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**ТЕОРЕТИЧЕСКИЕ ОСНОВЫ МЕТОДИКИ ФОРМИРОВАНИЯ
КЛИНИЧЕСКОГО МЫШЛЕНИЯ У БУДУЩИХ ВРАЧЕЙ ПРИ
ОБУЧЕНИИ ФИЗИКЕ В ВУЗЕ**

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***Аннотация.** В статье представлено исследование, которое легло в основу создания модели обучения физике в медицинском вузе. Представленная модель является синергизмом тенденции компетентностного подхода направленного на формирование набора компетенций как способности и готовности к будущей профессиональной деятельности студентов медицинских вузов с исторически сложившимся подходом при обучении будущих врачей в российской и зарубежной практике. Теоретической основой данного исследования стало сформированное авторами раннее определение клинического мышления. Именно оно позволило обоснованно сформулировать основные точки пересечения компетенций как элементов клинического мышления. В модели впервые использован методический подход по формированию клинического мышления ранее применявшийся исключительно на клинических кафедрах. Таким образом теоретической основой исследования становится активный метод работы со студентами в форме ситуационного подхода, реализованного через кейс-стади, как наиболее гармонично сочетающий тенденции развития современного образования. Своей моделью авторы доказывают, что методы познания формируемые на занятиях физики не противоречат основным этапам*

деятельности врача и способствуют ее структурированности и осознанности, что положительно сказалось на результатах внедрения данной модели. Оценка которых произведена при помощи выделенных критерии диагностики, что позволяет охарактеризовать представленную модель как актуальную для внедрения в образовательный процесс медицинского вуза.

Ключевые слова: *клиническое мышление, обучение физике студентов медицинских вузов.*

THEORETICAL BASES OF METHODS OF FORMING MEDICAL JUDGMENT AMONG FUTURE DOCTORS WHEN STUDYING PHYSICS IN A UNIVERSITY

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Abstract. *The given article presents a study that formed a basis for creating a model for teaching physics in a medical university. The presented model is a synergy of the tendency of competency-based approach aimed at forming a set of competencies as abilities and readiness for future professional activity of medical students with a historically established approach in teaching future doctors in Russian and foreign practice. Theoretical basis of the given study became the authors' early definition of medical judgment. It is the medical judgment that allowed us to reasonably formulate the main intersection points of competencies as elements of medical judgment. The model first used a methodological approach on forming medical judgment that had previously been used exclusively in clinical*

chairs. Thus, the theoretical basis of the study is the active method of working with students in the form of a situational approach that is implemented through a case study, which concordantly combines trends in the development of modern education. The authors prove with their model that the cognition methods that are generated in physics classes do not contradict the main stages of a doctor's activity and promote its structuredness and awareness. All this positively affected the results of the introduction of the given model. The evaluation of these methods was carried out with the help of the selected diagnostic criteria, which allows characterizing the presented model as the relevant one for the introduction into the educational process of a medical university.

Keywords: medical judgment, teaching physics the students of medical universities.

It is known that the presence of the so-called medical judgment is one of the fundamental indicators of a doctor's professionalism. The significance of the given type of thinking was reflected in the works of well-known clinicians. They wrote about the need of forming medical judgment in future doctors in their studies and discussed it during public lectures. Thus, according to many clinicians and researchers in the field of medicine, psychology and higher vocational education pedagogics, medical judgment is “one of the highest forms of reflective activity of brain, cognition and mental operations (analysis and synthesis, comparison and discrimination, judgment and inference, abstraction, generalization, etc.), which allows a professional doctor solving tasks on medical diagnostics, prognostics and therapeutic approach”[1]. “Only the developed medical judgment will allow a doctor understanding the process of a disease correctly and approaching creatively the tactics of his treatment <...> by analyzing the genesis and the development of a pathological process (disease) and its etiological factors” [2].

So, a doctor's medical judgment allows applying theoretical knowledge gained at the university or at further education courses, as well as applying evidence-based medicine methods for developing strategies for diagnostic and therapeutic measures for the patient.

