DEVELOPING STUDENTS' PROFESSIONAL COMPETENCIES BASED ON AN INTEGRATIVE APPROACH TO TEACHING HETEROCYCLIC COMPOUNDS OF PHARMACEUTICAL IMPORTANCE

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Abstract. This thesis highlights the role of interdisciplinary integration in teaching heterocyclic compounds of pharmaceutical importance in higher education institutions and its significance in developing students' professional competencies. Unlike the traditional teaching system, an integrated model of organic chemistry, pharmaceutical chemistry, and pharmacology is proposed.

Keywords: heterocyclic compounds, integrative approach, professional competence, pharmaceuticals, interdisciplinary connection, biological activity.

Introduction (Relevance). Today, heterocyclic compounds and their derivatives account for more than 70% of the medicinal products on the global pharmaceutical market. The chemical basis of antibiotics, vitamins, and cardiovascular and anti-tumor drugs is rooted in heterocyclic structures. However, the teaching of fundamental organic chemistry in higher education is often conducted in isolation from biomedical and specialized pharmaceutical disciplines. This creates difficulties for students in forming a comprehensive understanding of the relationship between a drug substance's chemical structure and its pharmacological effect within the body. Therefore, implementing an integrative approach to shaping the professional competencies of future pharmacists is of great importance.

Research Objective. To scientifically substantiate a methodology for developing students' analytical, research, and professional competencies by integrating chemical and specialized disciplines, using the teaching of pharmaceutically significant heterocyclic compounds as a case study.

Methods and Practical Approach. During the research, a three-stage model of interdisciplinary integration (Organic Chemistry → Pharmaceutical Chemistry → Pharmacology) was developed. The following integrative methods were employed in teaching heterocyclic compounds (e.g., derivatives of pyrimidine, purine, and pyrrolidine):

- **SAR** (Structure-Activity Relationship) analysis: Students learned—through case studies—how modifications to heteroatoms (N, O, S) within the heterocycle and changes to functional groups affect the biological activity and toxicity of a drug substance.
- **"From synthesis to metabolism"** chain: The laboratory synthesis of a specific heterocyclic drug, its quality analysis (IR and UV spectroscopy), and the mechanisms of its breakdown (metabolism) within the body were integrated into a single, cohesive topic.

Results and Analysis. The developed integrative teaching model underwent pedagogical testing with pharmacy students. A traditional approach was used for the control group, while an integrative approach was applied to the experimental group. The results demonstrated that students in the experimental group showed professional competency levels—specifically in analyzing the chemical structures of medicinal substances, applying their physicochemical properties in practice, and conducting independent research—that were 22–25% higher than those of the control group. Students developed skills in logical-clinical reasoning rather than mere rote memorization.

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Conclusion. Teaching pharmaceutically significant heterocyclic compounds using an integrative approach elevates the professional training of future specialists to a qualitatively new level. This model successfully fosters an integrated mindset in students, enabling them to develop and analyze medicinal products and predict their biological effects.

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