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FEATURES OF THE MODEL OF INTERDISCIPLINARY INTEGRATION IN A MEDICAL UNIVERSITY

Resume. *Aspects of building an integrated program "Fundamentals of Pharmacology and Medicinal Chemistry" for teaching students of the specialty "General Medicine" were considered within the framework of the module "Fundamentals of Living Systems Functioning". The combination of different elements of the disciplines made it possible to exclude duplication of the same medical concepts. Emphasis was placed on the key points of an integrated discipline. This made it possible to form the specifics of an integrated approach to the study of various disciplines by students, both chemistry and pharmacology, as well as to stimulate the acquisition of knowledge from various sources in solving the interdisciplinary tasks. Performance criteria have been researched over several years of student learning. Based on the results of the work carried out, conclusions were drawn about the effectiveness of the introduction of an integrated discipline into the educational process. The implementation of interdisciplinary links in integrated learning will help to increase the effectiveness of learning, broaden the horizons of students. It is of fundamental importance in the training of future specialists. Integrated learning is an important trend in modern education and it aims to expand the existing narrow specialization in education. The strategy of medical education is focused on the development of integrated education, the implementation of the principle of integration of basic and clinical disciplines, and early clinical motivation of students.*
Keywords: *education, medical university, professional competence, integration, interdisciplinary connections.*

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МЕДИЦИНАЛЫҚ ЖОҒАРЫ ОҚУ ОРЫНДАРЫНДА ПӘНАРАЛЫҚ ИНТЕГРАЦИЯ МОДЕЛІНІҢ ЕРЕКШЕЛІКТЕРІ

Түйін. "Жалпы медицина" мамандығының студенттерін оқыту үшін "тірі жүйелердің жұмыс істеу негіздері" модулі шеңберінде "фармакология және медициналық химия негіздері"интеграцияланған бағдарламасын құру аспектілері қарастырылды. Пәндердің әртүрлі элементтерінің үйлесуі бірдей медициналық ұғымдардың қайталануын болдырмауға, интеграцияланған пәннің негізгі сәттеріне назар аударуға мүмкіндік берді, бұл студенттердің химия мен фармакологияның әртүрлі пәндерін оқуға интеграцияланған тәсілінің ерекшелігін қалыптастыруға, сондайақ қойылған пәнаралық міндеттерді шешуде әртүрлі көздерден білім алуға ынталандыруға мүмкіндік берді. Студенттердің бірнеше жылдық оқу үлгерімінің критерийлері зерттелді. Жүргізілген жұмыстың нәтижелері бойынша оқу процесіне интеграцияланған пәнді енгізудің тиімділігі бойынша қорытынды жасалды. Интеграцияланған оқытуда пәнаралық байланыстарды іс-

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ОСОБЕННОСТИ МОДЕЛИ МЕЖДИСЦИПЛИНАРНОЙ ИНТЕГРАЦИИ В МЕДИЦИНСКОМ ВУЗЕ

Резюме. Рассмотрены аспекты построения интегрированной программы «Основы Фармакологии и медицинская химия» в рамках модуля «Основы функционирования живых систем» для обучения студентов специальности «Общая медицина». Сочетание различных элементов дисциплин позволило исключить дублирование одних и тех же медицинских понятий, сделать акцент на ключевые моменты интегрированной дисциплины, что дало возможность сформировать специфику интегрированного подхода к изучению студентами различных дисциплин, как химии, так и фармакологии, а также, стимулировать приобретение знаний из различных источников в решении поставленных междисциплинарных задач. Исследованы критерии успеваемости в течение нескольких лет обучения студентов. По результатам поведенной работы сделаны выводы по эффективности внедрения интегрированной дисциплины в учебный процесс. Реализация

ке асыру оқытудың тиімділігін арттыруға, студенттердің ой-өрісін кеңейтуге ықпал ететін болады, бұл болашақ мамандарды даярлауда қағидатты мәнге ие. Интеграцияланған оқыту қазіргі білім берудегі маңызды бағыт болып табылады және оқытудағы тар мамандандыруды кеңейтуге бағытталған. Медициналық білім беру стратегиясы интеграцияланған оқытуды дамытуға, базалық және клиникалық пәндерді интеграциялау қағидатын іске асыруға және білім алушыларды ерте клиникалық ынталандыруға бағытталған.
Түйінді сөздер: білім беру, Медицина Университеті, кәсіби құзыреттер, интеграция, пәнаралық байланыстар