However, the system of higher vocational education including medical education, is undergoing significant changes related to the implementation of the competency-based approach. By now considerable experience has been accumulated in the theory and methodology of the competency-based approach: terminological apparatus has been developed for the competency-based approach in the system of higher vocational approach (D. Raven, I. Zimnyaya, A. Khutorsky, A. Rusina, E. Zeer, N. Shestak, V. Shadrikov, M. Ilyazova and others); principles of implementation of the competency-based approach have been

distinguished (L. Perevozchikova, E. Kagakina, T. Chekalina, O. Ustinova, Sh. Bobokhuzhaev, T. Rozova, I Yudin, V. Panina and others); practical methods of implementing the competency-based approach while teaching domain knowledge have been developed (G. Bordovsky, I. Buromsky, V. Zhura and others). Undoubtedly, all these changes influenced the image (model) formation of a future doctor. The modern image of a doctor is represented in the form of a specialist with a set of general cultural, general professional and professional competencies.

Thus, modern approaches in preparing future doctors for professional activity shifted the need for the formation of medical judgment among medical students to the background. Such a refocusing, in our opinion, can promote the loss of traditions of the Russian higher medical education system, which will undoubtedly affect the position of Russian doctors in the global medical space.

Summarizing the abovementioned we can talk about the presence of a contradiction between the need for the formation of medical judgment in the future doctor as an essential element of the development of his professionalism, and the lack of methods for its formation in the framework of the competency approach implementation.

Discipline “Physics” (“Medical physics”, “Bases of medical biophysics”) as one of the main disciplines in the system of professional training of a future doctor occupies a rightful place among all the academic subjects that are regulated by the Federal Educational Standard of Higher Education for higher medical education. Nowadays there exist a lot of methodologist researchers who devote their studies to the problems of teaching physics to the students of medical universities. While analyzing studies in the field of teaching physics in a medical university, we tried to distinguish:

1) which methods exist in practical implementation of a competency approach while teaching physics to the students of medical universities. That is, what methods of teaching physics to future doctors aimed at forming general cultural, general professional and professional competencies exist that compose a model of a future specialist;

2) if there are studies aimed at forming medical judgment among students while teaching physics;

3) if there are studies establishing connection of medical judgment and competencies that are included in the model of a future doctor. According to the outlined directions we distinguished 3 groups of studies and practices of teaching physics to students of medical universities: a) studies devoted to the implementation of the competency approach while teaching physics to students of medical universities; b) studies devoted to forming medical judgment (professional judgment) among medical universities students while teaching physics. The

detailed analysis of the distinguished studies and the generalization of the results allowed forming the following conclusions.

First of all it should be noted that the group of studies we distinguished, are based on the fundamental didactic principle, professional direction principle. Implementing the given principle is also traditional: a) establishing intrasubject connections; b) selecting the content of physics course by finding out the most significant material for future doctors and connections with other general professional and special disciplines; c) developing special didactic means (tasks, laboratory practice and others), that reflect a doctor's professional activity); d) teaching how to solve professional tasks with the help of physics knowledge[3].

Secondly, the general understanding of such key notions as “competence” and “competency” wasn't developed in the studies devoted to the implementation of competency approach while teaching physics to medical universities students. As a rule the researchers refract the content of the given notions according to the goals of the maintained scientific research, teaching goals, etc. As is shown in the analysis of the given group of studies, methods of teaching physics to future doctors developed by the authors, are aimed at forming the generalized model of a specialist or at forming competencies that have a shorter performance, they will be in demand in the course of educational process as they are necessary for studying other disciplines. Mastering such competencies in the framework of medical education represents means instead of ends [4].

Thirdly in the studies devoted to forming medical judgment (professional judgment) among medical university students, the significance of scientific thinking in its general structure is noted first of all. One of the main qualities of a modern successful person is the ability to build a chain out of consequent actions from the current position to the desired goal. Creation of such a chain implicates the presence of the long term thinking instead of the mosaic one, i.e. the need of developing analytical skills is intensified. These qualities are the features of scientific thinking. Mastering at least one element of scientific thinking becomes a competitive advantage. Besides to prepare a person professional activity as well as to vital function, it is necessary for a person to form a worldview with the corresponding scientific worldview that satisfies the content of science on the given historical stage of its development.

