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TÍTULO: Nuevos enfoques para la enseñanza de la física a estudiantes extranjeros en universidades médicas.

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RESUMEN: Las universidades rusas han sido y siguen siendo atractivas para estudiantes extranjeros tanto de ex-repúblicas soviéticas como de otros países, pero últimamente, los estudiantes con bajo conocimiento de la lengua tienen grandes dificultades con el estudio de asignaturas generales y específicas en sus primeros años de estudios. Los autores del artículo describen su método de enseñanza de la física a los estudiantes extranjeros de universidades médicas; este método no solo permite prepararlos para la actividad profesional sino también desarrolla sus competencias lingüísticas y comunicativas en el ambiente de habla rusa. Este método fue aprobado y ha demostrado su efectividad, confirmada por métodos de estadística matemática.

PALABRAS CLAVES: estudiantes extranjeros, enseñanza de la física, preparación para la actividad profesional, desarrollo de competencias lingüísticas.

TITLE: New approaches to teaching physics to medical university foreign students

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ABSTRACT: Russian universities have been and continue to be attractive to foreign students from both former Soviet republics and other countries, but lately, students with low knowledge of the language have great difficulties with the study of general and specific subjects in their early years of studies. The authors of the article describe their method of teaching physics to foreign students of medical universities; This method not only allows them to prepare for professional activity but also develops their linguistic and communicative skills in the Russian-speaking environment. This method was approved and has proven its effectiveness, confirmed by mathematical statistics methods.

KEY WORDS: foreign students, teaching of physics, preparation for professional activities, development of language skills.

INTRODUCTION.

Currently, a practice-oriented approach is recommended in higher medical education. This is due to the fact, that the so-called academicism of knowledge is being relegated to the background. Attention is increasingly focused on training graduates who have the skills to solve professional problems.

Speaking of professional tasks of a doctor, one can single out tasks after performing which a doctor makes a clinical diagnosis. We believe that the importance of developing methods for solving this professional problem does not require any proof. Therefore, it is a priority to teach diagnostics to future doctors during their studying at a medical university, not only during the study of specialization disciplines, but also during the study of general vocational disciplines.

We would separately note, that at present, there has been a positive trend in the number of students from CIS countries who are coming to Russian universities to receive higher medical education. This trend is due to a relatively low cost of educational services in Russian medical universities and the closeness of cultural and religious traditions of the countries. Yet, despite the fact that students from neighboring CIS countries have a certain level of the Russian language proficiency, they experience significant language difficulties during their university studies.

Students from these countries, for the most part, understand Russian, they can communicate in everyday life level, but face difficulties when they try to understand scientific terminology, formulate a reasonable answer, and pronounce some terms. Against this background, it is clear that solution to the problem of developing diagnostic skills presents a serious challenge that needs to be addressed.

DEVELOPMENT.

Purpose of the study.

The purpose of our study might be worded as follows: to develop methods for teaching physics to students from neighboring CIS countries that aim to ensure development of diagnostic activity or its components.

Findings.

In the first stage of our study, we found that diagnostic activity consists of a certain sequence of actions which includes actions for identifying necessary and sufficient signs (symptoms) of a disease, process of mental searching for a corresponding piece of knowledge about this disease that is available in medical practice [1,2, 3, and others].

Having compared this finding with studies carried out by prominent psychologists (V.V. Davydov [4], N.F. Talyzina [5], Salmina [6]) and studies in theory and methods of teaching physics (S.V. Anofrikova [7], L.A. Proyanenkova [8], O.V. Ivanchuk [9], and others), we came to a conclusion that diagnostic activity can be formed through organization of activities of matching symptoms with a

concept (activity of recognizing situations corresponding to concepts). For instance, according to scientists, knowledge can be considered to be assimilated by students, if the latter can perform activities based on the content of this knowledge.

Knowing a concept means being able to carry out various types of activities based on the genus-species attributes of objects, phenomena and processes associated with this concept. Therefore, the activity of matching symptoms with a concept, as the activity of "correlating any object to a particular concept based on determining the presence of necessary and sufficient signs of this object in this concept" [14, p.37], is an integral part of educational process. Thus, the activity of matching symptoms with a concept is similar to diagnostic activity.

