

QUESTIONING CULTURE IN CHEMISTRY LESSONS AND THE DEVELOPMENT OF SCIENTIFIC THINKINGNagiyev K. J., Pashayeva A. A., Elyasova J. E.

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In many chemistry classrooms, students often focus on obtaining the “correct answer” rather than learning to ask meaningful scientific questions. This limits curiosity, weakens argumentation, and reduces opportunities to connect chemical concepts with evidence and real-world phenomena. A strong questioning culture – where students learn to generate, refine, and justify questions – supports key components of scientific thinking such as hypothesizing, causal reasoning, model-based explanation, and critical evaluation of claims. Therefore, studying questioning culture in chemistry lessons is highly relevant for competency-based education, inquiry-oriented pedagogy, and improving conceptual understanding beyond memorization. The aim of this study is to examine how building a systematic questioning culture in chemistry lessons contributes to the development of students’ scientific thinking. Specifically, the study seeks to (1) identify instructional strategies that increase the quality and frequency of student-generated questions, (2) describe how different question types (descriptive, causal, predictive, and evaluative) support scientific reasoning, and (3) propose classroom-based tools for monitoring progress through formative assessment [1].

The novelty of the research lies in treating questioning culture as a measurable methodological construct in chemistry education rather than a general classroom interaction feature. The study proposes a structured model that links question types to components of scientific thinking (evidence use, causal explanation, hypothesis testing, and argumentation). It also introduces practical indicators for evaluating question quality (clarity, testability, conceptual relevance, and reasoning demand) and emphasizes the teacher’s role in scaffolding question refinement through dialogue protocols and task design. Practically, the findings can help chemistry teachers transform classroom discourse from teacher-led recitation to student-centered inquiry. The proposed approach offers implementable methods such as question stems, “why/how” prompts, claim–evidence–reasoning routines, and quick rubrics for assessing student questions. These tools can be integrated into typical chemistry topics (chemical reactions, acids and bases, equilibrium, and electrochemistry) without requiring additional laboratory equipment. The results are also useful for teacher training programs by providing clear techniques for fostering productive questioning and diagnosing misconceptions through students’ questions [2].

The study concludes that a well-designed questioning culture in chemistry lessons strengthens scientific thinking by increasing students’ ability to formulate problems, connect concepts with evidence, and construct reasoned explanations. When teachers explicitly teach question generation and refinement, students move from passive response patterns to active inquiry, demonstrating deeper conceptual engagement and improved reasoning quality. Consequently, questioning culture should be considered a central methodological mechanism for developing scientifically literate and critically thinking learners in chemistry education.

References

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