Innovative technologies as means of formation polytechnic competent of a future doctor in the study of integrated discipline "Physics, mathematics"

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Abstract. In article are considered innovative technologies of formation of polytechnical competence of the doctor and algorithm of design of the content of discipline "physics, mathematics", as means of its formation. In work are disclosed features of teaching of discipline "Physics, mathematics" in medical school for future doctors. Here is considered the question of the latest techniques of teaching of the physics, especially actual for nontechnical universities. Competence considered in terms of their place in the structure of physician competence model, which is represented in the federal state educational standard of higher education; disclosed a professionally-oriented design strategy of content of discipline "Physics, Mathematics" also it is described, the corresponding algorithm of procedure of design of electronic manuals developed by us and computer programs in educational process of future doctor.

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Introduction

Nowadays information technologies are introduced into our lives everywhere. They are used as well as in the system of higher professional education, particularly in teaching physics. Volume of information obligatory for learning by all pupils increases from year to year. Wide application of information technologies makes an institution of higher education more competitive at the market of educational services.

Introduction of information technologies in physical training of higher professional institutions has become one of the most important ways of intensification educational process and one of the forms of formation future doctors polytechnic competence. This is especially true for teaching physics, because it is very problematic to explain many phenomena and processes without hands-on demonstrations and to implement it in the conditions of one pair within the lecture-room [1]. Accomplishment of many tests and experiments becomes possible only under the circumstances of computer programmer use. Application of information technologies in teaching physics contributes to the development of students ' interest to the subject, to increase efficiency of their independent work and educational process in general, allows to solve tasks of individualization and differentiation of learning process.

Formation polytechnic competent of a future doctor

Polytechnic training of physicians today is modern requirement and social order to the system of medical education. Scientific-technical and social progress establish new requirements and, accordingly, new content of doctor's training. Analysis of dissertation researches and literature on the theory and practice of polytechnic education allow us to define polytechnic training as a process of formation polytechnic competent of future specialists. Polytechnic competent means knowledge and skills, polytechnic orientation, ability and motivation, readiness of an individual for reforming technical and technological activity[2]. Competences are active profession's characteristics; that is possession competences means competent. Skills are mastered by a personality meaning of activity.

Polytechnic competent is necessary in application of new technology in medicine. High level of training a doctor to practical and rationalization work with technical objects, including equipment, technologies, a complex of devices and technological processes, will provide their constructive and fruitful use. Inclusion polytechnic knowledge into the system of professional training will allow a future doctor to realize professional and social functions effectively and constantly increase qualification, to master adjacent specializations; as it is very actual for a contemporary doctor under the conditions of high technical equipment. While studying technical and scientific factors of polytechnic competent forming it is necessary to pay attention to analysis of modern medical technologies and technique, qualitative changes of all sides of medical professional activity[3]. This factor is constantly strengthening with labour intellectualization and technique complication.

In a common state, polytechnic training in medical institution includes forming fundamental physics and mathematics knowledge, necessary for forming harmoniously developed personality with strict imagination the world integrity and technological progress and applied physics knowledge used in professional activity. Formed polytechnic competence is a result of polytechnic training.

We suggest considering polytechnic competent to be a complex of competences [4]. Thus, polytechnic competent unites more narrow competences, abilities and skills, necessary for realization.

Considering competences with the point of view of their role in the structure of competence doctor's model, represented in FSES HPE [5], it is possible to notice the following: they are divided into common cultural competences and professional competences.

We propose to mark out polytechnic competent in connection with its importance. Polytechnic competent of a doctor is represented by the following:

- ability and readiness for analyzing important social problems and processes, for using in practice different methods of human, natural, medicine, biological and clinical sciences in different professional and social types of activity (polytech - 1);
- ability and readiness for identifying nature of problems, appearing in the process of doctor-pediatrist professional activity, for using relevant physics, chemistry and mathematics apparatus for their solution (polytech - 2);
- ability and readiness for forming systematic approach to medical information analyses, based on search of solutions with theoretical knowledge and practical skills use with the aim of mastering professional activity (polytech - 3);
- ability and readiness for analyzing the results of professional activity with the aim of averting medical mistakes, understanding at the same time disciplinary, administrative responsibilities, civil and criminal liabilities (polytech - 4);
- ability and readiness for studying scientific and medical information, domestic and foreign experience of research (polytech - 5);
- ability and readiness for working with medical-technical equipment, used in communicating with patients: children and teenagers, readiness for being able to work with computer technique, for receiving information in the global computer network; readiness for using possibilities of modern information technologies for solution of professional tasks (polytech - 6);
- ability and readiness for participating in the development of modern theoretical and experimental methods of investigation with the purpose of creation promising new meanings, in organization work on the practical use and introduction results of research (polytech – 7) [5].

