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Training System for the Course «Mathematical Modeling of Processes» in Pharmacy

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ABSTRACT

Background. The general ideas of modelling as a universal approach to the study of complex objects are used in almost all training courses. Many researchers rightly consider modelling as a general didactic tool and the main method of acquiring knowledge, which determines the importance of purposeful teaching of this method. In this regard, one of the aspects of professional training of students is the formation of knowledge and skills in the use of the method of mathematical modelling. In modern conditions, there are real opportunities to use them in the professional activities of pharmacists.

Methods. Systems of structuring the content of education, the formation of intra-subject and inter-subject integration, and types and forms of students' independent activity.

Conclusion. Important areas for improving mathematical education are the strengthening of the applied orientation and the individualization of the educational process. The proposed system of teaching the course "Mathematical Models of Processes" in pharmacy will allow students to receive theoretical training and acquire practical skills in the effective use of economic and mathematical models based on modern software for making competent management decisions in their future professional activities.

Keywords: Structural-functional scheme, education content formation, intra-subject and inter-subject integration, student's independent work.

INTRODUCTION

The mathematization of various branches of knowledge, the introduction of information technologies, the complication of production and technological processes, the need to analyze large amounts of information for successful decision-making and forecasting, and the adoption of managerial decisions lead to the need to build mathematical models of varying complexity. The general ideas of modelling as a universal approach to the study of complex objects are used in almost all training courses. Many researchers rightly consider modelling as a general didactic tool and the main method of acquiring knowledge, which determines the importance of purposeful teaching of this method. In this regard, one of the aspects of professional training of students is the formation of knowledge and skills to use the method of mathematical modelling [4].

In modern conditions, the issues of making competent, balanced decisions based on reliable data and their correct processing and interpretation, which is obviously impossible without knowledge of mathematical methods and the ability to build adequate mathematical models that reflect the processes of the real world, are becoming

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more and more relevant. Only mathematical methods can build reliable forecasts, evaluate the significance of the results obtained and make competent decisions on their basis in any field of activity. Economic and mathematical models are traditionally included in the training programs of universities. But only in modern conditions, there are real opportunities to use them in the professional activities of economists, managers, physicians, pharmacists and other specialists [3].

With all this, important areas for improving mathematics education are the strengthening of applied orientation and the individualization of the educational process.

METHODS

The practical use of economic and mathematical models in the courses of various specialities (management, economics, applied informatics, biology, chemistry, medicine, pharmacy, etc.) varies significantly [1,2].

The considered course "Mathematical Modeling of Processes" in pharmacy is an integral part of the discipline "Information technologies in medicine".

Note that the basis of the course "Mathematical Modeling of Processes» in pharmacy, in addition to chemical-pharmaceutical technological and production systems, they make up several sections of the discipline "Mathematical Methods in Economics".

The discipline "Mathematical Methods in Economics" provides for the study of the following economic and mathematical models and methods [3].

Network scheduling models (deterministic, probabilistic, as well as the possibility of optimizing network schedules according to the cost criterion). Inventory management models have found wide application not only in logistics systems but also in business processes of financial management and processes of technological preparation of production and investment.

Models of queuing systems are considered with the prospect of practical use for simulating the processes of functioning of technological processes, as well as for solving problems of analysis, planning, and forecasting in order to make decisions in the areas of technical service (maintenance and repair of machines and mechanisms) when modelling complex systems, for which reliable operation is required.

The use of models of queuing systems makes it possible to predict the failures of such systems, as well as to synthesize such systems in which reliable operation will be ensured at minimal cost to restore operability in the event of failures. An important place is occupied by models of queuing systems in economic applications when modelling logistics systems (material, financial and information flows).

An important place in the description of business processes for the purpose of forecasting the development of economic objects and systems is occupied by dynamic models, starting from the simplest - one-dimensional, and ending with multi-dimensional - diversified dynamic balance models, for the construction and use of which it is necessary to automate the receipt and solution of systems of differential equations.

In addition, models are included that provide for financial calculations and analysis of the economic activity of enterprises, which are relatively simple from a mathematical point of view but are very relevant from a practical standpoint.

Also included are models of securities management, investment optimization and innovation.

In the process of mathematical modelling, the following stages can be distinguished:

1) specification - understanding the task, highlighting essential relationships and properties of the objects or processes being modelled;
2) formalization - drawing up a solution plan, describing in the language of mathematics the selected qualitative ideas about the objects of the model;
3) calculation (estimation) parameter models – the study of mathematical problems;
4) interpretation of the obtained results;
5) checking the adequacy of the model - whether the results obtained meet the criterion of practice; if the model is inadequate, then you should return to steps 1) and 2), if the model is adequate, then you can go to the next step;
6) building a forecast, using the results for management and decision-making;
7) subsequent analysis of the model and its modernization, i.e., the transition to steps 1) and 2).

