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Research Article

TEACHING INORGANIC CHEMISTRY TO MEDICAL UNIVERSITY STUDENTS: ENHANCING ENGAGEMENT THROUGH GAMIFICATION AND CONTEXTUALIZED LEARNING

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ABSTRACT

Inorganic chemistry is fundamental to medical education, yet students often find it challenging and disconnected from clinical practice. This article explores innovative teaching strategies such as gamification, digital learning platforms, and contextualized instruction to enhance student engagement and comprehension. By integrating these methods with real-world applications, educators can make inorganic chemistry more relevant and accessible for medical students. The implications of incorporating advanced educational methodologies and digital resources are also discussed.

KEYWORDS

Gamification, digital learning platforms, applications, educators, medical students.

INTRODUCTION

Inorganic chemistry forms the foundation for understanding many physiological and pharmacological processes essential to medical practice. It is known from chemistry that our ancestors were the same in terms of improving education on the basis of pedagogical technologies how many researches have been conducted. The great scholars of the East are Musa al-Khorazmi, Ahmad al-Farghani, Abu Nasr Encyclopedic scholars such as Farabi, Abu Rayhan Beruni, Mirzo Ulug'bek in their works describe people in schools and madrasas. That they attach great importance to the use of various methods and means of teaching in mental development emphasized. A new concept-pedagogical technology of acquiring knowledge in the current educational system -It emphasizes the use of methods of non-traditional educational technologies. Non-traditional educational technology:

It is divided into collaborative learning, modeling, research (project) technologies, and it is carried out on

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the basis of an integrated organic system. will go The main concept of pedagogical technology, without a word, is to approach the educational process as a system[2].

A non-traditional teaching method with the teacher and the learner for the realization of the educational goal is the basis of cooperation. Methods: what the learner should know, understand and appreciate ensures the achievement of expected results. In this, all things and events involved in education are mutual is functionally related and forms a whole, that is, a set of pedagogical processes. Currently of natural sciences development, emergence of processes of differentiation and integration between disciplines as an objective law demands that the natural sciences, biology, chemistry, and physics, make interdisciplinary connections[3].

The tasks of teaching chemistry are to introduce basic chemical concepts, theories and laws. Inorganic chemistry serves as a cornerstone for understanding various biochemical and physiological processes essential in medical practice. Despite its importance, many medical students perceive inorganic chemistry as abstract and irrelevant to their clinical education. This perception can lead to disengagement and a lack of motivation to master the subject. Recent research into educational methodologies suggests that employing interactive and context-driven approaches can significantly enhance student motivation and retention . This article discusses practical strategies to make inorganic chemistry education engaging and relevant for medical students, integrating insights from the literature, including works by Shernazarov I.E. and Saydaxmetova Sh.R.[11]

1. Gamification in Education. Gamification, defined as the integration of game design elements into non-game contexts, has proven effective in enhancing student engagement across various disciplines . In the context of inorganic chemistry, gamifying lessons can transform traditional learning experiences into interactive and enjoyable activities. By incorporating elements such as progress tracking, levels, and achievement badges, educators can motivate students to approach learning as a series of attainable challenges rather than overwhelming content.

Example in Practice: A digital quest or simulation can present diagnostic challenges where students must apply their knowledge of heavy metals and complex ions to identify and solve fictitious clinical cases. This interactive approach not only reinforces theoretical concepts but also enhances the perceived relevance of inorganic chemistry to clinical practice .

2. Situated Learning through Clinical Contexts

Situated learning emphasizes teaching concepts within authentic contexts, making learning more meaningful and applicable. By anchoring inorganic chemistry topics in clinical applications, educators can help students recognize the practical utility of their knowledge. For instance, discussions surrounding the role of metal ions in biological systems—such as the significance of iron in hemoglobin or the involvement of zinc in enzymatic reactions—can bridge the gap between chemistry and human physiology.

Example in Practice: Instructors could incorporate case studies that focus on the clinical implications of heavy metal toxicity, prompting students to engage with the material actively. This approach aligns with Шерназаров И.Э.'s recommendation for integrating information technology to enhance teaching methodologies in chemistry.

3. Utilizing AI and Digital Platforms for Personalized Learning

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The advent of artificial intelligence (AI) and digital learning platforms has revolutionized education by offering personalized learning experiences. These platforms can adapt to individual student needs, providing real-time feedback and tailored resources. Inorganic chemistry, with its complex structures and reactions, benefits greatly from these advancements, as they allow students to engage with the material at their own pace[7].

Example in Practice: Virtual laboratory simulations can enable students to manipulate variables in chemical reactions, observe outcomes, and explore the intricacies of coordination compounds without the constraints of a physical lab environment. Such tools reinforce spatial and structural understanding, making complex concepts more accessible[8].

4. Digital Game-Based Learning: Merging Theory with Practice

Digital game-based learning (DGBL) immerses students in interactive, problem-solving scenarios that enhance engagement and deepen learning outcomes. By using chemistry-based games or simulations, students can experiment with reactions, visualize molecular structures, and grasp the complexities of inorganic compounds in an enjoyable format[3].

Example in Practice: An interactive game simulating environmental issues—like the impact of acid rain on ecosystems—can illustrate the significance of inorganic compounds in real-life scenarios. This connection between theory and practical application helps students appreciate the relevance of their studies.

5. Case-Based Learning: Bridging Inorganic Chemistry and Medicine

Case-based learning (CBL) presents students with clinical cases requiring a solid foundation in chemistry, encouraging critical thinking and application of theoretical concepts. This method allows students to see the direct connections between their chemistry education and future medical practice, particularly in areas like pharmacology and toxicology[10].

Example in Practice: Discussing a clinical case involving iron overload (hemochromatosis) provides an opportunity for students to analyze the biochemical role of iron, its toxicity, and potential treatment options. This approach aligns with Сайдахметова Ш.Р.'s emphasis on enhancing experimental methodologies to improve students' understanding of chemistry.

6. Innovative Experimental Methodologies

Incorporating modern pedagogical strategies and technology can significantly enhance laboratory experiences in inorganic chemistry. Utilizing innovative experimental methodologies, educators can provide deeper insights into complex concepts and foster a more engaging learning environment. By leveraging digital resources, such as online simulations and interactive tutorials, instructors can expand students' experiential learning opportunities.

Example in Practice: Implementing virtual labs where students can conduct experiments related to coordination compounds or redox reactions allows for safe exploration of concepts that may be challenging to demonstrate in a traditional lab setting. This method not only improves accessibility but also encourages experimentation and exploration.

CONCLUSION

Integrating gamification, contextualized learning, and innovative methodologies into inorganic chemistry education can significantly enhance engagement and relevance for medical students. By employing a combination of interactive experiences, real-world applications, and advanced educational strategies, instructors can transform inorganic chemistry from a challenging subject into an accessible and impactful component of medical education. The incorporation of digital tools and innovative methodologies will prepare students to apply their knowledge in clinical settings, ultimately contributing to their success in the medical field.

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