So how forming competence is the aim and expected result of education, components of the educational process must provide achievement of this aim. Thus, it is necessary that the content of education on the whole and particularly the discipline "Physics, mathematics" contribute to the formation of the polytechnic competence. Srengthening vocational fundamental components of the polytechnic competence, as a clarification of the result should be automatically considered in the process of projecting the content of the discipline "Physics, mathematics".

In order to identify what part of the content of the discipline "Physics, mathematics" makes a great contribution in forming polytechnic competence of future doctors, we have used a concept of multilevel refinement. Considering the content of the discipline "Physics, mathematics" in terms of a concept of multilevel refinement of professional education content [4], it is possible to divide it into scientific- fundamental, technically-fundamental and professionally- fundamental component, which in their turn will contribute to the creation of the corresponding component of the polytechnic competence. Scientific and fundamental component of the content includes knowledge and skills necessary for theoretical research activities of the following kind. To techno and fundamental a component belong knowledge and skills necessary, for successful professional technical and technological activity. Professional knowledge and skills necessary for narrow specific professional activity relate to vocational fundamental component.

Thus, changes in one of the components of polytechnic competence entails optimization of relevant component of discipline "Physics and mathematics" content. Close relationship of polytechnic competence and the content of the discipline «Physics, mathematics", on the one hand, and need to preserve logic and structure of the science, on the other hand, impose special requirements when designing the content of the discipline. A question of clear definition the algorithm of designing the content of different disciplines, in particular the discipline "Physics, mathematics" is opical for the modern higher medical education. It will demonstrate the degree of a discipline content and medical education in general meeting the requirements of training a doctor[6].

Competence approach, as basic one, has been chosen for designing the content of discipline "Physics and mathematics". The advantages of this approach are possibilities hard enough to relate the content of higher medical education with requirements of training of doctors, which, undoubtedly, will ensure the quality and depth of training. A professionally-oriented strategy of designing the content of discipline "Physics and mathematics" has been chosen due to this aim as well as a corresponding algorithm design procedure has been developed. It consists of the following:

1. To analyze the requirements for personal and professional parts of medical profession, described in professional characteristic of a doctor, in the model of physician personality, in the activity model of a doctor, in his ethic code, in Federal state educational standards.

2. To develop a doctor's competence model, based on the analysis of personal and professional components.

3. To make a selection of competencies may be formed in the course of study discipline "Physics and mathematics" and belonging to polytechnic competence of a doctor.

4. To relate the content of "Physics and mathematics" and generated competences to identify missing or unnecessary information for forming competencies.

5. To adjust the content of discipline "Physics and mathematics» for forming selected competences.

6. To form this content in accordance with the logic of sciences (physics, mathematics).

7. To differentiate the resulted content of the discipline "Physics and mathematics" in accordance with the concept of multilevel refinement education content on scientific - fundamental, techno-fundamental, vocational fundamental components and to expand the content, if their balance is not observed.

8. To share received content into training thematic modules and topics further on.

9. To choose appropriate forms, methods and means of teaching each topic of the discipline "Physics and mathematics".

In our opinion, such a procedure of designing the content of discipline "Physics and mathematics" and quite a tough target determination of their content will help to ensure optimal volume, composition and structure of the learning process, and the main direct focus on polytechnic competent as one of the most important doctor's qualities, a doctor who is able to work with modern high-tech medical equipment.

