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STRENGTHENING THE TOPIC "STUDY OF THE MECHANICAL FEATURES OF THE HEART AND BLOOD VESSELS" USING THE "AQUARIUM" METHOD

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Abstract
The use of interactive methods in the educational process contributes to the improvement of the quality of education and the residual knowledge of students, as well as to the development of mature personnel in their specialities. This article describes the use of the "Aquarium" method in strengthening the topic of "studying the mechanical features of the heart and blood vessels".

Keywords: Aquarium method, innovation, Mechanocardiography, Ballistocardiography, Dynamocardiography, Sphygmography.

Introduction

It is not a secret to anyone that the necessity of reforming educational and scientific systems has been felt throughout the educational system of our country, and this work has been started consistently and systematically.

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The fundamental changes taking place in the socio-economic life of our country and society showed that the development of the education system is an important issue. At a time when the social lifestyle is rapidly changing, it is necessary to develop this system at a high rate based on the use of new technologies and methods of education. In particular, partially abandoning the traditional, i.e. independent, methods of teaching, teaching with the help of technical means, computers, the manager, organizer, consultant of the student's cognitive activity, the teacher-passenger to achieve the final result, organization of more independent activities of students under the guidance of the teacher, and the most important thing is that the teacher has the opportunity to achieve almost the same result. Especially in the current period of training of specialists who can meet the requirements of the standards of all countries of the world, when uniform state educational standards have been introduced, the next situation is of particular importance.

Methodology

It is absolutely impossible to use interactive methods aimlessly and turn them into the main form of work. Interactive methods, which are considered 21st-century methods in the research of world psychologists-pedagogues, not only fulfil the task of training modern highly qualified personnel but also create conditions for increasing the quality of education by accelerating this process. Our main goal is to make the educational process satisfy the vital interests of the person, to form the culture of the audience, and to adapt it to society. Higher education is very important in this regard. To convey the topic to students in a systematic and understandable manner in a short period of time during the educational process, to thoroughly teach the basics of science, to create skills and competencies related to specific activities, to teach on the basis of cooperation, control of student activity requires a new approach to the educational process with high pedagogical skills. In short, it is to create the necessary conditions for students to realize their potential and talents. This means that it is necessary to use modern pedagogical technologies in the educational process [1,2].

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To determine the attitude of students to the discussed topics, to see the advantages and disadvantages of organizing and conducting classes, to evaluate the results, as well as to form a general idea about the level of students' acquisition of knowledge related to the lesson, to check the remaining knowledge of the subject, at the same time in a row, 4 students are separated from the group in order to test and evaluate students' knowledge. They sit around a table in the middle of the auditorium. They can be compared to fish in an aquarium, while the rest of the surrounding students participate as observers.

"Fish in the aquarium" is asked a question or problem by the teacher. "Pisces" is asked to discuss the problem together for about two minutes and express their opinion. They will have to discuss it together, and the observers sitting around will have to listen carefully to the thoughts of the "fish" and write down the right and wrong thoughts. When the allotted time is up, the process goes to the discussion part. First, each of the "fish" and their general opinions is listened to, and then the observers state their views. "Fish in the Aquarium" students who have not been able to provide enough ideas give their place to the observer student who offered the best ideas and participate in the proceedings as an observer. The observing student who offers the best ideas goes to the "aquarium". In this way, questions are asked one after the other and students are evaluated based on their opinions. A student who correctly answers 4 questions in a row will receive an excellent grade and will exchange places with another student. A student who leaves the "aquarium" can express his opinion on the next questions as an observer, he will be re-entered the "aquarium" and will be evaluated based on his next answers. The opinions expressed on each problem are summarized by the teacher with the participation of students [2,3]. they are re-introduced into the "aquarium" and evaluated based on their next answers. The opinions expressed on each problem are summarized by the teacher with the participation of students [2,3]. they are re-introduced into the "aquarium" and evaluated based on their next answers. The opinions expressed on each problem are summarized by the teacher with the participation of students [2,3].