Besides the authors of the given group of studies understand that the main task of medical university education is the necessity “to form among future doctors integral professional thinking of theoretical type as the basis of their creative professional activity [5, p.112]. Solving of the given task is seen by the authors in the possibility of applying philosophical approach, applying problem situations in the theory of decision making.

It is necessary to note that unfortunately we haven't found studies devoted to forming medical judgment while teaching physics to the students of medical universities. A significant number of studies were devoted to the implementation of competency approach while teaching physics as well as other general professional and professional disciplines to students of medical universities. In spite of this, there wasn't revealed the connection between medical judgment (professional judgment) and competencies included in the model of a graduate specialist.

Thus, the generalized conclusions made it possible to formulate a contradiction between the need to form medical judgment in the future doctor as an essential element in the development of his professionalism and the lack of appropriate methods for teaching physics to medical students. The contradictions obtained as a result of the analysis of the academic literature and the practice of preparing a future doctor, speak about the relevance and significance of our research.

Methodological basis

For solving the problem of the research we decided it is necessary to specificate the notion "medical judgment". At the core of one of the research lines of the concept "medical judgment" can be an approach relying on the consideration (description) of the practical activities of prominent clinicians. As most researchers point out (B. Karvasarsky [6], V. Tashlykov [7], N. Tvorogova [8], S.N. Tolstov [9]), the regulatory approach is traditionally deontological, because it contains the main requirements for the personality of a doctor developed by the society. This approach is chronologically the initial and has not lost its value to the present.

The founder of clinical pedagogy is the great clinician G. Zakharyin. He considered the goal of clinical teaching to be the training of educated, independent, practical doctors. "A doctor must be independent as a character trusted with the most precious thing, health and life." Thus, it can be said that in the last third of the 19th century, G. Zakharyin transformed higher medical education, improved the training of practical doctors and introduced the concept of medical judgment in medicine.

Already in our time, the research line of doctors' professional thinking ("authorities") includes a focused analysis of practical situations to develop preventive measures and prevent the formation of inconvertible medical conditions, the development of medicine as a work sphere, which allows characterizing it as a socially oriented, systemic type of thinking. At the same time, in his study, B. A. Yasko [10] indicates that the feature of professional individuality of all the participants of an "elite" group is a high level of communicative and organizational skills.

The disadvantages of this approach include understanding of the term “medical judgment” as an archetypical image of a doctor endowed with unlimited wisdom and exciting clairvoyance of a person. [11] For example, “in the medical judgment of a doctor there are always elements of a specifically personal, exclusively individual character, and the manifestation, realization of the personal origin acts as a purely qualitative indicator of thinking” [12].

Thus, supporters of this concept include in the content of medical judgment, abilities of a clinician to a greater extent than his thinking. It includes the relevant application of knowledge and personal experience to the problem. [13] And yet, in our opinion, in spite of the existing advantages, nowadays the given approach has lost its relevance due to the specialization of medical practice. Today it is not possible to cover the entire spectrum of clinical diseases, as well as the research and teaching workload of a doctor.

The second approach in the description of the content of the notion “medical judgment” is based on an unbelievable intuitive ability of a clinician. For example Yu. Abaev [14] in his research points out the special role of intuition in establishing diagnosis, forming diagnostic and clinical judgment. The author considers that “the first form of diagnostic thinking was intuition”.

Intuition is the direct comprehension of truth without preliminary logical reasoning [15]. Intuition is an unconscious mind that gives knowledge, bypassing reasoning and inference, instant understanding or awareness without rational thinking [16]”.

T. Novikova and O. Vorobeychikova, [17] in their work assign a significant place to intuition as an integral part of medical judgment. “Medical judgment is defined as the ability of a doctor to “intuitively, as if with an inner view, to embrace the entire clinical picture as something integral and link it with similar previous observations. ... Medical judgment allows an experienced doctor to diagnose some diseases simply by an external, especially characteristic view of a patient without familiarizing with the medical background and further examination [18, p.19]. The semantic of the given definition is: intuition, perceptual unity of an information image, binding by analogy, classification (recognition, diagnostics) with incomplete information. This means that a significant place in medical judgment is occupied by moments of intuitive “insight”, when the situation is perceived by the subject as a whole and without preliminary reflection is evaluated as understood, comprehended and clear [19]. Still, in our opinion, the intuitive approach to “medical judgment” isn’t always specified and doesn’t always have strict boundaries, which in turn spawned a lot of arguments.

