Development of new interactive methods suitable for teaching semiconductor relays

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Abstract. In this article, the issues of improving the quality of education require special attention in all countries of the world, the problems arising in this regard are noted. The article says that there are different approaches to teaching in educational processes, it is necessary to completely abandon traditional approaches or to integrate these approaches with innovative, modern approaches. According to this, proposals were made for modern students to use exactly the methods of teaching suitable for them. This article is written based on existing pedagogical technologies and interactive teaching methods that serve to improve the quality of education and are more suitable for teaching students, and a proposal is made to create new interactive methods suitable for teaching technical sciences.

1 Introduction

Today, the field of science and technology is more important than ever. Especially in the age of technique and technology, the achievement of innovative achievements, the creation of new inventions and manufacturing products depend on thorough pedagogical knowledge and quality educational processes. Because the result of quality education is a qualified specialist. Quality education is conducted and formed in educational institutions. The correct organization of educational processes requires activities based on a targeted plan. The result to be achieved in the educational process requires thorough knowledge and pedagogical skills. The goal of education is achieved only when the teacher delivers the knowledge and skills to the learners with pedagogical skills. It can be seen that in the educational processes, the student requires a well-developed pedagogical approach in the lesson processes from the teacher to teach young people. This shows the need to accelerate scientific research in the field of pedagogy.

2 Literature review

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corresponding complexity can be observed in this process. The problem is to solve this complexity, that is, to create new interactive methods suitable for teaching technical sciences. Several scientists and independent researchers have conducted scientific work on these issues, and we will dwell on them first. The best ways to increase the effectiveness of education are a modern approach to education and the establishment of interactivity in educational processes. The wider introduction of information technology tools to the teaching process, integration of subjects, use of modern educational technologies, and preparation of training manuals based on the latest information on innovation and technical achievements affect the growth of students' intellectual potential (Abdulvosievna, 2021).

To train new specialists in technical areas, it is necessary to organize the correct approach to educational processes and to develop modern and modern educational programs adapted to the times (I. Kravchenko, et.al., 2016).

For the development of the teaching of technical sciences, the issues of competence of pedagogical personnel and their level are important. In particular, it is necessary for pedagogues teaching technical subjects to have pedagogical knowledge and skills. To ensure quality educational processes, strengthening relations with technical production enterprises in technical fields helps to strengthen theoretical knowledge from a practical point of view (Воронина, 2021).

Teaching processes related to project, creative, and practical activities in technical higher education institutions show the need to create a free environment for students with independent thinking. The development of competence issues among students in every direction is becoming a need of the hour (Rasulova, 2021).

A.Y. Krasnopolsky in the course of his scientific research, reflected on the effect of integrating technical disciplines with continuous production, noting precisely the existing problems and solutions in teaching in the areas of electrical engineering (Krasnopolskiy, 2003).

In pedagogy, the concept of "method" is used in the sense of a method, a way, and it is used to create concepts such as teaching methods. There are traditional and new approaches to education based on pedagogical technologies and teaching methods. Traditional teaching involves the largely one-sided approaches that have been used in the past, in which the teacher plays a central role. According to him, only the teacher's opinion and views are important in this approach. Modern approaches to educational processes put the learner at the centre. In such an approach, the student's activity, thoughts, and even conclusions are important (Alvin, 2001) (Kasimakhunova, 2020) (Shakhodjaev, 2022).

There is a two-way approach to educational processes, which is called interactivity. In such lesson processes, the teacher and the learner participate together, and both sides are equally active. Interactivity will put an end to dictation and individual management in existing lesson processes. Learning processes based on interactivity are among the types of modern approaches. Approaching educational processes with modern methods serves to form students' independent thinking and ability to apply acquired knowledge and skills in practice.

According to him, in the interactive methods used for teaching in the lesson processes, it is necessary to take into account the modern technical achievements, the effective use of information technology visits, and the requirements of today, following the students of this era.

Y.V. Bondarenko in his scientific research, proposed the effective use of information communication tools in the teaching of technical disciplines (Stupina, 2009).

In order to achieve quality results in educational processes, first of all, based on the topic and content of the lesson, pedagogical technologies should be selected accordingly. Effective use of pedagogical technologies and interactive methods requires pedagogical skills from the teacher. Pedagogical skills are formed during the activity of each teacher. According to the pedagogical skill, the teacher conveys the concepts of the subject to the learners with clear
3 Teaching methods

The use of effective methods in the teaching of technical sciences lays the groundwork for technical inventions and economic development. Complexity is encountered in the process of understanding formulas and schemes in the process of teaching technical sciences. Especially students of intermediate level of knowledge may not understand formulas related to the topic of science, in the old, traditional way of teaching. A student stops receiving information as soon as he encounters a misunderstanding or difficulty in understanding the processes of the lesson. If the student gets stuck in such a process, it will reach the state of completely not understanding the subject. Therefore, when organizing lesson processes, the teacher should take into account the features of information reception of all students when choosing methods of explaining the topic. At least, it should be taken into account that there are students who are not interested in the field and have little residual knowledge in receiving relevant knowledge (Королькова, 2009), (Khairnar, 2015), (Krayevsky, 2007), (Vlachopoulos, 2021), (Polat, 2008).

The interactive methods that should be created for teaching technical subjects should be able to reflect the following aspects:

- Special attention should be paid to the issue of interactivity in the created interactive method;
- Each method can interest students in the process of the lesson, regardless of their level of knowledge;
- The scheme of the explained device, the principle of operation and the choice of a simple method of formulas;
- The interactive method allows students to use all their senses during use;
- To create conditions for remembering and applying the subject in practice;
- Develop learners' independent thinking while using established methods and mastering concepts.

We will pay special attention to the aspects proposed above. According to him, interactivity, cooperation and consensus are considered very important in the course of the lesson, and during the use of newly created methods of teaching, there should be equal activity in the participation of the teacher and the student.

In the second aspect, the level of knowledge of students studying in the same direction and the same group is not the same. Some students understand the subject directly due to the presence of more residual knowledge and a higher speed of comprehension. In other students, the lack of residual knowledge limits the processes of understanding the subject. This increases students' attention to the lesson, along with a lack of interest in the subject. Therefore, the created method should attract all students equally and arouse their interest. Because if the student does not want to observe, listen and learn the subject during the lesson, the result will be ineffective. The issue of choosing a simple method of the device scheme, working principle and formulas, which are explained to the topic through the interactive method that is being created, is important in its way. Because complexity in the process of explanation makes the process of receiving information difficult for learners. Students easily give up on the subject due to a misunderstanding or a stressful situation. When the topics are explained in simple ways, the information seems light to the student. Especially, if the formulas related to the topics are explained in a simple way, with life-like comparisons and...
4 Application of the method
We will experiment with the application of the proposed "I know it - I like it" method in technical sciences. According to it, technical sciences are the main speciality subjects taught in higher technical educational institutions in the field of energy, and we pay attention to the use of interactive methods in their teaching processes. The topic of quality indicators of electric energy is constantly studied in the special sciences related to the direction of electric energy, and attention is paid to the solutions to the problems in this matter. Therefore, we choose the subject to be taught: "Quality indicators of electric energy". According to the purpose of this subject, first of all, the student should study the causes and consequences of the quality indicators of electricity. For example, the theory related to the science topic is explained regarding the increase in the amount of current in an electric circuit and its result. According to it, electrical circuits have specific voltages according to the relevant standards, and currents are based on Ohm's law. A change in the current in the electrical circuit from the nominal or permissible value leads to a violation of the quality indicator of electricity. Such situations cause abnormal situations and accidents in electrical circuits, breaking the nominal regimes. When a short circuit occurs in electric circuits, the value of the current increases several times. To explain the above-mentioned part of the topic to students in a simpler way, we will select similarities that even a special student can imagine according to the "I know it - I like it" method. These similarities can be shown through pre-made pictures or videos through information technology tools or using the classroom blackboard. Let's compare the results of normal and variation of the current value to a 50-kilogram bag. Students can easily visualize the bag. When the product is placed in a bag with the specified amount, that is, 50 kg, we can see that the location of the product is good, the appearance of the bag is good, and it can serve for a long time. If 72 kilograms of product are placed in a 50-kilogram bag, it can be observed that the bag is stretched and the material of the bag can become thin. If the product is 90 kilograms, the bag will be damaged. To explain the above similarities, the "I know it - I like it" method is used. This method creates interactivity during use. The method makes it possible for students to remember with great interest due to the fact that a simple method of teaching is used. This method can be used orally, using computer technology and using blackboards in classrooms. Allows students to think independently on the topic. Possibilities of the "I know it - I like it" method.
kilograms, we can see that the bag will be punctured, the product will be wasted at first and the bag will become unusable. Abnormalities may become more serious if the product inside our bag or another type of special product container causes a fire or spillage to create a hazardous situation.

Fig. 3. Arrangement of different quantities of products in a 50 kg bag

According to the topic, if the amount of current in the electric circuit exceeds the specified value, the formation of short-circuit currents can lead to accidents, damage to the electric circuit, failure of electrical equipment, and waste of electricity. The analogy is apt. From the moment you start explaining with such similes, it attracts students' attention, arouses their interest and makes it possible to remember.

As we know, it is not always guaranteed that normal conditions will not occur in power networks. Therefore, since the role of relay protection devices is significant in preventing accidents in electrical networks and electrical equipment, and providing consumers with constant quality and uninterrupted electricity, these devices are taught as a separate subject in the fields of energy. As digital devices occupy all aspects of science and technology, digital devices for relay protection and automation are being produced and put into practice. Taking this into account, when teaching this subject, we should improve the teaching of digital devices of relay protection. We will try the interactive method that we offer above, focusing on the topics of teaching this subject.

Semiconductor materials were the main reason for the creation of digital devices for relay protection. Therefore, we will start by explaining or reminding the students what semiconductor material is. According to electrical properties, electrotechnical materials are divided into 3 types. Having given a theoretical understanding of this, we will move on to comparing these concepts according to the "I know it-I like it" method. Conductivity materials are divided into conductors, dielectrics, and semiconductors, differing by their relative resistances and the number of free electrons, allowing each asks imaginatively students to pass through 3 different turbo lanes. So, a path with various obstacles was chosen for comparison. As the resistance on the conveyor belt is very low, the student can easily pass through it. A student stumbles across a semiconductor corridor whose resistance is slightly greater than that of a conductor but less than that of a dielectric. A dielectric strip with a high resistance has little space to pass through, and it is possible that it will not even fit into the strip. The student imagines the obstacles in the corridor as resistance or imagines the corridor in the school building and imagines the process of crossing it if the stars are typed as resistance. In the imagination, the student will act as an electric current.

If the student participates in the topic with interest, he will quickly understand it. He tries to actively participate in the course of the lesson with the questions that come to his mind. Using such a comparative method encourages all students to understand the subject with interest. Even the student concludes that the dielectric material does not conduct electricity.
When the topic of relay protection and automation digital devices, microprocessor devices is passed to students, it should be noted that many of the modern devices we use are microprocessor-based. Digital devices of relay protection meet all requirements for relay protection at a high level. Because it is fast, reliable and multi-functional, the interactive method “I know it—I like it” can be used in the teaching of these subjects. According to him, we liken the principle of operation of digital devices of relay protection to an eight-legged animal (octopus). Because eight legs can quickly control all legs through one brain. It does not need outside help to control any of the eight legs, it controls it with its brain. By performing the functions of his brain through his legs, he finds the opportunity to be nourished and protected. Microprocessor relays are also faster, more reliable, and more compact than basic electromechanical relays, and are designed to perform multiple functions. It will be more understandable if this topic is explained with the theories related to this science and the imaginary situation chosen for the method is shown. For this goal, drawings suitable for this topic can be prepared and shown to students using computer tools. They can add animation to the drawings they know, using the possibilities of information technology. This process also causes students to expand their imagination.

Explaining the principles of operation of microprocessor relays through the interactive method “I know it—I like it” solves the complexity of receiving information for the student. The correct selection of existing pedagogical technologies for teaching subjects in technical subjects or the use of interactive methods suitable for teaching technical subjects will have a great effect. The interactive method “I know it—I like it” can be used in all technical sciences. Especially, if the student connects the processes he knows and imagines to the topic, his activity increases. Gives a sense of intellectual freedom to science during the lesson. Because a student will gain knowledge only when he is interested in learning.

Fig. 4. Image to explain semiconductor material

Fig. 5. Multi-purpose eight-legged drawing
5 Conclusion

Improvement of teaching in higher education institutions, and training of skilled personnel creates a foundation for the future of every country. However, improving the quality of educational processes depends on the correct and effective use of existing pedagogical technologies, especially on the development of new interactive methods suitable for each era.

Taking into account the expansion of technical achievements in each country, the development of interactive methods suitable for teaching these technical sciences should be increased, taking into account the fact that they are formed from the teaching of technical sciences and the dedication of knowledge and skills acquired by students to research.

Therefore, the ability of all students to accept and apply complex concepts and information that can be encountered in technical subjects is evaluated by how the subject is delivered by the science teacher. The interactive method "I know it - I like it" proposed above serves as a solution to such problems. This shows that we should not stop scientific researchers in the field of pedagogy, but we should not stop working on the youth of this era, following the directions of education. Because quality education is the guarantee of a great future.

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