This method is appropriate if it is used mainly for the purpose of strengthening the topics covered. In this way, the skills students to conduct a discussion will be developed and the rest of their knowledge will be enriched.

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Topic: Study of the mechanical features of the heart and blood vessels

Physiological research methods are based on studying the manifestations and characteristics of vital activity of biological systems. This group includes the study of mechanical, electrical, magnetic, thermal and optical properties of the vital activity of the object.

The mechanical manifestations of the organism's vital activity include displacement, speed, acceleration, shape, volume, change in internal pressure change; acoustic phenomena accompanying the work of the heart, lungs, circulatory system, musculoskeletal system, and gastrointestinal tract. According to these views, research methods appeared, for example, mechanocardiography, sphygmography, plethysmography, spirography, etc. [4].

Mechanocardiography - a set of methods of mechanical recording of the heart. A cardiogram is a method of obtaining information and a record (analogue or digital) of the heart's activity, regardless of whether it is obtained in the bare heart or indirectly.

The energetic basis of mechanocardiography is the work and power of the heart. To estimate energy, we consider the mechanical work AC done by the heart to overcome pressure forces and deliver the kinetic energy of the blood, and AC=AL+AP, where AL and AP are the work done by the left and right ventricles, respectively. It is known from research that AP=0.2 AL, then AC=1.2 AL.

Let's calculate the work done by one contraction of the left ventricle.

Let's take VU - the stroke volume of blood in the form of a cylinder, which moves along the heart aorta at a distance s with a section s. Under the next moderate pressure R.

The work done in this case:

$$A1 = A\ell = RS\ell = RMU \left(A = RS\right) \quad (1)$$

Work is spent on delivering kinetic energy to this volume of blood.

$$A2 = mv^2 / 2 = \left(\rho VU v^2\right) / 2 \quad (2)$$

here:

r - blood density;

v - blood velocity in the aorta.

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Then, the work of the left ventricle during the contraction of the heart is calculated.

$$AL = A1 + A2 = RVU + \left(\rho VU\, v^2\right)/2 \quad (3)$$

With one contraction of the whole heart, we get the following equation.

$$AS = 1,2\,AL = 1,2VU\left(R + \left(\rho v^2\right)/2\right) \quad (4)$$

The last formula is valid both for rest and for the active state of the body, they differ in different blood flows.

We calculate the work of one contraction of the human heart at rest with the following average parameter values:

$$VU = 60\,ml = 610^{-5}\,m^3;$$
$$\rho = 1,05 \cdot 10^3\,kg/m^3;$$
$$v = 0,5\,m/s;$$
$$R = 13\,kPa = 100\,mm\,rt.st \quad (5)$$

By performing calculations, we get the value:

$$AS = 94,545 \cdot 10^{-2}\,Nm \approx 1J \quad (6)$$

Taking into account the average heart rate of one contraction per second, the work done per day is ~86400 J.

With active muscle activity, the work of the heart can increase several times. If we consider that the duration of systole is about 0.3 seconds, then the average heart power during one contraction is ~3.3 watts. The resulting energy estimate shows that activity can be monitored using simple mechanical sensors and transducers [5].

The cardiogram was first recorded in 1863 by the French physiologist Marie. He also created an open-type cardiograph. This cardiograph is a smooth-edged capsule placed on the patient's chest at the site of the heartbeat. The change in pressure inside the capsule caused by the movement of the chest wall at the heartbeat is transmitted by the pneumatic system to the recording device.

Ballistocardiography - this is a method of graphic registration of reactive mechanical movements of the human body caused by heart contraction and blood movement in large arteries.

The indicated curve - ballistocardiogram (BCG) - reflects body vibrations caused by heart systole, the hydraulic effect of blood on the aortic arch and

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elements of the pulmonary body. In the systolic phase, the amplitude of BCG waves is proportional to the cardiac output energy. At the same time, the mechanism of conveying heart and blood movements in the veins to the whole body becomes complicated.