It is obvious that the construction of a qualitative model is impossible by mathematicians alone. If for the successful implementation of step 3) it is enough to have a knowledge of the mathematical apparatus, then at the remaining steps close interaction with specialists in the relevant industry is necessary. The basis of such interaction and the guarantee of a successful search for a common language in solving the tasks is high mathematical culture and developed logical thinking of specialists.

When teaching mathematical modelling, several levels of education can be noted:

1) teaching the "language" in which modelling will be carried out;

2) learning to "translate" a real situation into a given mathematical language;

3) teaching the choice of significant factors and building a diagram of their relationships;

4) learning to compose mathematical expressions, relationships and relationships.

5) training in the compilation of mathematical expressions, the allocation of relationships and connections, and the interpretation of the resulting solution;

6) training in the study of the obtained solution, in particular, the skills of self-control.

Thus, mathematical modelling is one of the most important tools for the formation of mathematical culture, and, moreover, the degree of assimilation of mathematical modelling skills can be considered the main criterion for the level of the existing mathematical culture of a specialist.

The relevance of acquiring modelling skills is explained by the fact that in almost all areas of activity, the construction and use of models is a powerful means of cognition.

The objectives of the course "Mathematical modelling of processes" in pharmacy are:

- the study of the main methodological and philosophical aspects of modelling, the role and place of mathematical modelling in modern pharmacy.

- the formation of formalization skills, the ability to set mathematical problems, choose the appropriate methods for solving formulated problems and analyze the solutions obtained.

- formation of skills to apply calculation methods using personal computers and evaluate models for computer simulation.

- formation of skills for creating, coding, and testing simulation programs.

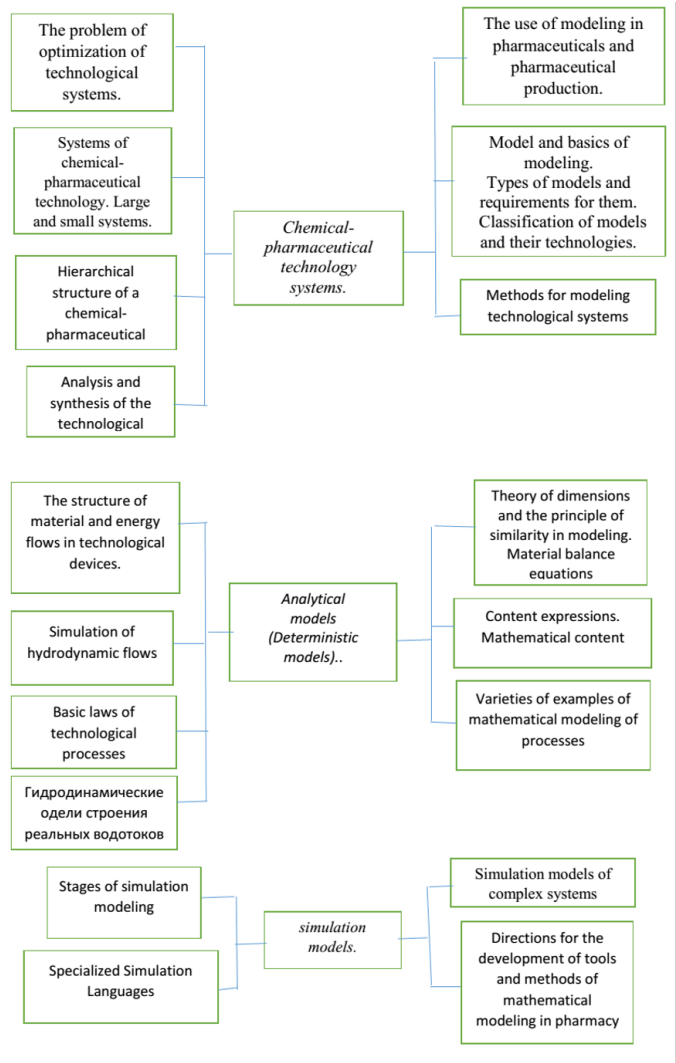
Important areas for improving mathematical education are the strengthening of the applied orientation and the individualization of the educational process.

RESULTS

The course "Mathematical Models of Processes" in pharmacy provides 6 hours of lectures and 24 hours of practical classes.

Based on the goals and objectives of training, the following content of the course was determined (see the structural and functional diagrams of the constituent parts of lectures and practical classes and discipline classes - "Mathematical modelling of processes" in pharmacy).

In fact, some structuring of the educational content of the course has been carried out. Independently allocated mathematical methods, methods of their use, and technological systems in pharmacy. In our opinion, this enables students to visualize the entire content of the course, and the teacher to create a system within the course and interdisciplinary integration.