The next stage which brought additional ins and outs to the definition “medical judgment” is the development of laboratory diagnostics and the emergence of evidence-based medicine. Interest in this issue arose in the analysis

of the ethical-moral approach to the problem of " medical judgment ". The reason was the identification of numerous cases of medical failure due to the technological approach to the patient. These cases are indicated by the cardiologist Bernard Lown in his book "The Lost Art of Healing" (USA, 1996). Supporting this topic, the professor neurosurgeon L. A. Kessler (USA) publishes an article "In a high tech age, is medical judgment a lost art form?" [20].

This research line finds response in the work of V. Petrov, who believes that evidence-based medicine is an integral part of the system of medical knowledge and is the only basis for clinical practice. And paying its attention to specifying the most important concepts for any doctor "medical judgment" sets the task of finding out what it is, how it is developed, and how medical judgment is connected with evidence-based medicine [21].

Thus, the modern idea of medical judgment pushes the boundaries of intuitive skill to make an exact diagnosis. Nowadays medical judgment is an integrate notion and includes the ability and desire of a doctor to: 1) estimate the objective condition of a patient on the basis of the medical background as well as physical and laboratory instrumental research methods; 2) interpret the obtained data and hold differential diagnostics of a supposed disease (which is in fact impossible without deep theoretical knowledge); 3) find and thoroughly analyze the existing clinical recommendations based on proof; 4) estimate their applicability to a specific patient (whether the personalization of recommendations is necessary and to what degree?)" [22].

However the definitions of a notion "medical judgment" that exist nowadays don't allow us to choose the theoretical idea of the research: its content and structure are remained unrevealed, analysis of the system of characteristics and principles of a clinical style of judgment is absent, ways and means of forming the bases of clinical style of judgment as entirety aren't developed.

To formulate the conceptual idea of our research, it is necessary to choose the so-called working definition. For this reason material devoted to the basics of the formation of "concepts" was studied. According to the rules of Aristotle (logic), which regulate the rules for drafting definitions of concepts, the definition of concepts should reflect: 1) generic feature or genus of the concept "is the concept of a class into which we introduce another concept we are considering"; 2) "generic features that separate a concept from a number of similar concepts"; 3) proper features (proprium) - features inherent in "all things of this class, which are not contained in the number of essential features, but which can be derived from them" [22].

Thus, we get an illustrative conceptualization scheme:

Concept = Immediate genus + Essential features

Guided by these rules, we analyzed a few definitions of the concept of “medical judgment” of a huge number, highlighting the genus of this concept and generic features. The results of this work allowed us to build a model of this concept, testifying to its multidimensionality and variability.

Medical judgment is thinking aimed at solving professional tasks of a clinician (medical, therapeutic and preventive, research), the purpose of which is to identify signs of the disease from the original syncretic image of ill health and determine their specific relationships in a biosocial and spiritual context that gives individual clinical picture of the disease.

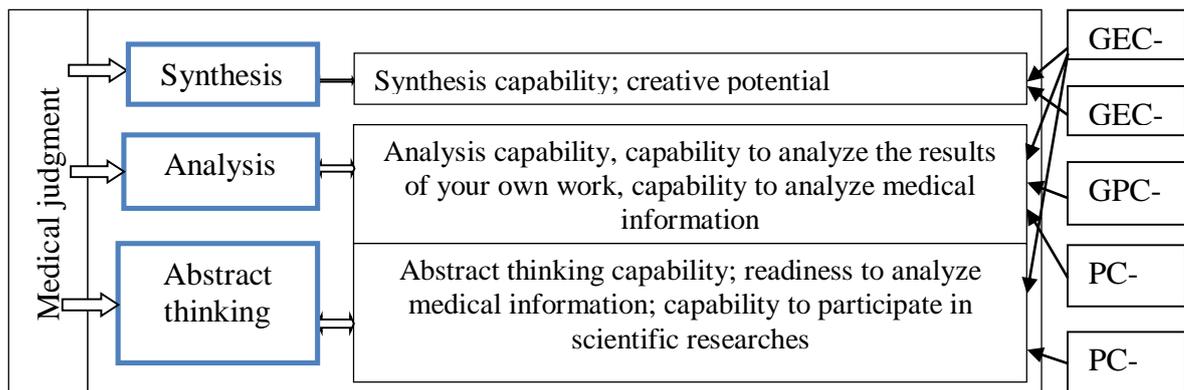


Fig. 1. Connection between medical judgment and the entirety of competencies (where GEC – general education competencies, ПЗС – general professional competencies, PC – professional competencies).

