



INNOVATIVE TECHNOLOGIES FOR TEACHING CHEMISTRY

Tadjieva Khosiyat Sultanovna
Tashkent State Medical University
hosiattadzieva@gmail.com

Abstract

In the most rapidly developing industries, which undoubtedly include the chemical and pharmaceutical industries, the demand for highly qualified specialists is constantly growing. This growth is driven by the increasing development of new products, innovative unique technologies, and the use of modern equipment, as well as the computerization of many production processes. This creates an urgent need to review existing educational technologies and integrate modern information and communication technologies into the educational process. In the current situation, the most appropriate form of organizing the educational process is e-learning, the primary objective of which is to elevate the quality of educational services related to the training, retraining, and advanced training of specialists in the chemical and pharmaceutical industries. Since many chemical and pharmaceutical corporations have numerous branches and representative offices worldwide, organizing training for personnel from different countries becomes challenging. Furthermore, there is a need to conduct training quickly so as not to limit the implementation of innovative technologies and the sale of new products. From this perspective, e-learning is one of the most effective methods of training, retraining, and advanced training of personnel.

The aim of the study: to study innovative teaching technologies in chemistry.

Research objectives:

Theoretical substantiation and experimental verification of the scientific and methodological foundations of the design and use of information and computer



innovative technologies within the framework of the modern educational paradigm.

The object of the study: educational activities in higher education institutions, as well as in the system of continuous, multi-level professional education using modern information technologies and computer teaching aids.

Subject of the research: scientific and methodological foundations of the design and application of innovative information and computer technologies in the system of continuous professional education.

Research Results

Electronic education is generating new learning tools in the form of electronic presentation of educational material, such as multimedia lectures, video lectures, virtual laboratory workshops, computerized knowledge assessment systems, and electronic textbooks. It also offers new opportunities, such as video conferencing and real-time lecture listening. These tools and capabilities, offered by e-learning technology, can provide high-quality education without interrupting students' primary activities. The use of modern innovative learning technologies is a decisive step toward elevating Russian education to a fundamentally new level of development and can significantly contribute to the effectiveness of learning. Therefore, in the current situation, the development and implementation of new e-learning tools and multimedia training courses in chemical engineering and pharmaceuticals, integrating these tools into a unified information and learning environment, is urgent. It is also necessary to develop a multimedia training course structure that will allow for the full complexity, variability, and multi-layered nature of the chemical and pharmaceutical industries, while also taking into account the specifics of organizing the e-learning process. The most suitable principle for developing the structure of a multimedia training course and meeting the above-mentioned requirements is the modular principle of organizing e-learning in chemical-engineering and pharmaceutical specialties, the essence of which is presented in this dissertation. An analysis of innovative teaching



technologies is conducted, the advantages of such a new form of organizing the educational process as e-learning are emphasized, and its didactic concept is outlined. Particular attention is paid to the description of the technologies underlying the e-learning process. The characteristics of a multimedia training course are given, and the main components of a multimedia course are also presented. Issues related to the problems of student identification in the e-learning process are addressed. A brief analysis of the quality of e-learning is presented. Existing Russian and foreign e-learning systems in chemical-engineering and pharmaceutical specialties, as well as e-learning tools used in the educational process for training specialists in these industries, are considered. A weak trend in the development of multimedia training courses and their components for training specialists in the field of pharmaceuticals is also noted. The developed multimedia course "Equipment and Technologies for Pharmaceutical Production" demonstrates the practical implementation of the developed multimedia course structure using the example of the created multimedia course. Designed with the specifics of training specialists in chemical engineering and pharmaceuticals in mind, e-learning tools such as multimedia lectures, video lectures, a virtual laboratory practical on fluidized bed hydrodynamics, a computerized intermediate knowledge assessment system, and the electronic textbook "Information Systems and Databases in Pharmaceutics" are components of the corresponding modules of the multimedia course. A pharmaceutical database system, "PHARM," and a database of patents for sterilizing and disinfecting agents have been created. The databases are based on systems analysis and segmentation of the overall dataset accumulated and used in the pharmaceutical industry. The developed databases can be used by professionals working in the pharmaceutical industry and can also serve as a component of the multimedia course for training specialists in this field.

