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THE IMPORTANCE OF USING VIRTUAL LABORATORIES IN TEACHING CHEMISTRY AT MEDICAL UNIVERSITIES

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Annotation: This article analyzes the creation and practical application of virtual laboratory experiments in chemistry within medical universities. It examines the essence, advantages, and significance of virtual laboratories in the educational process. The primary objective of the research is to develop virtual laboratory experiments and study the effectiveness of integrating them into the chemistry curriculum of medical higher education institutions.

Keywords: virtual laboratory, chemistry education, digital technologies, medical universities, interactive education.

In the decree of President Shavkat Mirziyoyev dated June 8, 2017, "On measures to develop the educational system," particular emphasis was placed on the importance of providing higher education institutions with laboratory equipment and materials. The President's decrees highlight that limited opportunities for practical sessions and experimentation in the educational process lead to serious difficulties for students in mastering practical knowledge.

VirtuLab Resource: This resource is the largest collection of virtual experiments across various educational disciplines in the Runet. The core unit of this collection is the virtual experiment. From a technical perspective, it is an interactive clip developed using Adobe Flash. Some laboratory works are designed using 3D graphics. To work with these, one must install Adobe Shockwave Player supplemented with the Havok Physics Scene. Each clip allows for the execution of an experiment aimed at a specific learning objective and task. VirtuLab provides users with the necessary equipment and objects to achieve results. The pedagogical aspect of VirtuLab is very strong; for instance, if a user makes an error, the system prevents progression to the next stage until the error is corrected. The archive is divided into four main blocks: Physics, Chemistry, Biology, and Ecology.

PhET Resource: Developed by the University of Colorado, this resource is also multidisciplinary. Its pages feature virtual laboratories that visually demonstrate phenomena in physics, chemistry, biology, and geology, along with interactive mathematical instruments. The PhET website is a multi-branch site of Java applets that can be used both online and on a standalone computer. The PhET catalog includes hundreds of experimental demonstrations. The "Cutting Edge Research" section features demonstrations dedicated to the most modern research, and the "New Sims" section regularly updates with new additions. The "Translated Sims" section indicates available languages, including Russian (with 50 translated simulations). PhET virtual laboratories are developed based on Java technology.

Virtual Laboratory for Analytical Chemistry: Literature analysis shows that specialized virtual laboratories have been developed for specific branches of chemistry. In this regard, the virtual laboratory developed by the faculty of the Kemerovo Institute of Food Science and Technology for analytical chemistry is noteworthy.

Super-chemistry Website: Among project-catalogs that aggregate and systemize various collections, the Super-chemistry website deserves special mention. This site features various chemical programs and tools for their localization (Russification). Most programs are distributed for free (FreeWare), some are shareware (ShareWare), and others are commercial. Notable virtual

labs listed include Model ChemLab 2.52, Electrochemical Cells Pro, and others. For example, **Model ChemLab 2.5** is designed for conducting various chemical reactions virtually. Additionally, the site includes **RasWin**, a mobile-compatible program for viewing 3D molecular structures. It allows users to rotate molecules, view them from different angles, and save them in several graphic formats.

Systematichem Solution Viewer 1.1.9 allows users to examine and categorize a vast number of syntheses using the MDL Chime plugin.

Chemical Formula Tutor 1.3 is a program designed to teach the formulation of inorganic salts and bases. It operates in two modes: learning and assessment (testing). Thus, the Super-chemistry site saves users significant time by providing valuable references and data. It is worth noting that in some regions of Russia, virtual laboratories like the "**Arximed**" digital educational labs are being centrally purchased and implemented by schools.

Conclusion. Virtual laboratories will play a crucial role in the future of the educational system. The possibilities of integrating Artificial Intelligence (AI) and Augmented Reality (AR) technologies into chemistry lessons were explored. Such innovative approaches will serve to further increase the effectiveness of virtual laboratories.

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