The given notion allowed us to reveal an interrelation with some competencies listed in Federal Educational Standard of Higher Education and medical judgment components. This medical judgment is possible and practical to form while teaching physics to future doctors (fig. 1).

Authorial conceptual ideas

Thus the specified definition of the notion “medical judgment”, the established connection between medical judgment and competencies that a medical university graduate should have, allowed us to formulate the theoretical idea of the study:

1) medical judgment is multicomponent and it is possible and practical to form only its several elements among the students of medical universities at physics classes;

2) elements of medical judgment correspond to general cultural (GCC1, GCC2), general professional (GPC5) and professional (PC20, PC21) competencies;

3) formation of medical judgment is possible to implement during physics classes in a medical university by including the students in solving tasks that model future professional activity.

It is rational to use a balanced combination of the situational approach and case – study technologies as theoretical basis of the development of methods of teaching physics. These methods allow forming elements of general cultural, general professional and professional competencies as the most important components of medical judgment, among medical university students. First of all the application of the situational approach will allow to organize the process of teaching physics to medical university students in accordance with the policy requirements of State accreditation of future doctors. Secondly it will allow implementing teaching through solving situational tasks that model professional activity of a doctor with the application of physics knowledge. We chose the case-study technology for a reason, as its efficiency was proved in academic researches more than once and is widely used in teaching clinical specialties. According to the authors, the application of the given teaching technology allows to: concordantly combine various traditional teaching approaches (problem, activity, person-centered, competency, context and others); implement many well-known interactive teaching methods and forms of organization of a lesson. For example project activities, system analysis, experimental works and research works, naturalistic methods, gaming technologies, “brainstorm” and others; implement at all the education levels: school level, elementary vocational education, secondary vocational education, higher vocational education; implement almost all the known forms of organization of students’ work – from individual work to collective creative projects; form scientific research activity skills – from problem (task, situation) adoption, its comprehension, to solving it via the choice of the most preferable method, forming and presenting the conclusion.

In spite of the fact that the given approaches are widely applied while teaching clinical specialties to students, we applied it for the first time for developing the model of teaching physics to future doctors.

