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Methodology For Integrating Educational Subjects Based On Electronic Devices Created In Engineering Education

Adilov N. Kh.
Is a senior teacher of the department of Chemical technology of the Jizzakh Polytechnic Institute, Doctor of Philosophy (PhD) in pedagogical sciences

Annotation. Knowledge of the principle of creation and operation of didactic electronic devices in the article presented the results of knowledge and practical experience obtained from teaching physics using the interdisciplinary integrated STEAM educational methodology.
Keywords. STEAM, Engineering, Materials Science, Electronic Device, Integration, TV, computer, anode, cathode, electrical discharge device.

It shows the need to further develop the higher education system, to ensure the maximum implementation of individual professional development in the training of competitive engineers, mastering the sciences.

Improving the production readiness of future engineering personnel is of great importance for the economy of our country, and they need to learn an integrative approach to the use of modern equipment with high production efficiency.

The theory and methodology of the integration in one way or another are considered in the scientific works in the design of the educational building, but there are no technological tools for its implementation. M. N. Riskulova [1] developed a methodology on the example of the University of Architecture and Civil Engineering.

Many special materials are used in electrical engineering, power generation, radio and electrical engineering, and related industries. Knowing the principles of creating and working electronic devices from these special materials, in the study of physics, is necessarily based on the knowledge and practical experiences gained from teaching using the interdisciplinary integrated STEAM educational methodology. X-ray devices are used to check the quality of the material during the production of refractory mirrors and silicate materials.

The organization of classes using the STEAM educational methodology reveals the principles of operation and practical importance of X-ray devices and similar electronic devices. In order to effectively use the interdisciplinary integrated STEAM educational methodology, it is necessary to have information about the special properties of materials, that is, mechanical properties, electrical conductivity, electromagnetic and other properties.

The analysis of the current situation of the practical application of pedagogical technologies in the educational process shows that today the most developed field is the teaching technology that describes the way of mastering specific educational material within a certain educational subject, didactic topic or question [2].

1. Methodology of teaching using the STEAM educational methodology based on the created device:

STEAM Science

Science (Physics) subject "Properties of electric charge" on the example of charging when an ebonite rod is rubbed against a material (for example, fabric) and preparation of an electric arc device and an electric discharge device for practical visual observation of these properties (i.e. design of a device that can be observed in practice).

STEAM technology

Computer, radiometer, thermometer, television, interactive board, video devices. These devices are used in the preparation of an electric arc device and a discharge device.

STEAM Engineering (Materials Science)

The mechanical, electrical and electromagnetic properties of materials from the science of materials are initially studied theoretically, and an electric arc and an electric discharge device are prepared for the

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purpose of practical study of the obtained theoretical knowledge. In the created electric arc device and electric discharge device, the magnetization of materials and electrical perforation of insulator materials, electron diffraction, and mechanical properties of materials (heat effect) are observed experimentally. In this way, a practical understanding of the working process of the electric arc furnace used in steel production plants will be gained.

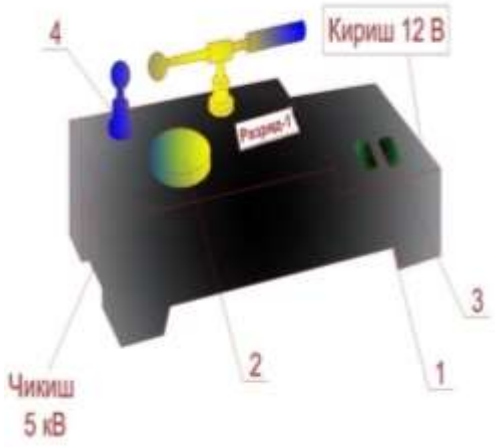
STEAM Art for art

Creativity and design. The design of the created electric arc device. An image, a drawing of the device is drawn, and on this basis, a model of it is made from insulating materials, and then the decoration works, that is, the design of this innovative-new electric arc device, are performed.

STEAM math

The cost of the created electric arc device, the cost estimate is made. For example, the mass is measured in kilograms, and the dimensions of the boxes are measured in mm. First, they study special technological electronic devices that are actually produced in the classes.

Application: applying knowledge in practice. For example, performing labor operations, applying the learned knowledge in new situations.



Pic 1.