междисциплинарных связей в интегрированном обучении будет способствовать повышению эффективности обучения, расширению кругозора студентов, что имеет принципиальное значение в подготовке будущих специалистов. Интегрированное обучение является важной тенденцией в современном образовании и направлено на расширение существующей узкой специализации в обучении. Стратегия медицинского образования сконцентрирована на развитии интегрированного обучения, реализации принципа интеграции базовых и клинических дисциплин, и ранней клинической мотивации обучающихся.
Ключевые слова: образование, медицинский университет, профессиональные компетенции, интеграция, междисциплинарные связи.

Introduction.

The change in the education policy of the Republic of Kazakhstan is associated with the formation of market relations, as well as with the development of the country's economy and society. One of the most important factors in the development of society is the training of competitive specialists, especially in the medical and pharmaceutical industries. The overall purpose of reforming this area is to improve the quality of life of every citizen of the country.

According to the State Program of Health Care Reform and Development of the Republic of Kazakhstan, the Concept of Reforming Medical and Pharmaceutical Education has been developed. The purpose of modernization of medical and pharmaceutical education is to create a new system for training medical and pharmaceutical specialists, taking into account changes in the structure and content of educational programs.

Introduction. One of the most important directions of modernization of higher education in Kazakhstan is the introduction of competence approach, which allows using the obtained knowledge, abilities and skills in real conditions [1]. This approach implies the creation of an individual trajectory of student's learning taking into account the mandatory component of disciplines and the component of elective disciplines, introduction of modular system of disciplines formation in educational programs, introduction of interdisciplinary approach in studying the module of basic fundamental medical and biological disciplines of medical and pharmaceutical specialties.

Karaganda Medical University took an active part in the development and implementation of the tasks of medical education reforming. Within integration to European educational space in context of Bologna process on 17th of September 2010, KSMU signed the Great Charter of Universities in Bologna (Italy). For implementation of competence approach in educational process there were developed and approved spheres of competence of graduate and teacher of KSMU, which served for integration of university into world educational process [2].

Karaganda Medical University was one of the first among medical universities of the Republic of Kazakhstan to implement mechanisms of university autonomy. When assessing the level of autonomy, the criteria and indicators internationally recognized by the European Association of Universities were used. After a long discussion in the professional community, the necessary legal framework was formalized in the form of the law of the Republic of Kazakhstan "On amendments and additions to some legislative acts of the Republic of Kazakhstan on the expansion of academic and managerial independence of higher educational institutions" of July 4, 2018 [3].

Autonomy of higher education institutions implies changes in the organizational, personnel, financial and academic policies of the university. At present, each higher education institution in Kazakhstan has been granted the right to independently form educational programs, choose and develop the content, forms of intermediate and final control. In the future, such changes should lead to the creation of a competitive academic environment.

The competence approach allows to motivate the student for reflection, analysis of his/her own activity, self-discovery. Attempts to motivate students at our University are implemented in the form of annual knowledge survival in the form of testing in all passed subjects. Analysis of the results allows us to identify learning problems. Such problems include errors in formulating learning goals and objectives, the correction of which leads to a more balanced planning of university teaching staff activities.

Planning and organization of the educational process is based on the formation of educational programs for each specialty. The educational process is built on the basis of capabilities, aptitudes and immediate interests of the students [4]. This implies the development of educational programs that include interdisciplinary integration.

Integration of disciplines within one specialty is aimed at the interaction of all structural components. This implies, first of all, the need to develop a thematic plan based on the interrelation of the content of disciplines depending on the purpose and objectives of integration. Subsequently, based on the formulated fundamental components of

the program, forms and methods of teaching, as well as methods of evaluating students' knowledge are developed. Currently, many higher education institutions in Kazakhstan and Russia are working on the implementation of the principle of integration of disciplines in the educational process. For example, there is experience in implementing the competency-based approach in mastering interdisciplinary links in radiology diagnostics, microbiology, pulmonology, oncopulmonology in training specialists at medical and pediatric faculties in the discipline "Phthisiology" [5].