Methods of forming competencies should be polyfunctional: they must give knowledge, form skills and build necessary qualities of a personality. Today use of information technologies has become one of the most important ways of forming and validation of competences [4]. In a complex with traditional educational technologies we have chosen innovative technology with use of modular object-indicative educational system MOODLE, which is designed to manage the process of learning. The basic opportunities of the system while developing the course can be the following:

- holding courses as a Calendar (for mixed forms of training), a Forum (for collaborative learning), a Structure (for self-study);
- possibility of adding such elements in the content of courses as a forum, a notebook, a test, a resource, a glossary, survey, a questionnaire. homework and etc.;
- ability to add situational problems for creation and validation of competences;
- the maximum score, specified deadlines can be assigned (students may upload their work to the server, where response time is automatically being written);
- creation tests with different types of questions (matching and multiple choice, nested answers and etc.) and ability to implement import /export;
- ability of introducing media objects: audio - video files, viewing test results;
- supporting import/export files according to the international standard SCORM and a number of describing tests standards (GIFT, IMS QTI and etc.);
- possibility of organizing interactive communication: forums, chats, newsgroups.

Training courses available in the system MOODLE, may include such kinds of training materials as annotations of courses, resources, assignments and discussion topics. The courses may have special keys providing limited access to educational materials. They can be accessed only by registered users.

In addition, the system provides a communicative interaction of educational process participants, implemented in different forms of Internet-conferences (forums, discussions) and an exchange of messages containing job trainees, tasks and notes.

Electronic textbooks in application to physical training in medical school may improve organization of independent work. This is especially true for teaching physics, because it is very difficult to explain many processes and phenomena without hands-on demonstrations, moreover it turns out to be

problematic to implement it in the tight framework of one lecture within the audience[5]. Demonstration of many tests and experiments becomes possible only with the use of computer programs. Application of information technologies in teaching physics and mathematics contributes to the development of students ' interest to the subject, increases efficiency of their work and educational process in general, allows to solve the tasks of individualization and differentiation of training process[6].

Various computer programs can be used in physical and mathematical preparation for:

- Intensification and organization educational process in general (MOODLE, Sakai, Blackboard and etc.);
- enhancing the visibility of physical experiments (for example, the video book on physics, created at the physics department of KFU; its authors are A.I. Fishman, A.I. Scvortsov, R.V. Daminov);
- organization virtual laboratory works (Course Lab);
- use of multimedia courses in studying phenomena being covered in details in electronic educational programs, which can't be studied under the circumstances of a real experiment;
- more full visualization of objects and phenomena in comparison with printed learning tools (such as "Physics in the animation");
- use of possibility to choose different time scales events, to interrupt action of a computer model or of experiment using their recurrence;
- automation the process of monitoring the level of students knowledge and skills;
- solution and analysis of interactive tasks requiring analytical and graphical solutions using GUI;
- testing and correction results of educational activity (Mini Test-SL, Exe Test-SL, Reg Test-SL and etc.);
- organisation creative teaching and search activity of students (for ex. Phun)[7, 8].

Conclusions

Rapid development of information technologies, a slow, but steady transformation of computer from a sacred object, accessible only to a narrow group of scientists into the phenomenon of everyday routine, emergence of Internet and computer-based training programs – all this sooner or later should have been addressed to such traditionally conservative area as Russian education. In recent years we have witnessed the appearance of first English-speaking and then domestic electronic encyclopedias, providing users new «degrees of freedom» rather than their traditional "paper" analogues. There was only one step for attempts to create fundamentally new tutorials - electronic manuals. Now, when the process of establishing such textbooks is already beyond the individual private experiments, when active attempts to introduce them into the educational process are being undertaken, there is considerable experience in this sphere[9]. It is finally possible to say that definition of term ‘electronic textbook’, as well as its concept, which pioneers enthusiasts "probed the blind’, begin to dawn.

Use of ET in educational process, in particular, in studying integrated discipline "Physics, mathematics» does not mean inevitability of refusal from traditional teaching methods. This is only a new meanings in the hands of experienced teacher, which allows to achieve results with a smaller expenditure of time and effort, to increase efficiency of information assimilation, to facilitate largely students' work.

Electronic textbook helps students to overcome difficulties in learning and creates favorable conditions for close and effective interaction of teachers and students in the training process, allows all participants of a training process to feel comfortable in a new format of education, promotes students in their general development, shows them possibilities of using information and communication technologies for self-education, motivating them to independent research work[10]. All this helps to increase volume of knowledge and improvement of its' quality, development of skills needed in medicine. All in all, it gives future physicians chances to become more successful in life and competitive at the labour market.

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