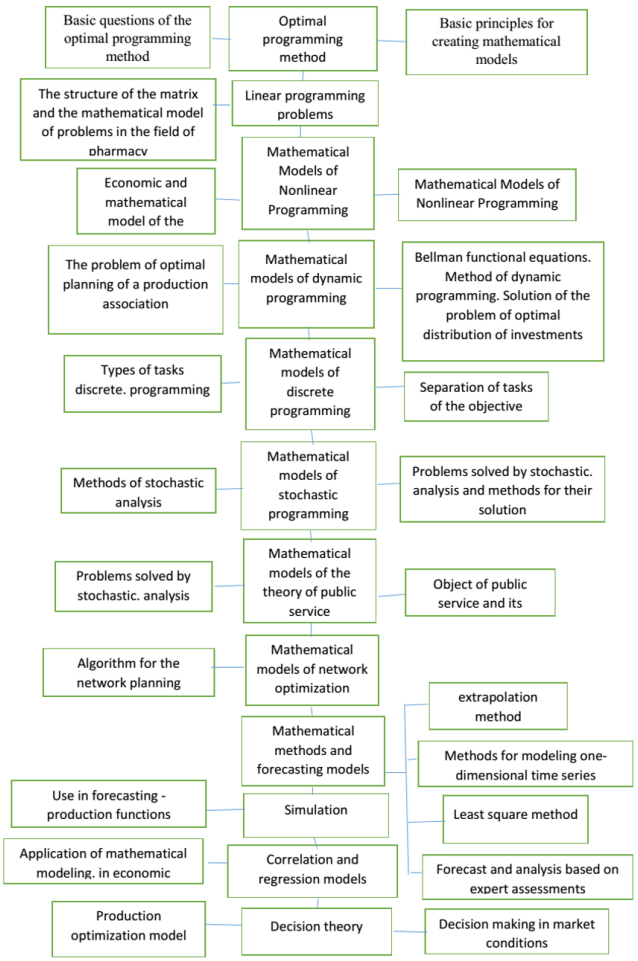
Structural-functional diagram of the constituent parts of the lectures of the course "Mathematical Modeling of Processes" in Pharmacy

To effectively perform independent work at different levels, a student needs to master a stable set of methods of activity to solve various types of educational problems. First, we are talking about the ability to take notes, select examples, compare, establish inter-subject relationships, use additional literature, paraphrase, make a conceptual tree, etc.

Special requirements should be imposed on the content and form of assignments for independent work. Tasks should be aimed at the formation of competencies and have a problematic nature, which leads to an in-

crease in the variety of forms and methods of independent work and gives it a differentiated, variable character, demonstrating a more complete consideration of the individual capabilities, needs and interests of students.

Thus, conditions are created for the wider use of tasks of students' choice. It is necessary to increase the number of tasks for independent work, built on an integrative basis (within the subject and interdisciplinary content), required to combine individual components of competencies into the experience and the formation of general cultural and professional competencies, it is also necessary to expand the independent work of students, carried out in the form of educational-professional activity.



Structural-functional diagram of the components of the practical classes of the course "Mathematical Modeling of Processes"

DISCUSSION

The problems of using mathematical models and information technologies in education are considered in several works by both foreign and domestic researchers [1-7 and many others. etc.].

It is noted in [6] that the "Mathematical Model", based on some simplification, and idealization, is not identical to the object, but is its approximate description. However, due to the replacement of a real object with a model corresponding to it, it becomes possible to formulate the problem of its study as a mathematical one and use for analysis a universal mathematical apparatus that does not depend on the specific nature of the object.

Mathematics makes it possible to uniformly describe a wide range of facts and observations, to conduct their detailed quantitative analysis, to predict how an object will behave under different conditions, i.e., to predict the results of future observations" [4].

Mathematical modelling in the learning process is an important tool: - for the formation of new knowledge and creative abilities of students; - effective assimilation of new material, systematization, and visualization of knowledge; - for awareness and fixation of the essential properties and relationships of the studied objects and phenomena; - formation of professional skills; - development of the independent activity of students.

In [5], it is noted that information technologies in education provide several opportunities for optimizing the learning process. However, this does not remove some problems: the problem of choosing teaching methods, the problem of goals, problems of classes and educational literature, etc.

The paper [1] indicates that the persons responsible for managing the economy at the level of a business entity should make managerial decisions in conditions of high uncertainty that affect the development of production, distribution, exchange, and consumption processes. It is impossible to evaluate the effectiveness of such projects and processes without appropriate economic and mathematical calculations.

CONCLUSION

Thus, the course "Mathematical Models of Processes" in Pharmacy will allow students to receive theoretical training and acquire practical skills in the effective use of economic and mathematical models based on modern software for making competent management decisions in their future professional activities.