Another approach to interdisciplinary integration is described in the work of Litvinova T.N., Bykov I.M., Volkova N.K. [6]. It consists in introducing vertical integration of chemical understanding of matter at the stages - pre-university chemistry, general chemistry, bioorganic chemistry, biological chemistry, clinical biochemistry.

The purpose of this work is to study the effectiveness of the implementation of interdisciplinary integration in the educational process on the example of the analysis of learning outcomes of students of "General Medicine" in the integrated discipline "Fundamentals of Pharmacology and Medical Chemistry".

Methods.

Based on the learning outcomes of the 2nd year General Medicine students in the integrated discipline "Basics of Pharmacology and Medical Chemistry" (2017/2018, 2018/2019, 2019/2020 year of study) and "Basics of Pharmacology" (2016/2017 year of study), a comparative assessment of learning outcomes was conducted.

Results.

In order to implement interdisciplinary integration in the educational process, the modular program "Fundamentals of functioning of living systems" was introduced. This program belongs to the part of natural science cycle, which is mastered during two semesters of the second year of study of students of "General Medicine" specialty. The aim of this modular project was to form a scientific understanding of the structure, molecular organization, mechanisms of functional interaction at the cellular and tissue levels, their dependence on the initial state of the body, as well as the basic principles of action of biologically active substances and drugs at the molecular, cellular and tissue levels.

As part of this module for second-year students of the specialty "General Medicine", an integrated discipline "Fundamentals of Pharmacology and Medical Chemistry" was developed and introduced into the educational process. Students studied the discipline according to the working curricula for the specialty "General Medicine" in 2017/2018, 2018/2019, 2019/2020 years of study. The discipline Fundamentals of Pharmacology and Medicinal Chemistry is a required undergraduate component of the cycle of basic disciplines for students of medical specialties. The content of the discipline covers aspects of medicinal chemistry and other biomedical sciences, allowing for fundamental knowledge of the action of drugs at the molecular and cellular level.

The discipline "Fundamentals of Pharmacology and Medicinal Chemistry" was introduced into the educational model of the university as a multidisciplinary subject that allows you to obtain current knowledge about the cellular, subcellular and physiological targets and mechanisms of action of drugs, to study the effects of pharmacotherapy on the entire body with consideration of chemical interactions with biotargets.

The final learning outcomes were formulated based on the Dublin Descriptors and thereby defined the competencies of students in mastering this integrated discipline. Thus, by the end of the discipline Fundamentals of Pharmacology and Medical Chemistry, students should be able to:

a) describe the mechanisms of acid-base equilibrium and the functions of the body's buffer systems;

b) explain mechanisms of interaction of drugs with biotargets;

c) identify the relationship of biological functions of drugs with their structure and biological activity;

d) apply known statistical methods in modeling lead molecules;

