses, circles go beyond the framework of basic education and include a large number of practical and laboratory work,

the implementation of which using a digital microscope will allow schoolchildren to feel like researchers in a particular field of biology. A student can become not a simple contemplator of the demonstrated materials, but an ally of the teacher in creating a collection of various biological objects.

Research and project activities of students have recently become very widespread and contribute to the development of intelligence and creativity of students. It is based on the independent, purposeful activity of students on a specific topic. Therefore, the use of a digital microscope is an integral part when working on research projects in the fields of cytology, histology and ecology.

#### **PROSPECTS FOR USING A DIGITAL MICROSCOPE:**

The use of computer technology in the classroom is of great importance in modern education. Such a school discipline as biology is closely related to a wide range of use of various methods and means of teaching, since its main task is to reveal to the child the laws of the development of living nature. And digital microscopy will help to solve this problem. The use of a digital microscope in biology lessons is one of the newest promising areas of application of information technologies in modern schools. This contributes to a more durable assimilation of knowledge, forms an information culture among students, arouses interest and increases motivation to study biology, the educational process becomes more accessible, visual, and interesting. Students are happy to be involved in the work in the classroom, they master the material better, and the quality of their knowledge increases.

The use of a digital microscope in the educational process is aimed at:

- Increasing the level of motivation and cognitive activity of students;

- Conducting laboratory and practical work in the classroom individually, in a group method and frontally using a multimedia projector;
- Organization of research and project activities of students;
- Implementation of the tasks of intellectually oriented pedagogy as a means of development and self-development of gifted children in ICT - a rich environment;
- Changing the ways of interaction between students and the teacher in the course of joint educational and extracurricular activities

#### **ADVANTAGES AND ADVANTAGES OF A DIGITAL MICROSCOPE:**

- The possibility of studying the object under study not for one student, but for a group of students at the same time, since without additional transformations of the microscope, the observation results are displayed on the monitor screen or demonstrated on the board screen using a multimedia projector;
- To carry out a full and high-quality work, it is enough to use only one microscope on the teacher's desk;
- The possibility of demonstrating a micropreparation, if it is in the teacher's possession in a single copy;
- Autonomous lighting and high magnification allows you to work in transmitted light, which significantly increases the list of objects for microscopy;
- Accurate reproduction of the shape, border and color of the object;
- Performance of a variety of delicate works;
- Preservation of intermediate and final research results;
- photographing the displayed object; the ability to make photo captions in Photoshop;
- Transmission of observation results over a distance;
- The ability to use computer analysis methods and image editing;

- Study of the object in dynamics. One of the advantages of the microscope is the possibility of video filming to display the intermediate stages of long-term experiments, when it is not possible to show transformations in real time (for example, the process of seed germination). It can also be used to demonstrate the movements of various objects;

- As a result of working with a digital microscope, it is possible to embody one of the most important principles of studying natural sciences - the principle of visibility.

Recommendations for the safe use of the microscope:

- Do not expose the microscope to moisture. Using the microscope in high humidity conditions will cause the device to stop working;

- Use the microscope only within temperatures between 5 ° C and 50 ° C. A sudden change in temperature can form condensation in the device. When moving the device from a warm room to a cold one and back, do not connect or use the device for half an hour;

- Avoid touching the lens;

- Strictly observe the time limits for working with a digital microscope, taking into account the load on the visual apparatus;

- White LEDs that illuminate the displayed area are very bright. Do not look directly at them, as this can damage the eyes;

- Do not disconnect the microscope from the USB port when the LEDs are on. This can cause information loss or electrical circuit damage. After finishing work, be sure to close the program and then turn off the device;

- The transparent plastic stopper can sometimes get dirt or poisonous substances from the surface of the test material. It is necessary to avoid contact with skin and mucous membranes, be careful;

- When working with a digital microscope, take into account that images may be indistinct, blurry (especially at high magnification);

- Supplement the work with a digital microscope with photographs obtained from Internet resources;

The use of a digital microscope in the study of biology saves educational time, contributes to an increase in the efficiency and information content of the lesson and the transition from reproductive transmission of knowledge to intensive creative discussion with students, conducting joint research, and carrying out independent research projects of various levels of complexity.

Equipping classrooms with computer technology and using it in the classroom are becoming mandatory attributes of the 21st century School. A digital microscope will help to effectively use a computer in biology lessons.

#### **DIGITAL MICROSCOPES IN THE EDUCATIONAL PROCESS ALLOW:**

- To enlarge the objects under study, placed on the subject table, 20, 40 and 100 times;

- Use both transparent and non-transparent objects, both fixed and non-fixed, as investigated;

- Study the surfaces of large enough objects that do not fit directly on the stage;

- Take pictures, as well as make a video recording of what is happening by pressing the appropriate button inside the program interface;

- Fix the observed without worrying about its safety at this moment (files are automatically placed on the hard disk of the computer);

- Make the simplest changes in the obtained photographs without leaving the microscope program;

- Put signatures and signs, copy parts of the image;

- Print the resulting graphic file in different modes;
- To demonstrate the objects under study and all actions performed with them on a personal computer monitor and / or on a projection screen;
- Study the object under study not for one student, but for a group of students at the same time;
- Use images of objects as demo tables to explain the topic or when interviewing students;
- Study the object in dynamics;
- Apply multilevel assignments for students of the same class;
- Create presentation photos and videos on the topic under study;
- Use images of objects on paper as a handout or reporting material.

When using digital microscopes, it becomes possible to:

- Better quality, it is interesting to conduct laboratory work and achieve the desired results (pictures from digital microscopes are visual, available to every student);
- To increase interest in biological science, prospecting and research activities;
- To intensify the work of students in the lesson. Promote the development of cognitive, informational and research competencies;
- Increase the level of motivation of students;
- Resolve the issue with the lack of light microscopes and handouts (micropreparations) during laboratory work;
- Change the traditional approach to laboratory work; Conduct practical and laboratory work individually, frontally and in groups;
- To move from reproductive to creative transfer of knowledge, to systematization and deepening of knowledge;
- Work with a digital microscope or various software products should in no way replace the classical methods of working with natural

objects, herbaria, and light microscopes. You need to understand that this is just one of the methodological techniques that allow you to diversify the lesson.

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- 6) <http://www.myshared.ru/slide/9958>
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