Conclusions

The developed multimedia training courses and their key components allow for the optimal organization of e-learning for specialists in chemical engineering and



pharmaceuticals, which in turn will enable the development of highly qualified professionals.

References

1. J. Stenhous. Ueber Larixinsäure, einen krystallisirbaren flüchtigen Bestandtheil der Rinde des Lerchenbaums (Pinus Larix L.). // Annalen der Chemie und Pharmacie. 1862. V. 123. N 47 48. P. 191-199.
2. J. Brand. Ueber Maltol. //Berichte der Deutschen Chemischen Gesellschaft. 1894. V. 27(1). P. 806-810.
3. Abduraimovna, A.D., Turg'unboyevna, Y.N. and Rustamovna, Q.S., 2023. QIZLARNI OILA VA JAMIYATDA O 'ZO 'RNINI TOPISHDA PSIXOLOGIK KO 'NIKMA VA MA'NAVIY YETUKLIKNI SHAKLLANTIRISH. Scientific Impulse, 1(7), pp.310-313.
4. Abduraimovna, A.D., Turg'unboyevna, Y.N. and Rustamovna, Q.S., 2023. QIZLARNI OILA VA JAMIYATDA O 'ZO 'RNINI TOPISHDA PSIXOLOGIK KO 'NIKMA VA MA'NAVIY YETUKLIKNI SHAKLLANTIRISH. Scientific Impulse, 1(7), pp.310-313.
5. ERMATOV, N., KASSYMOVA, G., TAJIYEVA, K., KHASANOVA, M., ALIMUKHAMEDOVA, M., & AZIMOVA, S. (2020). Expression of tissue-specific genes in mice with hepatocarcinogenesis. International Journal of Pharmaceutical Research (09752366), 12(3).
6. Inakov, S. A., Mamatkulov, B. B., Kosimova, K., Saidalikhujaeva, S., & Shoyusupova, K. B. (2020). Social and demographic characteristics of elderly and their lifestyle in developing countries: on the example of Uzbekistan. Indian Journal of Forensic Medicine & Toxicology, 14(4), 7418-7425.
7. Kamilova DN, Saydalikhujaeva SK, Abdashimov ZB, Rakhmatullaeva DM, Tadjieva XS. Employment relations and responsibilities of medical institutions workers in a pandemic in Uzbekistan. Journal of Medicine and Innovations. 2021;2(13-1).



-
8. Kamilova, D. N., Saydalikhujaeva, S. K., Rakhmatullaeva, D. M., Makhmudova, M. K., & Tadjieva, K. S. (2021). Professional image of a teacher and a doctor. *British Medical Journal*, 1(4), 4-14.
 9. Kasimova, K. T. (2024). The Role Of Ecology In The Development Of Cardiovascular Diseases.
 10. Khilola, T. K. (2024). Assessment of environmental conditions in tashkent and relationship with the population suffering from cardiovascular diseases.
 11. Khudoyberganov, M., Rakhmatkarieva, F., Abdurakhmonov, E., Tojiboeva, I., & Tadjieva, K. (2022, June). Thermodynamics of water adsorption on local kaolin modified microporous sorbents. In *American Institute of Physics Conference Series* (Vol. 2432, No. 1, p. 050001).
 12. Kosimova, K. T., Jalolov, N. N., & Ikramova, N. A. (2025, April). THE RELATIONSHIP BETWEEN AIR POLLUTION AND ARTERIAL HYPERTENSION. *International Conference on Advance Research in Humanities, Applied Sciences and Education*.
 13. Qosimova, X. T., Ikramova, N. A., Juraboyeva, D. N., & Mukhtorova, D. A. (2025, March). THE ADVERSE EFFECTS OF SMARTPHONES ON COGNITIVE ACTIVITY IN THE EDUCATIONAL PROCESS AND WAYS TO MITIGATE THEM. In *The Conference Hub* (pp. 76-79).
 14. Sadullayeva, X. A., Salomova, F. I., & Sultonov, E. Y. (2023). Ochiq suv havzalari muhofazalash ob'ekti sifatida. In *V международная научно-практическая конференция «Современные достижения и перспективы развития охраны здоровья населения»*.
 15. Sadullayeva, X. A., Salomova, F. I., & Sultonov, E. Y. (2023). Ochiq suv havzalari muhofazalash ob'ekti sifatida. In *V международная научно-практическая конференция «Современные достижения и перспективы развития охраны здоровья населения»*.
 16. Sadullayeva, X. A., Salomova, F. I., Mirsagatova, M. R., & Kobiljonova Sh, R. (2023). Problems of Pollution of Reservoirs in the Conditions of Uzbekistan.