In the next stage of the study, we were solving the problem of identifying (selecting) such a psychological technology that, on the one hand, would facilitate assimilating knowledge by students, and on the other hand, would help them in overcoming language-related difficulties and developing their speech skills in using scientific terms. We considered it appropriate to use the theory of step-by-step formation of intellectual actions and concepts developed by P.Ya. Galperin [10]. The idea of this theory is formulated as follows: in order to develop any kind of activity skills in students it is necessary to set up five stages of their formation:

Stage I – It is a motivational stage where motivation (need) to implement the activity that is being formed is created.

Stage II – It is mapping a reference basis of the action. In this stage, a student, with the assistance of the teacher, draws up a generalized plan for implementation of activities. Thus, in the framework of our study, students should identify actions to recognize a situation that corresponds to a concept (scientific fact, law, etc.).

Stage III – It is forming action in a material or materialized form. An action is performed as external, practical, with real objects (material form of action). An action is performed with the use of converted material: models, diagrams, charts, drawings, etc. (materialized form). At the same time, the student is aware of all operations of the action, and their slow execution allows one to see and understand the content of both operations and the entire action as a whole. In this stage, a prerequisite is the combination of the material form of action with the speech form of action which allows one to separate the assimilated action from those objects or their substitutes through which [the substitutes] it is performed. When the action begins to proceed smoothly, accurately, and faster, reference cards and material aids are removed.

Stage IV – It is forming an action by means of loud speech. The student, who is deprived of the material aids of action, analyzes material by means of a loud socialized speech addressed to another person. This is both a speech action and an act of informing the audience about this action. The speech action should be a detailed answer, the information presented has to be understood by another person who supervises the learning process. In this stage, there is a “leap” - transition from external action to the thought about the action. The assimilated action undergoes further generalization, but remains unabridged, non-automated.

Stage V - The formation of action through external speech “to oneself”. The student uses the same speech form of action as in the previous step, but without speaking (even in a whisper). The stage is completed when a fast and correct performance of each operation and the entire action is achieved.

As seen above, application of this psychological and pedagogical theory will allow for the organization of education where students-future doctors from CIS countries will constantly pronounce definitions of concepts, wordings of laws, and performed actions which will undoubtedly contribute to the development of language skills.

To organize this type of activity in physics classes at a medical university, it was necessary to develop special didactic tools. We have developed (selected) the following didactic means of teaching physics to future doctors:

1) Exercises-tasks aimed at recognizing concepts about physical objects, phenomena, processes, scientific facts in situations close to professional ones.

2) Laboratory workshop consisting of situations simulating professional activities in which biological objects with properties corresponding to the state of disease are described, or in which biological objects are under conditions that have a significant impact on the state of the object. To analyze the physical models of these situations, special equipment was selected, medical equipment as well (as a rule, this equipment is available at departments of physics of medical universities).

3) Topic of round tables, discussion disputes and presentations for organization of the third level of the method of teaching physics to students of medical universities.

These approaches were introduced into the practice of teaching physics to students from neighboring CIS countries at a medical university.

To assess the effectiveness of the developed methodology, we have designed a diagnostic apparatus that includes qualitative and quantitative indicators. Quantitative data reflected information about the number of students who have either correctly/incorrectly:

1) Completed the tasks of recognizing situations that correspond to physical knowledge.

2) Written down a generalized system of recognition actions.

3) Highlighted the necessary and sufficient signs of disease in situations that simulate professional activity.

4) Written down a generalized system of actions for performing experimental tasks.

5) Who have completed tasks of establishing cause-and-effect relations between physics and medicine.

The generalization of the obtained quantitative data made it possible to draw the following conclusions:

1) The number of students who have mastered the activity of recognizing situations that correspond to scientific knowledge has significantly increased (the difference between the number of trained control and experimental groups correctly performing recognition tasks was 57.7%).

2) The number of third-year students of medical universities who have completed their task correctly increased by 2.8%, which, in our opinion, is due to the inclusion of future doctors in the process of analyzing professional situations during the study of clinical disciplines.

3) About 60% of all students in experimental groups (in control groups - about 6%) were able to correctly write down generalized methods for carrying out activities of matching symptoms with a concept and activities of performing experimental tasks.

4) There is a significant difference in the number of students in the control and experimental groups who have completed tasks of establishing cause-and-effect relations between physics and medicine (an average of 16.8% in the control groups, and 75% in the experimental groups).

Qualitative data was represented as the information about the features of actions formed in the students:

1) Generalization (the learner’s ability to carry out the formed activity in other subject areas).