e) characterize the effectiveness of a drug product with

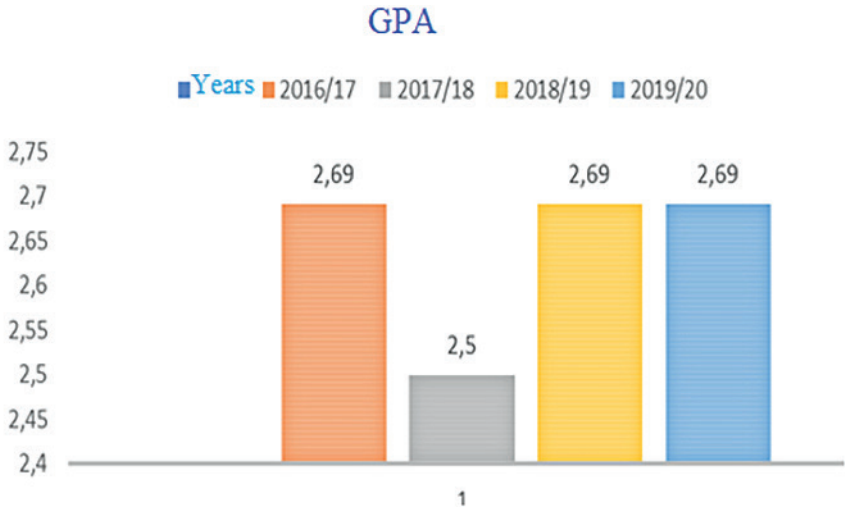

Figure 1 - GPA results by year

regard to pharmacokinetics and pharmacodynamics;
f) choose the optimal route of drug administration;
g) publicly present their own judgments, analysis and synthesis of information in the field of study.
The developed integrated program of Fundamentals of Pharmacology and Medicinal Chemistry includes 5 ESTC credits (150 hours) and consists of two large sections. The first section examines the relationship between the chemical structure and features of the pharmacokinetics and pharmacodynamics of drugs. In this section, the subject matters studied are:
1. Chemical nomenclature and classification of drug substances according to structure and functional groups.
2. Absorption. Problems of ionization and lipophilicity of biologically active compounds
3. Types of interactions at the interface. Structure of cell membranes.
4. Pharmacokinetics of drugs and pharmacokinetics parameters.
5. Excretion, deposition, metabolism
6. Basic provisions of pharmacodynamics of drugs.
7. Structural features of chemical compounds affecting various target molecules.
8. Types of chemical interactions.
9. Fundamentals of stereochemistry. Stereoisomerism of drugs. Relationship between stereoisomerism and biological activity of drugs.
10. The concept of QSAR (quantitative structure-activity relationships).
11. Chemical methods of directed modification of the leader compound structure.
12. Modern physicochemical methods of analysis in medicinal chemistry.
The second section integrates the issues of private pharmacology and medicinal chemistry, which gives a complete picture and understanding of the basic principles of action of drugs, the interpretation of their mechanisms of action at the molecular level and behavior in the body. The following topics are covered in this section:
1. General prescribing. Rules for prescribing solid, soft, and liquid dosage forms.
2. Cyclic compounds and their biological activity.
3. Drugs affecting afferent innervation: local anesthetics agents.
4. Molecular pharmacology of cholinergic drugs.
5. Molecular pharmacology of adrenergic drugs.
6. Molecular pharmacology of opioid analgesics and antagonists.
7. Molecular pharmacology of sedative hypnotics.
8. Anti-inflammatory drugs. Anti-allergic agents.
9. General characteristics of antiseptics and disinfectants.
10. Antiseptics and disinfectants.
11. Structure and characteristics of antibiotics. Antibiotics.
12. Quinolones.
13. Antitubercular drugs.
14. Antifungal drugs. Antiviral drugs.
15. Antiprotozoal drugs. Anthelminthics.
16. General principles of treatment of acute poisoning by drugs [7].
Professorial staff of the departments of pharmaceutical disciplines and chemistry and clinical pharmacology and evidence-based medicine developed educational-methodical complex and control-measuring tools for evaluating students' knowledge. Such forms as problem lecture, lecture-conversation were used in training of students at lectures. In practical classes were used such forms as verbal interview, discussion, work in pairs, work with textbooks, writing out recipes, solving situational tasks, performance of tests, work in small groups, consultations with the teacher on all emerging issues, testing, conducting an integrated boundary control and integrated exam.
Every year the program "Fundamentals of Pharmacology and Medicinal Chemistry" is coordinated by interdisciplinary links with other fundamental biomedical disciplines of basic and profile components. This allows to trace the relationship of perpendicular integration of prerequisite disciplines, related disciplines and post-requisite disciplines.
For the final control of the discipline developed situational tasks for the 5 studied sections, which are placed in a computerized electronic program Session, with the man-