-
17. Sadullayeva, X. A., Salomova, F. I., Mirsagatova, M. R., & Kobiljonova Sh, R. (2023). Problems of Pollution of Reservoirs in the Conditions of Uzbekistan.
 18. Sadullayeva, X. A., Salomova, F. I., Mirsagatova, M. R., & Kobiljonova Sh, R. (2023). Problems of Pollution of Reservoirs in the Conditions of Uzbekistan.
 19. Sadullayeva, X. A., Salomova, F. I., Mirsagatova, M. R., & Kobiljonova Sh, R. (2023). Problems of Pollution of Reservoirs in the Conditions of Uzbekistan.
 20. Salomova, F. I., & Kosimova, H. T. (2017). RELEVANCE OF STUDYING INFLUENCE OF THE BONDS OF NITROGEN POLLUTING THE ENVIRONMENT ON HEALTH OF THE POPULATION SUFFERING CARDIOVASCULAR ILLNESSES (REPUBLIC OF UZBEKISTAN). In INTERNATIONAL SCIENTIFIC REVIEW OF THE PROBLEMS AND PROSPECTS OF MODERN SCIENCE AND EDUCATION (pp. 81-83).
 21. Salomova, F. I., Ahmadaliev, N. O., Sadullaeva, K. A., & Sherkuzieva, G. F. (2022). Dust storm and atmosphere air pollution in Uzbekistan.
 22. Salomova, F. I., Ahmadaliev, N. O., Sadullaeva, K. A., & Sherkuzieva, G. F. (2022). Dust storm and atmosphere air pollution in Uzbekistan.
 23. Saydalikhujayeva, S. K., Kosimova, K. T., Mamadzhanov, N. A., & Ibragimova, S. R. (2020). The role of modern pedagogical technologies in improving the system of higher medical education in the republic of Uzbekistan. *New Day in Medicine*, 1(29), 85.
 24. Sherkuzieva, G. F., Salomova, F. I., & Yuldasheva, F. U. (2023). Oziq ovqat qo'shimchalari va aholi salomatligi. 2023.«. O 'zbekistonda vinochilik va sanoat Uzumchiligi sohasining muammolari va Ularning innovatsion yechimlari» Respublika ilmiy-texnikaviy konferensiya Ilmiy ishlar to 'plami, 101-102.
 25. Sherkuzieva, G. F., Salomova, F. I., & Yuldasheva, F. U. (2023). Oziq ovqat qo'shimchalari va aholi salomatligi. 2023.«. O 'zbekistonda vinochilik va sanoat Uzumchiligi sohasining muammolari va Ularning innovatsion