Individualization of learning is considered the organization of the educational process, considering the individual differences of students. At the same time, individualization in the narrow sense means the development of an individual learning trajectory for each student, in the broad sense - the creation of conditions for the manifestation of individual characteristics in the educational

process by different students. An individual approach should be distinguished from differentiation when training is conducted on the principle of dividing students into groups based on some externally specified criterion. At the same time, it is important to introduce different ways of individualizing learning, using educational materials of different levels of complexity [5].

The need for studying the types and forms of individualization of teaching Mathematical modelling of processes in pharmacy" is determined by several prerequisites. The first of them is associated with the active use in the practice of training future pharmacists of collective forms of education (group projects, interactive and network methods, etc.). The second prerequisite is determined by the need to consider the individual psychological and personal characteristics of students since it is the appeal to the capabilities and potential of a particular individual that is the main pedagogical task of any educational system. Finally, the third premise follows from the need to study existing experiences and patterns that determine the prospects and realize the potential for individualization of teaching "Mathematical modelling of processes in pharmacy.

In modern theory and teaching methods, research devoted to the implementation of the applied orientation of education based on a competency-based approach to learning is relevant. This approach involves teaching not only ready-made knowledge, but also activities to acquire knowledge, ways of reasoning, and the ability to solve problems of varying complexity based on existing knowledge.

One of the factors stimulating the development of learning motivation among students is the practical significance of the discipline and the connection with the future profession.

Consent for publication - The study is valid, and recognition by the organization is not required.

Availability of data and material - Available

Conflict of interest - No

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FARMATSEVTIKA FANIDA “JARAYONLARNI MATEMATIK MODELLASHTIRISH” KURSI BO‘YICHA O‘QUV TIZIMI

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Abstrakt

Dolzarbligi. Murakkab ob'ektlarni o'rganishga universal yondashuv sifatida modellashtirishning umumiy g'oyalari deyarli barcha o'quv kurslarida qo'llaniladi. Ko'pgina tadqiqotchilar modellashtirishni umumiy didaktik vosita va bilimlarni egallashning asosiy usuli sifatida haqli ravishda hisoblashadi, bu esa ushbu uslubni maqsadli o'qitishning ahamiyatini belgilaydi. Shu munosabat bilan talabalarning kasbiy tayyorgarligining jihatlaridan biri matematik modellashtirish usulidan foydalanish bo'yicha bilim va ko'nikmalarni shakllantirishdir. Zamonaviy sharoitda ulardan farmatsevtlarning kasbiy faoliyatida foydalanish uchun real imkoniyatlar mavjud.

Usullari. Ta'lim mazmunini strukturalash tizimlari, o'quv fanlari va o'zaro o'zaro integratsiyani shakllantirish, o'quvchilarning mustaqil faoliyatining turlari va shakllari.

Xulosa. Matematik ta'limni takomillashtirishning muhim yo'nalishlari amaliy yo'nalishni kuchaytirish va o'quv jarayonini individuallashtirishdir. Farmatsevtika fanida “Jarayonlarning matematik modellari” kursini o‘qitishning taklif etilayotgan tizimi talabalarga nazariy ta’lim olish va ularning kelgusidagi kasbiy faoliyatida malakali boshqaruv qarorlarini qabul qilish uchun zamonaviy dasturiy ta’minotga asoslangan iqtisodiy-matematik modellardan samarali foydalanish bo‘yicha amaliy ko‘nikmalarni egallash imkonini beradi.

Kalit so'zlar: strukturaviy-funktsional sxema, ta'lim mazmunini shakllantirish, fan ichidagi va sub'ektlararo integratsiya.

СИСТЕМА ОБУЧЕНИЯ КУРСА «МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ ПРОЦЕССОВ» В ФАРМАЦИИ

Марасулов А.Ф.
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Абстракт

Актуальность. Общие идеи моделирования как универсального подхода к изучению сложных объектов используются практически во всех учебных курсах. Многими исследователями моделирование по праву рассматривается как обще дидактическое средство и основной метод приобретения знаний, что обуславливает важность целенаправленного обучения этому методу. В связи с этим одним из аспектов профессиональной подготовки студентов является формирование знаний и умений по использованию метода математического моделирования. В современных условиях существуют реальные возможности использования их в профессиональной деятельности фармацевтов.

Методы. Системы структуризация содержания обучения, формирования внутри предметной и межпредметной интеграции, видов и форм самостоятельной деятельности студентов.

Заключение. Важными направлениями совершенствования математического образования являются усиление прикладной направленности и индивидуализация учебного процесса. Предлагаемая нами система обучения курса «Математические модели процессов» в фармации позволит получить студентам теоретическую подготовку и приобрести практические навыки эффективного использования экономико-математических моделей на базе современного программного обеспечения для принятия грамотных управленческих решений в будущей профессиональной деятельности.

Ключевые слова: структурно-функциональная схема, формирования содержания обучения, внутри предметная и межпредметная интеграция.