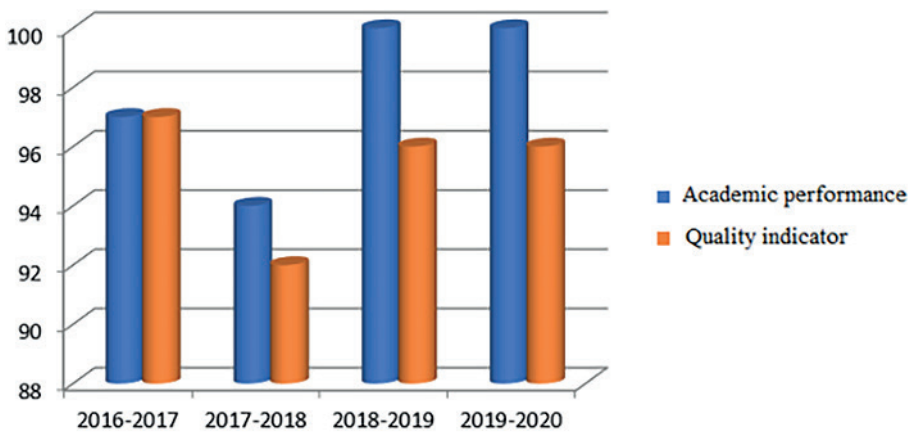

Figure 2 - Results of the quality indicator and performance by year

datory check of works on the anti-plagiarism system "Turnitin". This form of examination allowed for a more objective assessment of submitted answers, because the evaluation was conducted online without marking the names of students and took into account the percentage of borrowed Internet sources.

Discussion.

Students of the specialty "General Medicine" were trained according to this integrated program. The 2016-2017 academic year enrollment was - 498 students, 2017-2018 academic year - 518 students, 2018 - 2019 academic year - 548 students, 2019 -2020 academic year - 418 students. The effectiveness of the educational program was assessed by performance criteria such as grade point average (0-4) (Figure 1), qualitative performance, and relative performance (0-100%) (Figure 2). The mean score was calculated as the arithmetic mean of all students' final scores. The qualitative score was defined as the ratio of the sum of the number of "good" and "excellent" grades to the total number of grades. Relative performance was calculated as the ratio of the sum of all grades "satisfactory", "good", "excellent" to the total number of grades.

A comparative analysis of the learning outcomes of 2nd year General Medicine students in the integrated discipline of Basic Pharmacology and Medicinal Chemistry (2017/2018, 2018/2019, 2019/2020 years of study) and Fundamentals of Pharmacology (2016/2017 year of study).

The analysis of the results of academic performance showed that the first year (2017/2018) showed a decrease in the average score from 2.69 to 2.5 (7.06%). In our opinion, the decrease in the result has an objective reason, as the teachers and students had their first experience in an integrated discipline.

Further (2018/2019, 2019/2020) there is a leveling of scores. The effectiveness of the implementation of the integrated discipline is shown by the results of the qualitative indicator and relative achievement. Quality and relative achievement increased from 97% to 100% while the grade point average did not change. This indicates that the number of positive results increased, that is, the number of satisfactory and unsatisfactory grades decreased.

Conclusion.

Analyzing the data obtained, we can conclude about the effectiveness of the developed integrated discipline "Fundamentals of Pharmacology and Medical Chemistry". The introduction of this discipline in the educational process has improved the understanding of the studied processes and physiological action of certain biologically active molecules on the cell and cellular mechanisms of action of drugs. It is necessary to note the positive aspects for the teaching staff, which are to increase the responsibility for the implementation of certain sections of the discipline and the establishment of the necessary interdisciplinary links.

Under modern conditions, the responsibility of physicians for their professional activities is increasing, therefore, the requirements for the training of highly qualified specialists are increasing. If the purpose and objectives of interdisciplinary disciplines are set correctly, it seems appropriate to introduce integrated training, which can be the most optimal and effective. Only organic combination of the content, methods and forms of educational process organization, will lead to the effectiveness of these programs and the formation of reliable professional competencies. According to the results of the development of integrated program, a certificate for the object of copyright indicating the originality of the proposed method of implementing interdisciplinary links, taking into account the development of competence approach to the problems of improving education in the higher medical school was obtained [7].

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Авторлардың үлесі. Барлық авторлар осы мақаланы жазуға тең дәрежеде қатысты.
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Бұл материал басқа басылымдарда жариялау үшін бұрын мәлімделмеген және басқа басылымдардың қарауына ұсынылмаған.
Осы жұмысты жүргізу кезінде сыртқы ұйымдар мен медициналық өкілдіктердің қаржыландыруы жасалған жоқ.
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Сведения об авторах
Features of the model of interdisciplinary integration in a medical university.

Медициналық жоғары оқу орындарында пәнаралық интеграция моделінің ерекшеліктері.
Особенности модели междисциплинарной интеграции в медицинском вузе.
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