-
- yechimlari» Respublika ilmiy-texnikaviy konferensiya Ilmiy ishlar to 'plami, 101-102.
26. ShR, K., Mirrakhimova, M. H., & Sadullaeva, H. A. (2022). Prevalence and risk factors of bronchial asthma in children. *Journal of Theoretical and Clinical Medicine*, 2, 51-56.
 27. ShR, K., Mirrakhimova, M. H., & Sadullaeva, H. A. (2022). Prevalence and risk factors of bronchial asthma in children. *Journal of Theoretical and Clinical Medicine*, 2, 51-56.
 28. Tadjieva, K. S. (2024). USING SITUATIONAL TASKS TO INCREASE THE EFFECTIVENESS OF TEACHING MEDICAL CHEMISTRY. *Web of Teachers: Inderscience Research*, 2(1), 64-68.
 29. Tadjieva, K. S., Kosimova, K. T., & Niyazova, O. A. (2025). THE ROLE OF AIR POLLUTION IN THE DEVELOPMENT OF CARDIOVASCULAR DISEASES.
 30. Tursunov, D., Sabiorva, R., Kasimova, X., Azizova, N., & Najmiddinova, N. (2016). Status of oxidant and antioxidant systems in alloxan diabetes and ways its correction. In *Science and practice: a new level of integration in the modern world* (pp. 188-190).
 31. АБДУЛЛАЕВА, М., & ТАДЖИЕВА, Х. (2023). ИЗУЧЕНИЕ РАСТВОРИМОСТИ СИСТЕМ: КАЛИЕВАЯ СОЛЬ-ОДНОЗАМЕЩЕННЫЙ УКСУСНОКИСЛЫЙ МОНОЭТАНОЛАММОНИЙ-ВОДА. Международный центр научного партнерства «Новая Наука»(ИП Ивановская ИИ) КОНФЕРЕНЦИЯ: НАУЧНЫЙ ДЕБЮТ 2023 Петрозаводск, 03 декабря 2023 года Организаторы: Международный центр научного партнерства «Новая Наука»(ИП Ивановская ИИ).
 32. Акромов, Д. А., & Касимова, Х. Т. (2017). Результаты изучения токсикологических свойств фунгицида" Вербактин". *Молодой ученый*, (1-2), 2-3.
 33. Ахмадалиева, С. У., & Машарипова, Р. Ю. ОСНОВЫ ЗДОРОВОГО ОБРАЗА ЖИЗНИ СТУДЕНТА МЕДИКА. ББК: 51.1 л0я43 С-56 А-95, 228.



-
34. Ахмадалиева, С. У., & Машарипова, Р. Ю. ОСНОВЫ ЗДОРОВОГО ОБРАЗА ЖИЗНИ СТУДЕНТА МЕДИКА. ББК: 51.1 л0я43 С-56 А-95, 228.
 35. Ахметов, Н. С., Азизова, М. К., & Бадыгина, Л. И. (2014). Лабораторные и семинарские занятия по общей и неорганической химии.
 36. Балтабаев, У. А., Джураев, А. Д., & Таджиева, Х. С. (2008). Реакции фенилизотиоцианата с α -аминокислотами. Жур. Химия и химическая технология, 1, 39-42.
 37. Денисова, У. Ж., & Машарипова, Р. Ю. (2022). ПОВЫШЕНИЕ ПОКАЗАТЕЛЕЙ ЭФФЕКТИВНОСТИ ОБМАННЫХ ДЕЙСТВИЙ В СОРЕВНОВАТЕЛЬНОЙ ДЕЯТЕЛЬНОСТИ СТУДЕНТОВ БАСКЕТБОЛИСТОВ 1-КУРСА НА ОСНОВЕ ПОДВИЖНЫХ ИГР. Вестник науки, 4(1 (46)), 18-24.
 38. Денисова, У. Ж., & Машарипова, Р. Ю. (2022). ПОВЫШЕНИЕ ПОКАЗАТЕЛЕЙ ЭФФЕКТИВНОСТИ ОБМАННЫХ ДЕЙСТВИЙ В СОРЕВНОВАТЕЛЬНОЙ ДЕЯТЕЛЬНОСТИ СТУДЕНТОВ БАСКЕТБОЛИСТОВ 1-КУРСА НА ОСНОВЕ ПОДВИЖНЫХ ИГР. Вестник науки, 4(1 (46)), 18-24.
 39. КАМИЛОВА, Д., САЙДАЛИХУЖАЕВА, Ш., МАХМУДОВА, М., РАХМАТУЛЛАЕВА, Д., & ТАДЖИЕВА, Х. (2022). ИНСОН САЛОМАТЛИГИ ВА ТИББИЙ КЎРИКНИНГ АҲАМИЯТИ. Журнал "Медицина и инновации", (3), 143-162.
 40. Каримов, В. В., & Машарипова, Р. Ю. (2021). Метод «Джит Кун До» в учебном процессе на занятиях по физической культуре для студентов-стоматологов. Вестник науки, 4(12 (45)), 32-36.
 41. Косимова, Х. Т., & Садирова, М. К. (2018). Нормативная база для проведения мониторинга по изучению влияния соединений азота на здоровье населения. In INTERNATIONAL SCIENTIFIC REVIEW OF THE PROBLEMS OF NATURAL SCIENCES AND MEDICINE (pp. 30-32).
 42. Косимова, Х. Т., & Садирова, М. К. (2018). ОЦЕНКА ТЯЖЕСТИ И НАПРЯЖЕННОСТИ ТРУДОВОЙ ДЕЯТЕЛЬНОСТИ ВРАЧЕЙ