Ballistocardiography methods can also be used to examine individual parts of the body. This direction is called local ballistocardiography. It has the following options:

- seismocardiography - registration of chest vibrations;
- kinetocardiography - registration of chest wall vibrations in 1 frequency range...10 Hz;

dynamocardiography (as a research method, we will consider it in more detail)

Dynamocardiography- a method of recording the movements of the centre of gravity of the chest, which occur in connection with the kinematics of the heart and the movement of blood in the large vessels.

To implement the method, a dynamocardiograph device consisting of a receiving device (pickup device) and a recording device is used. The receiving device is installed on a special table where the patient is placed. The voltage of the dynamic forces acting on the patient's chest on the receiving device is converted into electrical signals with the help of a tensometer, which after amplification are recorded in the form of a curve - a dynamocardiogram (DCG). From the point of view of mechanics, DCG is a curve describing the changes at the moment M of vertically directed forces R, while dynamocardiography is a method of moment-force analysis of the mechanical processes accompanying heart contraction. Recording of the moment of force M(t) directed along the patient's body is called longitudinal or standard DCG. Accordingly, recording the moments of forces acting in the transverse direction is called transverse DCG.

Typically DCG is a periodic curve with seven characteristic intervals with teeth indicated by letters of the Latin alphabet.

During the analysis of DCG, the amplitude of oscillations and the duration of intervals are determined. The mathematical processing of DCG allows for estimating the speed (first derivative of the curve) and acceleration (second derivative) of the recorded processes.

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Sphygmography (sphygmos – pulse (Greek)) - graphic recording of pulse vibrations of the vascular wall (SFG).

In mechanical sphygmography, pulsation is received with the help of sensors placed on the pulsation area from the surface of the skin above the vessel being studied. The second, pneumatic, piezoelectric, capacitive, inductive and tensometric sensors are used.

Sphygmography is used as an independent research method to assess the state of the circulatory system and to detect certain diseases (heart disease). It is also used as one of the information channels of polycardiography as part of several other techniques. Arterial sphygmography has found wide practical use.

The analysis of arterial sphygmograms mainly consists of determining the pulse frequency, evaluating the shape of the curve, and the amplitude and time ratios of individual components.

Synchronously recorded SFGs of central and peripheral pulses are used to determine the propagation speed of the pulse wave through the artery: v=l/t, where l is the distance between the data collection points, and t is the number of the same type of recording slices time change. The propagation speed of the pulse wave depends on the modulus of elasticity of the arterial wall and varies from 4 m/s (for children) to 10 m/s (for people older than 65 years) and is a diagnostic sign of arteriosclerosis.

Phlebosphygmography or vascular pulsography, due to the low elasticity of the walls of the vessels, reflects the changes in blood filling of the vessels more than the blood pressure in them. Therefore, mechanical converters are rarely used in this type of sphygmography. Measurement of quantities such as electrical resistance, conductivity, and optical density has found applications here. Phlebosphygmograms are usually recorded from the jugular or femoral veins.

The test of the concept of Maskur teaching methodology was conducted among students studying at the 2nd Pediatric Faculty of the Tashkent State Medical Pediatric Institute. In conducting the test, they used educational and methodological instructions and materials prepared by professors of the department [6,7,8].

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Conclusion

In conclusion, it can be said that it is possible to conduct a lesson using the "Aquarium" method for all subjects of all directions taught in medical universities. In the lesson, this method increases students' interest in the lesson, strengthens their memory, teaches debate culture, consolidates and analyses the knowledge acquired by students during the educational process, and determines and evaluates the level of mastery. The more students are interested in the lesson, the more their knowledge increases. This will help him to be more promising in his field.

The task of us pedagogues is to increase the knowledge of students using various methods, as well as to form the ability of independent research and independent thinking.

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