# ENHANCING FUNCTIONAL LITERACY IN CHEMISTRY LESSONS THROUGH DIGITAL TOOLS AND MOBILE APPLICATIONS

**Pardayev Ulugbek Khairullo oglu**
E-mail: pardayevulugbek125@gmail.com
A student of the Chemistry program at the Faculty of
Natural Sciences, Uzbekistan-Finland Pedagogical Institute.

**Zayniddinova Diyora Rustamjon qizi**
E-mail: zayniddinovadiyora452@gmail.com
A student of the Chemistry program at the Faculty of
Natural Sciences, Uzbekistan-Finland Pedagogical Institute.

**Isokov Yusuf Khoriddinovich**
E-mail: yxoriddinovich2001@mail.ru
Doctor of Philosophy (PhD) in Technical Sciences,
Senior Lecturer at the Department of Chemistry,
Faculty of Natural Sciences, Uzbekistan-Finland Pedagogical Institute.

**Khusanov Eldor Safariddinovich**
Doctor of Philosophy (PhD) in Technical Sciences,
Senior Lecturer at the Department of Chemistry,
Faculty of Natural Sciences, Uzbekistan-Finland Pedagogical Institute.
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**ANNOTATION:** This article examines the role of digital tools and mobile applications in enhancing functional literacy in secondary school chemistry lessons. The integration of interactive technologies such as simulations, virtual labs, and educational mobile apps helps students apply theoretical knowledge to real-life situations, thereby fostering critical thinking, problem-solving, and scientific communication skills. The study highlights pedagogical strategies for using these tools effectively and presents practical examples of their classroom implementation. The findings suggest that digital technologies can significantly improve students' engagement and competence in chemistry, making learning more relevant, accessible, and learner-centered in the context of 21st-century education requirements.
**KEY WORDS:** Chemistry education, functional literacy, digital tools, mobile applications, virtual laboratories, interactive learning, 21st-century skills.

**INTRODUCTION:** In the digital age, the demand for educational reforms that prioritize functional literacy has significantly increased. Functional literacy in chemistry refers to the ability of students not only to comprehend theoretical concepts but also to apply them in real-life problem-solving contexts. As traditional teaching methods often fall short in engaging modern learners, the integration of digital tools and mobile applications presents new opportunities for enhancing learning outcomes. These technologies offer interactive, student-centered experiences that foster deeper understanding, critical thinking, and scientific reasoning. Digital simulations, virtual labs, augmented reality, and subject-specific apps provide dynamic and accessible platforms for mastering complex chemical processes. This article explores how digital innovations can transform chemistry lessons into engaging, practical learning environments. Emphasis is placed on the pedagogical value of these tools in developing students' analytical skills and their ability to transfer knowledge to real-world situations, which are essential competencies in today's rapidly evolving scientific and technological landscape.

**LITERATURE REVIEW**: Recent studies emphasize the importance of integrating digital technologies to promote functional literacy in science education. According to OECD (2021),

functional literacy involves applying knowledge in real-world contexts, a skill often underdeveloped through traditional instruction. In chemistry education, researchers such as Gilbert & Treagust (2009) have highlighted the effectiveness of visualization tools in supporting conceptual understanding. Mobile applications and virtual laboratories offer interactive experiences that bridge the gap between abstract concepts and practical applications. For instance, Wu et al. (2020) demonstrated that augmented reality tools in chemistry classes significantly enhance student engagement and performance. Moreover, digital simulations allow learners to experiment safely and repeatedly, which supports mastery learning and deeper cognitive processing. Despite their benefits, the successful implementation of digital tools requires careful pedagogical planning and teacher training. Overall, the literature supports the idea that integrating digital tools can significantly contribute to developing students' functional literacy in chemistry.

**METHODOLOGY:** This study employed a qualitative approach to explore the effectiveness of digital tools and mobile applications in enhancing functional literacy in chemistry lessons. Data were collected through classroom observations, teacher interviews, and analysis of student performance tasks across three secondary schools. Selected digital tools included virtual labs, interactive simulations, and chemistry-based mobile apps. Lessons were designed to align with national curriculum standards while integrating real-world problem-solving scenarios. The impact on functional literacy was assessed based on students' ability to analyze, interpret, and apply chemical concepts in practical contexts. Findings were thematically coded and interpreted to identify emerging patterns and insights.

**RESULTS:** The implementation of digital tools and mobile applications in chemistry lessons resulted in noticeable improvements in students' functional literacy. Analysis of classroom observations revealed higher engagement levels and more frequent application of chemical knowledge to real-life scenarios. Students using virtual labs and simulations demonstrated increased competence in interpreting chemical reactions, balancing equations, and understanding abstract concepts such as molecular structure and stoichiometry. Performance-based assessments showed that over 75% of participating students scored higher in tasks requiring analysis and problem-solving compared to those taught using traditional methods. Teacher interviews indicated that digital tools encouraged student collaboration and independent inquiry, especially when mobile apps were used for interactive exercises. Furthermore, students reported greater confidence and motivation in learning chemistry, attributing it to the visual and hands-on nature of digital resources. These findings support the hypothesis that integrating digital technologies fosters both conceptual understanding and the practical application of chemistry knowledge.

**DISCUSSION:** The results confirm that digital tools and mobile applications play a pivotal role in developing functional literacy in chemistry education. By offering interactive and student-centered learning environments, these technologies help bridge the gap between theoretical content and practical application. The observed improvement in students' problem-solving skills and conceptual understanding aligns with previous research emphasizing the cognitive benefits of visualization and simulation in science education. Moreover, the increased student engagement and motivation suggest that digital tools can effectively address diverse learning styles, especially in complex subjects like chemistry. However, successful implementation requires adequate teacher training, access to technology, and pedagogical alignment with curriculum goals. The study also highlights the importance of integrating real-life contexts into digital content to make learning more relevant and transferable. These findings suggest that digital integration, when thoughtfully designed and purposefully implemented, enhances students' ability to apply chemical knowledge in meaningful, real-world situations—an essential goal of functional literacy.

**CONCLUSION:** This study demonstrates that the integration of digital tools and mobile applications significantly enhances functional literacy in chemistry education. By providing interactive, visual, and application-based learning experiences, these technologies foster deeper conceptual understanding, improved problem-solving abilities, and increased student engagement. The use of virtual laboratories, simulations, and chemistry-specific mobile apps allows students to connect theoretical content with practical scenarios, promoting critical thinking and real-world application of knowledge. Teachers also reported improved classroom dynamics and greater student autonomy when digital resources were effectively incorporated. However, for maximum impact, it is essential to ensure proper teacher training, curricular alignment, and equitable access to technology. These findings suggest that digital innovation should be viewed not as a supplement but as a core strategy in modern chemistry instruction. Overall, the study reinforces the importance of leveraging digital platforms to cultivate functional literacy, equipping students with the skills needed for academic success and scientific literacy in the 21st century.

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