2) Awareness (the ability to correctly/ incorrectly/incompletely describe the explanation of the tasks performed).

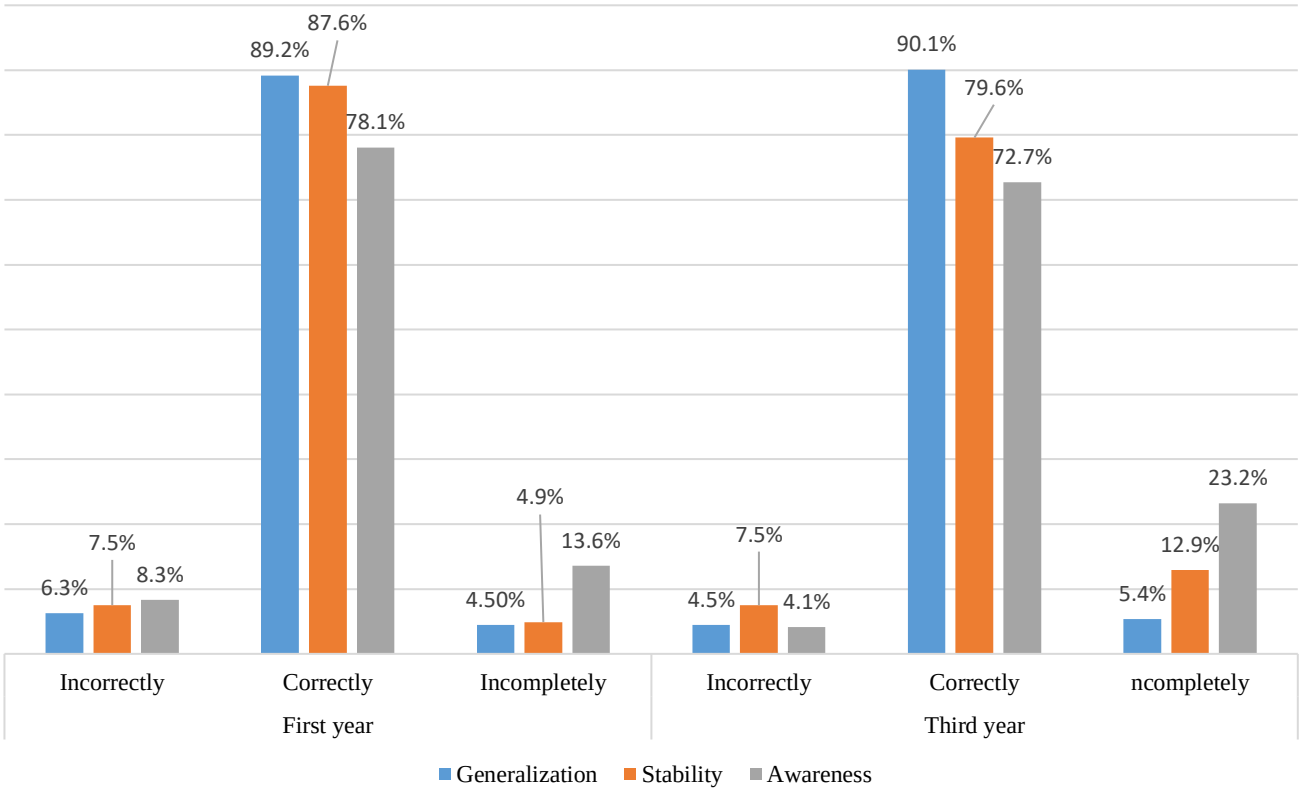
3) Stability (correctness of activities performance after some time has passed).

The results of summarizing the qualitative data are presented in the diagram (Fig. 1) and indicate the following:

1) The students have well-formed actions characterized by necessary and sufficient signs that suggest that future doctors have mastered the activity of recognizing situations that correspond to scientific knowledge, and therefore, the students have assimilated scientific knowledge.

2) The students have formed a fairly firm understanding of interconnection between two fundamental sciences, physics and medicine.

Figure 1. Generalization of quantitative data



It should be noted that the methodology that we developed for teaching physics to students of medical universities allowed us to formulate activities in a generalized form, that is, activities that are invariant to conditions of their application.

The obtained experimental results indicate a high level of generalization. For instance, first-year students were given situations corresponding to scientific knowledge in physics and medical biophysics, third-year students - in the field of professional knowledge, on average 89.65% have completed the tasks correctly.

