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Editorial

We have launched the second issue of our 10th year, marking the completion of our first decade. Reaching this milestone has not been easy, but it has been equally rewarding and fulfilling. As we have often emphasized, the declining number of chemistry teacher education programs in our country has led to a

decrease in the number of undergraduate graduates and, consequently, in the number of graduate students. This situation is deeply concerning for all chemistry educators; nevertheless, we continue to pursue our academic work to with unwavering dedication..

Throughout this journey, I am profoundly grateful to all my colleagues who have consistently supported our journal, both through their article contributions and their invaluable service as reviewers, which have ensured its sustained publication.

I would also like to extend my sincere appreciation to our Managing Editor, Dr. Barbaros Akkurt, and our Language Editor, