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APPLICATION OF THE "VENN DIAGRAM" METHOD IN TEACHING NUCLEAR TECHNOLOGY IN HIGHER EDUCATION INSTITUTIONS

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Abstract
The Venn diagram method is a graphic organizer used to visually compare and contrast two or more concepts, emphasizing their similarities and differences. Its integration into lecture-based instruction within the discipline of nuclear technology holds significant potential for addressing contemporary pedagogical challenges. As a component of modern pedagogical technology, the Venn diagram method contributes meaningfully to enhancing educational quality by promoting learner-centered, outcome-oriented, and reproducible teaching practices. Unlike traditional didactic approaches, pedagogical technologies emphasize active student engagement, conceptual understanding, and the practical application of knowledge. This paper examines the pedagogical value of incorporating the Venn diagram method into lectures on nuclear technology, particularly in the context of medical applications such as computed tomography (CT), magnetic resonance imaging (MRI), and X-ray diagnostics. While this method has been employed in various disciplines—including language instruction, teacher education, mathematics, and physics—its use in nuclear technology education remains underexplored. The study presents an applied model for implementing the Venn diagram technique in specialized coursework, demonstrating its effectiveness in improving student comprehension and interdisciplinary integration.

Keywords: Nuclear technology, Venn diagram, medical imaging, CT, MRI, X-ray tube, pedagogical technology, graphic organizer, higher education, specialized instruction.

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Introduction

As stated in Resolution № PQ-5032 dated 19.03.2021 "On improving the quality of education and development of scientific research in physics", "Ensuring the integral connection of scientific research in physics with medicine, expanding the scope of scientific work in all areas

of medicine, problem solving, further increasing the practical significance of measures to control the effectiveness of innovative research" [1].

"Nuclear technology" is an interesting science that combines modern medical equipment with processes such as diagnosis, treatment and laboratory analyses. This is because devices ranging from radionuclides to accelerators are widely used in medicine. Observations have shown that the majority of students who do not understand the subject and do not have skills in the teaching process do not ask questions to the teacher [2].

If the student has mastered a new subject by asking the teacher about the part he/she does not understand during the lesson, he/she will improve his/her skills and abilities to understand the following subjects. Keeping this in mind, every educator should pay close attention to reinforcing the topic covered and listen to the opinions of the students if it is a practical lesson. The use of new pedagogical technologies in the classroom to improve students' knowledge and skills gives good results [3].

Today in many developed countries of the world there is a large number of experience and scientific papers on the use of new pedagogical technologies that increase students' interest, increase teachers' creativity and improve the effectiveness of the educational process. One of the interactive methods based on these knowledge and skills is the Venn Diagram strategy method [4].

This method is used to develop students' analytical approach to the subject, the ability to master the general essence of the subject on the basis of individual chapters, and the strategy is implemented in groups based on the formation of small groups.

The strategy helps to conduct a comparative analysis of close theoretical knowledge, data or evidence acquired by students. It is more effective to use this strategy to organise final lessons on specific chapters or sections.

Steps to implement the strategy include:

1. Students in the class are divided into two groups. Draw a diagram on the board showing the essence of the task.
2. Each group is given a separate task related to the subject they will specialise in and the time allocated in the plan for the task is announced.
3. After the tasks are completed, leaders are selected among the team members and the role of the leaders is explained.
4. Leaders summarise the ideas expressed by the group members and complete the diagram on the board.

The board is divided into two equal parts (according to the topic) and the diagram shown in Figure 1 is completed:

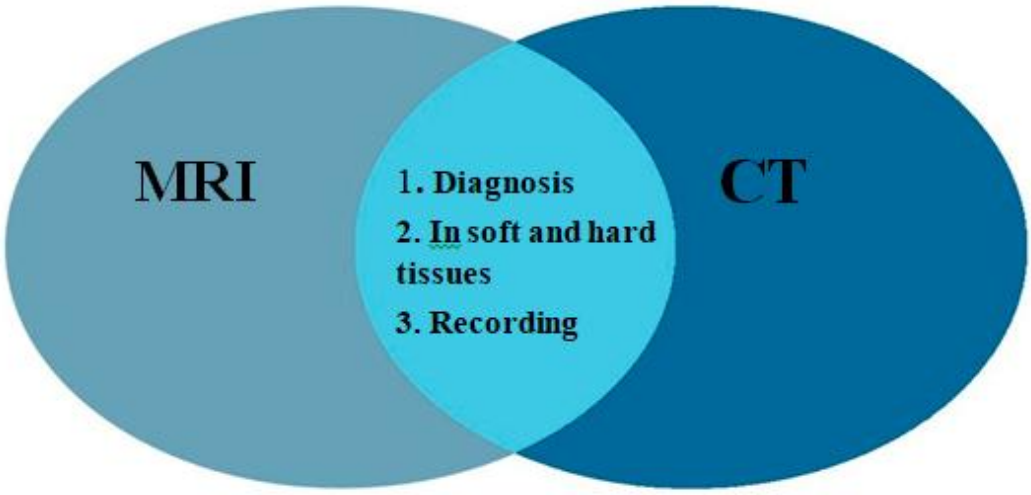

Figure 1. Venn diagram

First, the professor introduces a new topic: "MRI, (Magnetic Resonance Imaging) and (CT) Computed Tomography in Medicine", one of the topics related to nuclear technology in higher education. We will look at using the above method to move on to this topic and consolidate the topics [5,6].

This method is the Venn diagram method. We divide this method into three parts:

Method 1. What is magnetic resonance imaging on the first left side of the Venn diagram in Figure 1. It informs students about the operation of the device, its dependence on magnetic field induction and its widespread use in soft tissue diagnosis. The devices that work on it are divided into the following types:

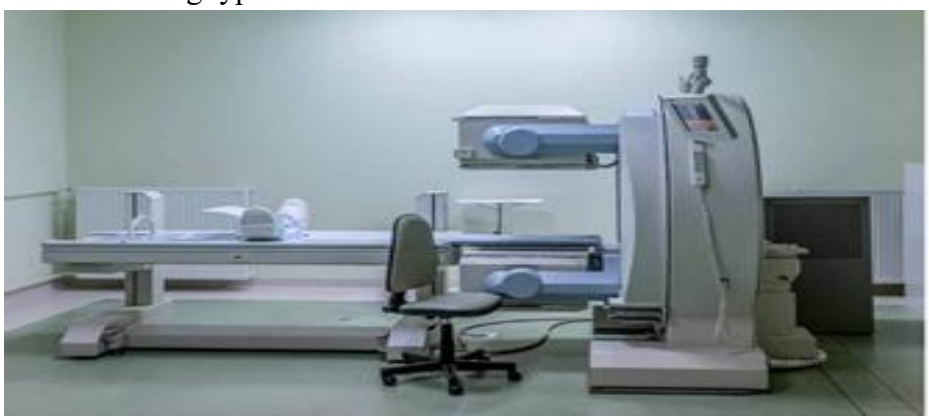

Figure 2. Magnetic resonance imaging.

MRI is a method of obtaining medical tomographic images to study internal organs and tissues using the phenomenon of nuclear magnetic resonance. The method is based on combining the electromagnetic response of atomic nuclei, usually the response of the nuclei of hydrogen atoms, i.e. a combination of known electromagnetic waves in a high-voltage permanent magnetic field.

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The nuclear magnetic resonance method allows the study of human body tissues based on the saturation of tissues with hydrogen and their magnetic properties. The hydrogen nucleus consists of a single proton, which has its own magnetic moment and changes its spatial position under the influence of a strong magnetic field and additional fields called gradients [7,8,9]. Based on the vector direction of the hydrogen proton parameters and their time, which can be in two opposite phases, as well as on the proton magnetic moments, it is possible to determine in which texture the roof of this or that hydrogen is located. If a proton is placed in an external magnetic field, its magnetic moment will be in the direction of the magnetic field or against the direction of the magnetic field, and in the latter case the energy will be higher. When an electromagnetic field of a certain frequency is applied to the area under investigation, some protons reverse their magnetic moment and then return to their original state. In this case, the energy recording system of the tomograph records the energy released during the transition of the pre-excited protons to the stationary state.

Method 2: A brief description of computed tomography is given on the right side of the Venn diagram in Figure 1.

Computed tomography is a modern and universal X-ray examination method. It can also be used to obtain information about body parts, total organs, their condition, shape, size, structure of the organ, structure of its upper part and blood flow in the body.

This method is based on recording the cross-section of the examined body from different angles and creating an image on the computer.

In this case, the X-ray is rotated 3600 times around the patient and the image is processed by detectors.

Figure 3. Computed tomography.

Advantages of CT over conventional X-ray examinations:

1. Extreme precision and accuracy of examination.
2. CT allows obtaining only the image of the organ and the pathological lesion in the examined section.
3. With the help of CT, it is possible to obtain accurate information about the size and density of individual organ tissues and pathological products.

4. CT allows obtaining information not only about the pathology of the organ under study, but also about the interaction of the pathological process with neighbouring organs and tissues.

X-ray CT is the leading method of diagnosis in many diseases:

- Brain diseases
- Diseases of the spine
- Diseases of the lungs and spleen
- Liver and kidney disease
- Diseases of the pancreas and adrenal glands
- In diseases of the aorta and pulmonary artery
- In traumatology and other diseases

In medicine, X-rays are used in chemotherapy to treat dangerous tumours. This method is called X-ray therapy in medicine. At the same time, X-rays have harmful effects on biological tissues and give examples. Then explain X-rays and their properties. Giving an idea about the principle and properties of the devices working on this law, the teacher shows the principle of operation of the devices in multimedia control in the lesson.

To reinforce the topic, the audience informs the students about the similarities and differences between Magnetic Resonance Imaging and Text Writer Tomography to see how well the students have mastered the topic.

Groups are given 10 minutes to complete the centre of these diagrams.

Method 3: After a medium period of time, each group responds to the similarity of Magnetic Resonance Imaging and Computed Tomography. In this case, each member of the group has their own opinion. When each group answers a question, the teacher suggests the student to complete the errors and omissions by referring to other students. Then the teacher gives the final result. Similarities between Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) There are similarities in terms of diagnosis, soft and hard tissues and recording.

Do CT and MRI always make the correct diagnosis? The question was also discussed among many students: Do CT and MRI always make the correct diagnosis? The question was briefly stated.

The development of computed tomography (CT) and magnetic resonance imaging (MRI) has become a world medical breakthrough. These modern diagnostic methods entered medicine in the 1990s. The authors of this invention deservedly won the Nobel Prize. CT and MRI scans can be used in all areas of medical diagnostics. Especially CT and MRI are of great importance in neurology. However some patients have a CT or MRI scan of their brain without a doctor's recommendation. They panic when they read the words "atrophy" or "encephalopathy". We have described these situations in the book. Some patients with low back pain are alarmed by a small disc herniation detected by CT or MRI scan of the spine. Herniated discs of 2-3 or 4 mm between the lumbar vertebrae are safe and resolve after several treatments. The degree of disc herniation treated with or without surgery is decided by a neurologist and a neurosurgeon. Qualified doctors will never rely on a CT or MRI scan. They carefully examine the patient and

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try to treat the disc herniation without touching the patient. If this is not possible, the operation will be selected. However, you should never delay any treatment, you should start treatment without delay. CT and MRI do not always help to make the correct diagnosis. For example, in neurosis and depression, some types of epilepsy, some hereditary diseases, metabolic disorders, muscle wasting diseases, CT and MRI will not detect anything. In these cases, other diagnostic methods such as laboratory tests, biochemical or genetic tests are used. There are also diagnoses such as neurosis and depression, which can only be diagnosed by interview.

Active learners will be encouraged at the end of this course.

By applying this method to the teaching process, the following results can be achieved:

1. Students will be able to compare and contrast the concepts of magnetic resonance imaging and computed tomography. The study of the relationship between similar magnetic resonance imaging and computed tomography opens the way for small physical discoveries by finding common points in physical bodies. It will be a creative approach to science.
2. The student both listens and speaks, gets the answer to the question and is evaluated. The new topic is reinforced not only by the teacher but also by the students.
3. It is clear which part of the subject the student could not consolidate and the problem is solved in the lesson itself.

When we used this method in the Department of Physics, Biophysics and Medical Physics of the Faculty of Medicine of Samarkand State Medical University, the method proved to be effective. Two groups were selected as a test. When this method was applied to group 2, the lecture was hotly discussed and the students actively participated.

Conclusions

In short, the use of this method is very effective in teaching nuclear technology science. Because each student is active in groups. Students develop the ability to express and justify their views independently. Students' interest in nuclear technology science will increase and their world view of nuclear technology science will expand. In this case, the teacher fills in the gaps of the students and reaches a general conclusion. Students who actively participate will be assessed. We used student criteria to test the effectiveness of our research. It is seen that the use of Venn diagrams in the teaching of nuclear technology related courses is quite effective.

The core pedagogical technology teaching process using the above new pedagogical technology was also approved by the students. Unlike the simple, traditional teaching process, the teaching process based on new pedagogical technologies showed significant results.

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