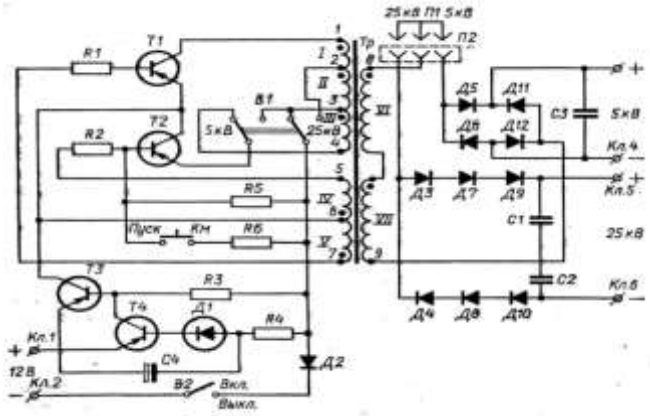


Рис 2.

High voltage transformer device used in school. ("Razryad 1").

This device generates voltages from 12 V DC to 5 kV or 4-25 kV. The maximum power consumption of the device is 20 watts. As can be seen from the schematic diagram, the device consists of four units: an alternating current generator, a high-voltage transformer, a rectifier and an electronic protection unit. The generator is built according to the push-pull scheme of two transistors T1 and T2 and converts the direct voltage into an alternating voltage. And consists of transistor T3 and T4 and diode D1 and D2, resistor R3 and R4. Practitioners are required to:

1. Know the principle of operation of the devices used;
2. Knowledge of basic technical data and operation of devices;
3. Knowing how to explain physical phenomena observed at work;
4. Know safety rules when working with devices.

Based on the study of this device, it will be possible to make our own electric arc electronic device in a simple version based on the drawing from TV or computer parts (Figure 2.3.5).

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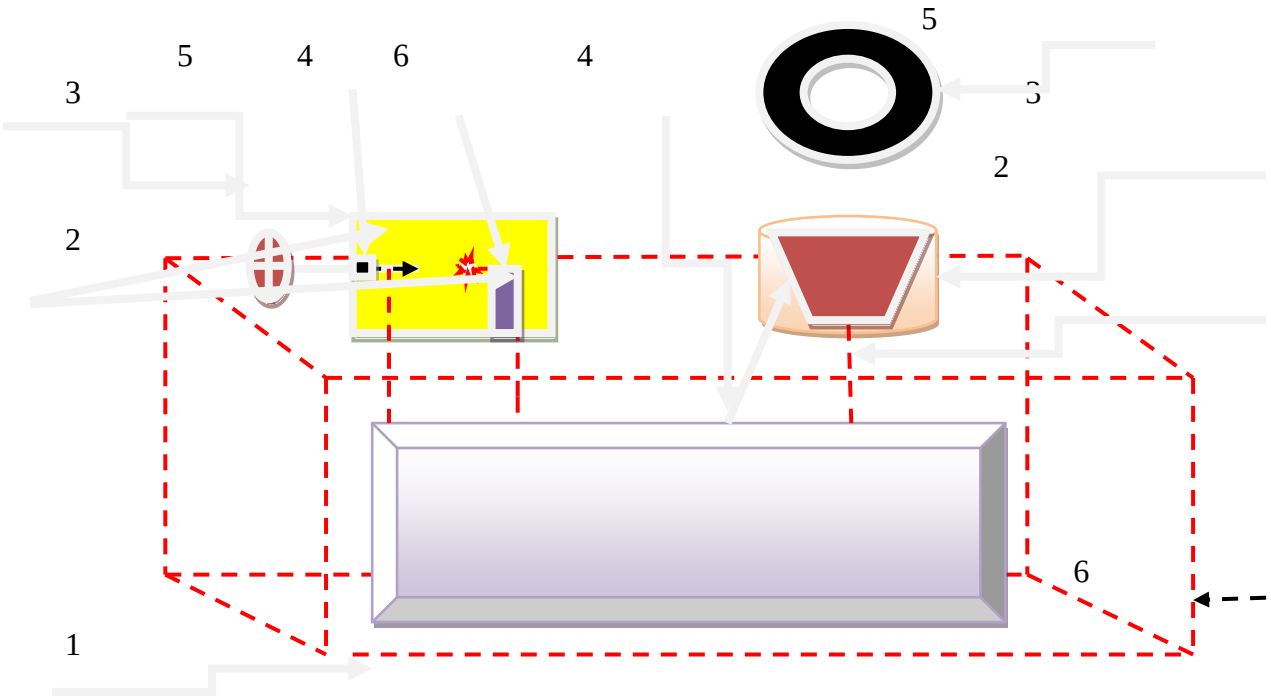

3 - расм.

