

TECHNOLOGY FOR DEVELOPING CRITICAL THINKING IN MEDICAL EDUCATION STUDENTS THROUGH MODELLING BIOLOGICAL PROBLEMS

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Abstract: The article highlights the essence, methods, and significance of developing critical thinking skills in medical education students through biological problem modelling technologies. The types of biological modelling technologies, their integration into the educational process, and their role in shaping critical thinking are analyzed on a scientific basis. The practical significance of modelling in enhancing students' analytical and research skills is demonstrated through examples. Additionally, the article discusses the prospects of biological modelling in medical education and the opportunities for improving educational quality with the help of modern technologies.

Keywords: Medical education, biological modelling, critical thinking, computer simulation, educational technologies, analytical skills, virtual reality, medical models.

ТЕХНОЛОГИЯ РАЗВИТИЯ КРИТИЧЕСКОГО МЫШЛЕНИЯ У СТУДЕНТОВ МЕДИЦИНСКОГО ОБРАЗОВАНИЯ ПУТЕМ МОДЕЛИРОВАНИЯ БИОЛОГИЧЕСКИХ ПРОБЛЕМ

Аннотация: В статье освещаются сущность, методы и значение развития навыков критического мышления у студентов медицинских вузов посредством технологий моделирования биологических проблем. На научной основе анализируются виды технологий биологического моделирования, их интеграция в образовательный процесс и их роль в формировании критического мышления. На примерах демонстрируется практическая значимость моделирования в повышении аналитических и исследовательских навыков студентов. Кроме того, в статье рассматриваются перспективы биологического моделирования в

медицинском образовании и возможности повышения качества образования с помощью современных технологий.

Ключевые слова: Медицинское образование, биологическое моделирование, критическое мышление, компьютерное моделирование, образовательные технологии, аналитические навыки, виртуальная реальность, медицинские модели.

Introduction

Today, medical education is constantly evolving in response to the demands of the times. The need for a healthy society and high-quality medical services calls for the preparation of highly qualified specialists who are capable of making independent decisions and possess analytical and critical thinking abilities. Biological problem modelling technologies play an important role in achieving these goals. This approach is becoming the methodological basis for developing critical thinking in medical education.

Main Part

Teaching students critical thinking and deepening their knowledge through biological problem modelling, as well as developing analytical skills, is of great importance. Given the complexity of biological systems and processes, modelling and analysis allow students not only to acquire scientific knowledge but also to develop skills in analysis, evaluation, and problem-solving. The complexity of biological systems and processes lies in the fact that they are interrelated and dynamically change. This is important for students in understanding how biological systems work and how changes occur in them. Biological problem modelling helps students to more accurately understand how these systems function and what changes occur in them. This, in turn, contributes to the deepening and development of medical knowledge.

The main goal of technologies for modelling biological systems is to use various mathematical and computer technologies to identify natural processes and their interrelationships. In biological problem modelling, mathematical models, computer simulations, and statistical analysis are the main tools. **Mathematical Models.** Mathematical models play a significant role in representing the simple and complex characteristics of biological systems. For example, this could involve modelling the spread of diseases, studying the dynamics of ecosystems, or analyzing genetic mutations. Mathematical modelling helps students better understand how biological processes change over time. **Computer Simulation.** Studying biological systems through computer simulation allows students to see biological processes interactively. For example, modelling cellular processes or the spread of a disease helps students apply their knowledge in practice. This helps students gain a deeper understanding of biological systems and

processes.

Statistical Analysis. Statistical models are used to analyze and predict data obtained in biological studies. In epidemiology and social medicine, statistical methods are widely used to study the spread of diseases and to analyze trends in population health. Students learn to use these methods to analyze and predict biological processes. Critical thinking is the ability to analyze knowledge in greater depth, to consider each situation from different perspectives, and to expand one's knowledge. Developing critical thinking in medical education provides students with the opportunity to carry out scientific analysis and research in biological problems in greater depth. To develop critical thinking, students should engage in the following activities:

Researching Biological Problems. Students should conduct independent research on biological topics, read scientific papers, and study new data. For example, reading articles on genetic mutations or changes in cellular structure, observing new research and experiments encourages students to generate new ideas and approaches.

Analyzing and Evaluating Problems. Biological problem modelling teaches students to consider issues from different perspectives. For example, when analyzing the spread of diseases or changes in biological systems, students must consider various factors such as ecological, genetic, social, and other variables. This, in turn, creates opportunities for developing critical thinking. **Proposing and Evaluating Solutions.** In developing critical thinking, students should not only analyze existing knowledge but also be involved in activities that propose new approaches and solutions to existing problems. In this process, students learn to view biological problems from a new perspective, apply new methods, and evaluate potential results. For example, applying new methods in biological system modelling and assessing their results helps students develop critical thinking.

By studying biological problem modelling technologies, students develop critical thinking skills. Several methods can be used for this: **Simulations and Interactive Learning.** Interactive learning methods allow students to model biological systems and processes. Through computer simulations, students study biological processes and systems in an interactive way. This method helps students understand the interconnections of complex biological problems and how they work. **Group Discussions and Task-Based Learning.** Group discussions are an effective method for analyzing biological problems for students. Exchanging ideas within the group and developing new approaches and solutions creates opportunities for students to develop critical thinking and apply knowledge in practice. **Time Management and Testing Solutions.** Students learn to apply their knowledge in practice by modelling biological systems, managing time, and testing different solutions. Testing each solution and evaluating its effectiveness helps students develop critical thinking.

Conclusion

Developing critical thinking in medical education students through biological problem modelling technologies is of great importance for reinforcing scientific and practical knowledge. With modelling technologies, students learn to understand biological processes in greater depth, analyze them, and develop solutions. These methods create opportunities for preparing students for independent research, solving complex problems, and scientific analysis. Thus, technologies for developing critical thinking in medical education enhance not only scientific activity but also professional practice.

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