The general sample consists of data on students from medical and pediatric faculties of medical universities in their first, second and third year of study. To assess the reliability of the results, a G-criterion of signs was calculated, which provides the proof that the implementation of the methodology that we have developed has a positive effect on the indicators we have identified:

1 - Correctly perform tasks of recognizing situations.

2 - Correctly write down a generalized system of recognition actions.

3 - Correctly identify necessary and sufficient signs in a situation.

4 - Correctly write down a generalized system of actions of performing experimental tasks.

5 - Correctly complete tasks of establishing cause-and-effect relations).

Statistical hypotheses were formulated as follows:

1. H_0: a change in the identified indicators towards a positive direction in the experimental group is incidental; H_1 – is an alternative hypothesis.

2. H_0: a change in the identified indicators towards a positive direction in the experimental group is incidental в; H_1 – is an alternative hypothesis.

Quantitative data on the values of empirical G_{emp}-criterion and critical G_{cr}-criterion for each indicator are given in table 2.

Table 2. Values of the G-criterion of signs for the experimental and control groups (1 - correctly complete the tasks of recognizing situations, 2 - correctly write down a generalized system of recognition actions, 3 - correctly identify necessary and sufficient signs in a situation, 4 - correctly write down a generalized system of actions of performing experimental tasks, 5 - correctly complete tasks of establishing cause-and-effect relations).

G- criterion ($p \leq 0,05$)	**1**	**2**	**3**	**4**	**5**
Experimental group					
G_{emp}-criterion	12	54	35	52	67
G_{cr}-criterion	78	78	64	73	87
Control group					
G_{emp}-criterion	148	176	154	128	104
G_{cr}-criterion	133	106	83	87	93

When comparing the results, it was noted that in the two groups there was a typical shift towards positive changes; however, for the experimental group $G_{emp} < G_{cr}$, from which we can conclude that the hypothesis H_1 is valid. For the control group $G_{emp} > G_{cr}$, therefore, the hypothesis H_0 is accepted. Thus, when comparing the results, it can be seen that the changes in the experimental group are actually reliable. This serves to prove that the methodology that we developed for teaching physics to students of medical universities and that aims at forming diagnostic activities in future doctors is effective.

CONCLUSIONS.

The methodology we have developed for teaching physics to future doctors allows, in our opinion, for the inclusion of physics as an academic discipline in the system of training of medical personnel for professional activity with them as its active participants.

Learning process is reoriented from conveying static knowledge towards application of the knowledge in professionally significant situations.

BIBLIOGRAPHIC REFERENCES.

1. F. Tetenev. (1995). Physical research methods in the clinic of internal diseases. - Tomsk: Publishing house of Tomsk university, 321p.

2. I. Sultanov. The importance of dialectic and formal logic in the diagnostic process and the logical type of mistakes in the diagnosis in the clinic of internal diseases //Bulletin of RUDN university. Series: Medicine, no. 3, 2008, pp. 92-97.

3. Ledley R. S., Lee Reasoning. Foundations of Medical Diagnosis (1959) // American Association for the Advancement of Science, New Series, Vol. 130, №. 3366 (Jul. 3), C. 9-21.

4. Developmental and pedagogic psychology (1992). Compiled and commented by M. Shuare; Introductory word by V. Davydov, M. Shuare. - Moscow.: MSU Publishing house, 268 p.

5. N. Talyzina (1984) Learning process management: (Psychological basis) [Text] / N. Talyzina. – The 2nd edition supplemented and corrected. - Moscow: Publishing house of Moscow state university, 344 p.

6. N. Salmina (1995). Subjects and notions. - Moscow: Company “AST-press”, B., 49 p.

7. S. Anofricova (1989). Forming the generalized methods of activity in training of physics teachers [Text] / S. Anofricova // Practice of creating a specialist model in various universities. - Moscow: Publishing house “Znanie” №4(8). pp.77-90.

8. L. Proyanenkova (2010) Methodological preparation of a future teacher for organization of a personality-oriented educational process in physics: dissertation of... Doctor of pedagogical sciences: [Defensed at: Moscow Pedagogical State University]. Moscow, 357 p.

9. M. Solodikhina, N. Odintsova (2019). Case-problems in physics lessons // Physics at school. No.1. pp.23-29.

10. P. Galperin (1999). Introduction to Psychology: Textbook for universities. - M.: “University” Book house, 332 p.

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