Depending on the process that takes place here, we can say that the one marked in yellow is a discharge device and the second one with a black cap is an electric arc device. It is a combination of two separate devices.

1- In the drawing of the yellow device, 1- the internal chassis of the TV, 2- the anode and the cathode of the chassis connecting to the TV screen, 3- the lever that moves the anode and cathode closer and further apart, 4- the nut that holds the lever, 5- the insulating outer covering of the device, 6- a metal plate fastened to strengthen the cathode.

2. The red drawing also shows the elements related to both devices. 1. TV internal chassis, 2. Anode contact connecting to the TV screen, 3. Isolation device for placing the electron emitter OS, 4. Electron emitter coil, 5. Electron emitter coil glass cover. , 6-box for placing the elements of the general device. One of the simplest methods is to remove the TV or computer screen and replace it. With plastic materials, a remote device is made by bringing the anode and cathode closer to the top of the TV, and the electric discharge device is ready. The screen electron emitting coil obtained for making an electric arc device is placed on the top of the TV, and instead of the screen, an anode connecting to the screen is placed, and thus a cheap simple didactic electronic device is made.

Voluntary idea, which serves as the basis of teaching technology, ensures optimization of the didactic process in one way or another as a result. Ishmatov K [3]., Ishmuhamedov R [4].

Borisova N.V. [5] In today's pedagogical and psychological theories, the activation of students' practical skills is approached as the basis of the didactic process. This process requires the organization of students' actions aimed at understanding and solving specific educational problems, and the use of innovative methods and methods.

Below, as a result of our many years of creative research, we have created a 25-square-meter didactic electronic device from TV and computer parts to implement interdisciplinary integration in the essence of the STEAM educational methodology.

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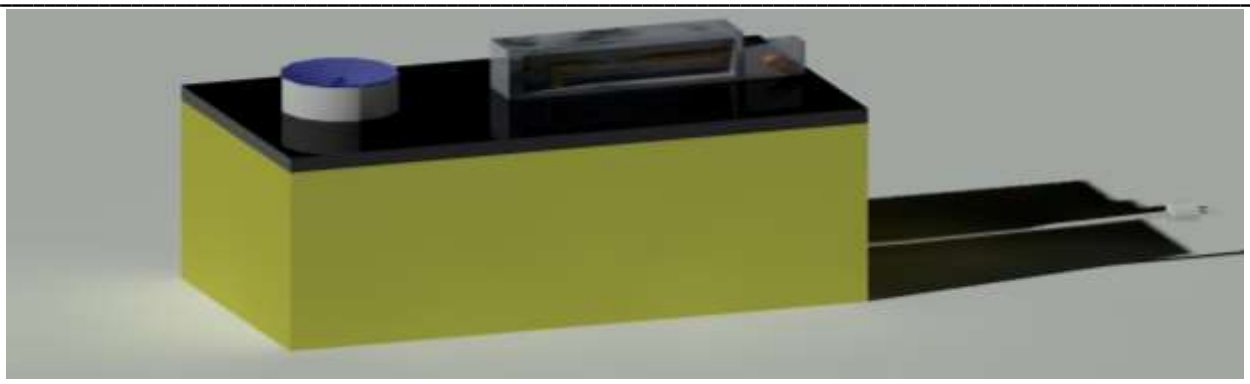

4 – picture. Created high-voltage universal teledevice structure.

On the basis of the use of didactic artificial-electronic devices, the students' interest in the integration of electrical engineering, physics, material science is increased and the study process is directed to scientific and creative activities.

A number of scientists are of the opinion that the development plan of research thinking shapes the teacher, his cognitive activity in general, as well as develops his outlook and knowledge, the practical orientation of the intellect.

An integrated course is a special course that combines learning from two or more subjects in the study of a single concept or common topic. Such classes should be extremely well thought out at all stages, creating favorable conditions for the student and increasing the success of studies.

On the basis of kinescope televisions, processes such as discharge, streamer, electric breakdown of dielectrics in physics from high voltage (17 kV-30 kV) between their anode and cathode are studied. In order to create the opportunity to determine the electrical resistance (E=U/h; kV/m), the shear current (Isi=Ir-Ir.abs (A), the difference between reactive and reactive absorption currents) of solid and liquid dielectric materials, students are given interdisciplinary integrative knowledge

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