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Competence potential of timelines in chemistry education of gymnasium students

Tetiana Korshevniuk
Institute of pedagogy of the NAPS of Ukraine
https://orcid.org/0000-0003-0430-5808

Abstract. *This article explores the use of timelines in teaching chemistry to gymnasium students (grades 7–9) within the framework of the New Ukrainian School. The didactic affordances of timelines are identified, and their potential in fostering the key competences defined by the State Standard of Basic Secondary Education is examined. The article substantiates the effectiveness of timelines as a pedagogical instrument for achieving the mandatory learning outcomes in chemistry at the level of basic secondary education.*
Keywords: *basic secondary education, chemistry teaching, timeline, key competencies.*

Ensuring the quality of science education in the New Ukrainian School requires the use of effective didactic tools – accessible and informative for teachers, engaging, motivational, and practically meaningful for students. The design or selection of such tools from the arsenal of modern methodological support for chemistry teachers is based on the principles of competence-based learning, cross-curricular integration, activity-based approaches, and the focus on developing a holistic scientific worldview. In this context, special attention deserves the use of timelines as a didactic means that contributes to achieving mandatory learning outcomes in chemistry within the subject-based learning cycle of gymnasium students (grades 7–9 of general secondary education institutions).

A timeline is understood as a graphical representation of a sequence of events in chronological or logical order. It is not only a visualization tool but also a powerful method for developing thinking, a means of understanding the interconnection of chemistry with history, technology, and everyday life, fostering the formation of a holistic vision of scientific progress in time and space. In chemistry education, a timeline can be applied to:

– visualize the history of chemical element discoveries, theories, and technologies;

– demonstrate stages of the development of chemical science in the context of social progress;

– compare chemical processes over time (for example, the evolution of atomic theory, or the development of organic chemistry);

– integrate knowledge from various subjects or integrated courses in natural sciences and other educational fields (e.g., physics, biology, history, technology).

Didactic possibilities of using timelines in chemistry education include:

– developing students' ability to think in the logic of time and causality, visualizing the progress of science from discovery to contemporary chemical knowledge;

– ensuring the integration of chemical knowledge into a broader educational context by linking it with facts from physics, biology, technology, and the history of science;

– stimulating the development of information-handling skills – from searching and selecting facts to structuring, summarizing, and presenting them as a visual scheme;

– serving as a tool for research activities, as students may independently create their own timelines, demonstrating their understanding of key events and discoveries.

Given their didactic potential, examples of timelines and instructions for working with them are included in the new chemistry textbook [2]. A variety of tasks involving timelines in chemistry education stand out for their significant competence-building potential, as creating and analyzing timelines makes it possible to form and develop all the key competencies defined by the State Standard of Basic Secondary Education. Among them are proficiency in the state language, the ability to communicate in one's native (if different from the state) and foreign languages, mathematical competence, competencies in natural sciences, engineering and technology, innovativeness, ecological competence, information and communication competence, lifelong learning, civic and social competencies, cultural competence, entrepreneurship, and financial literacy [1].

In particular, understanding how chemists' achievements and discoveries relate to society, environmental challenges, and technological change helps develop civic and social competencies. Meanwhile, creating and analyzing timelines builds skills in processing, structuring, visualizing, and presenting information, which supports the development of information and communication competence.

The use of timelines in chemistry teaching also promotes the development of competencies in natural sciences, engineering, and technology, as it allows students to trace the evolution of science and technology, highlighting the role of chemistry in the emergence of new technologies and materials. This approach develops critical thinking, an understanding of the practical significance of science, and the ability to integrate knowledge into life contexts.

Thus, in chemistry education of gymnasium students (grades 7–9), timelines serve not only as a visual tool for organizing knowledge but also as an effective means of forming the key competencies outlined in the State Standard of Basic Secondary Education.

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