-
- ФИЗИОТЕРАПЕВТИЧЕСКИХ КАБИНЕТОВ. In WORLD SCIENCE: PROBLEMS AND INNOVATIONS (pp. 276-278).
43. Косимова, Х. Т., Мамаджанов, Н. А., & Ибрагимова, Ш. Р. (2020). РОЛЬ СОВРЕМЕННЫХ ПЕДАГОГИЧЕСКИХ ТЕХНОЛОГИЙ В ДАЛЬНЕЙШЕМ СОВЕРШЕНСТВОВАНИИ СИСТЕМЫ ВЫСШЕГО МЕДИЦИНСКОГО ОБРАЗОВАНИЯ В РЕСПУБЛИКЕ УЗБЕКИСТАН. Новый день в медицине, (1), 88-90.
44. Машарипова РЮ, Рожкова АС. Использование нетрадиционных видов гимнастики для оптимизации занятий физической культурой в вузе. In Сборник научных трудов I-Международная научно-практической онлайн-конференция «Актуальные вопросы медицинской науки в XXI веке». УДК 2019 (Vol. 6, pp. 613-615).
45. Машарипова, Р. Ю. (2020). Повышение специальной двигательной активности студентов-стоматологов. Наука, образование и культура, (8 (52)), 51-53.
46. Машарипова, Р. Ю. (2022). АНАЛИЗ ФИЗИЧЕСКОЙ ПОДГОТОВЛЕННОСТИ СПЕЦИАЛЬНЫХ АТЛЕТОВ-ГИМНАСТОВ. Central Asian Research Journal for Interdisciplinary Studies (CARJIS), 2(5), 730-737.
47. Машарипова, Р. Ю. (2022). АНАЛИЗ ФИЗИЧЕСКОЙ ПОДГОТОВЛЕННОСТИ СПЕЦИАЛЬНЫХ АТЛЕТОВ-ГИМНАСТОВ. Central Asian Research Journal for Interdisciplinary Studies (CARJIS), 2(5), 730-737.
48. Машарипова, Р. Ю., & Хасанова, Г. М. (2020). Повышение двигательной подготовленности студентов-стоматологов в процессе учебных занятий физической культурой. Вестник науки, 5(3 (24)), 101-104.
49. Пахрудинова, Н. Ю., Хасанова, Г. М., & Машарипова, Р. Ю. Хореография и здоровый образ жизни. ББК: 51.1 л0я43 С-56 А-95, 278.
50. Таджиева, Х. С. (2022). ИСПОЛЬЗОВАНИЕ МЕТОДА ПРОБЛЕМНЫХ СИТУАЦИЙ НА ЗАНЯТИЯХ МЕДИЦИНСКОЙ ХИМИИ. In Kimyo va tibbiyot: nazariyadan amaliyotgacha (pp. 205-208).
-



-
51. Таджиева, Х. С. (2023). МОДЕЛИРОВАНИЕ ПРОБЛЕМНОГО ОБУЧЕНИЯ В МЕДИЦИНСКОМ ВУЗЕ. West Kazakhstan Medical Journal, (3 (65)), 170-175.
 52. Таджиева, Х., & Юсупходжаева, Х. (2023). Особенности преподавания медицинской химии в современных условиях на лечебном и педиатрическом факультетах медицинских вузов. Современные аспекты развития фундаментальных наук и вопросы их преподавания, 1(1), 119-124.
 53. Шеркузиева, Г. Ф., & Касимова, Х. Т. (2017). Токсичность биологически активной добавки "Laktonorm-H (K Kaliy)" в условиях хронического эксперимента. Молодой ученый, (1-2), 10-12.