Results

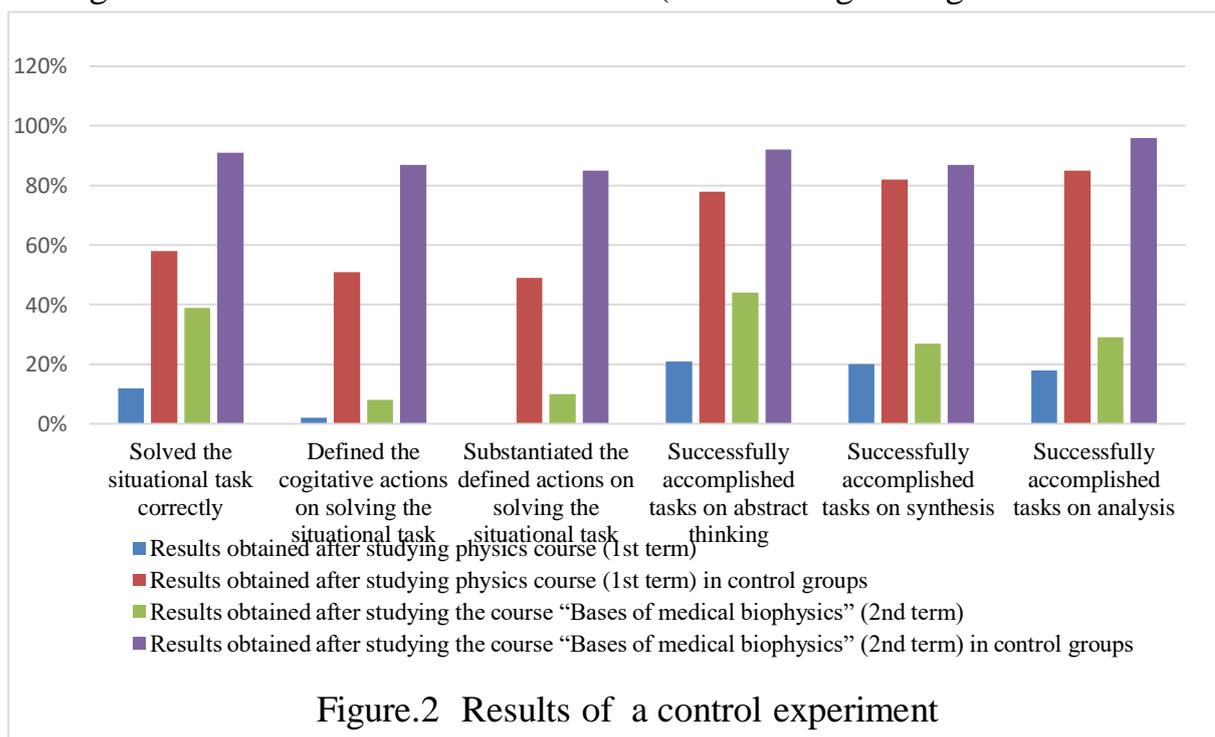
The given theoretical basis allowed us to develop a model of physics teaching methods aimed at forming in medical university students the elements of general cultural, general professional and professional competencies as the most important components of medical judgment. This model is a multi-stage model, each of the stages containing traditional elements: first-level goals that set the overall strategy for organizing each stage of the methodology, as well as goals specifying a teacher’s and a student’s activities; the content of educational material and the content of activities of participants of the educational process; practical for each stage of interaction between a teacher and students; didactic means for the organization of educational activities and control.

On a separate note, all the stages as components of a model for teaching physics to students of medical universities, are highlighted by us according to the activities of a clinician. The results of a search experiment became the basis for it. During this experiment a survey was conducted among practicing clinicians, employees of clinical departments of universities, aimed at identifying actions to solve professional problems. The generalization and systematization of the obtained results allowed us to single out the stages of medical practice and relate them to the stages of educational activity in physics classes.

Understanding the fact that the introduction of the developed model requires mandatory diagnostics of the formation (lack of formation) of elements of medical judgment, that is, it requires an estimation of the model effectiveness, we have developed a criterion-diagnostic apparatus. The criterion-diagnostic apparatus was also developed based on the definition of the concept “medical judgment” that we formulated by isolating its components, correlating it with the stages of a doctor’s activity, abstracting and creating a model of a doctor’s mental activity.

Therefore, the formation of medical judgment was estimated not so much by the correctness of the solution of situational tasks by students, which simulate professional activity, as by the identification and description of mental operations by students when performing tasks. In addition, tasks were selected to evaluate the formation of abstract thinking and its components.

The application of the criterion diagnostic apparatus, the summary of the obtained data (Fig.2) allowed us to formulate the following conclusions: 1) there is a need to organize special activities for forming skills on solving situational tasks among students of medical universities (without organizing such activities in



physics classes only 12% of students were able to solve tasks correctly after the physics course in the first term and 39% after studying the course of medical biophysics in the second term); 2) an extremely insignificant number of students (2-8%) were able to identify mental actions, which speaks of the intuitive solution of situational problems; 3) the introduction of a model for the formation of medical judgment elements in the in physics classes had a positive effect on the ability to solve situational problems, on the formation of abstract thinking and such mental operations as analysis and synthesis; 4) prolongation of the introduction of the model in the study of medical biophysics course has significantly increased the indicators of the formation of medical judgment.

Conclusion

Thus the obtained data of a pedagogical experiment allow to announce: 1) elements of medical judgment may be formed while teaching physics to students of medical universities during the 1st year of study; 2) elements of medical judgment aren't formed spontaneously 3) the developed model of a methodology of teaching physics to future doctors aimed at forming medical judgment is efficient and may be introduced to an educational process.

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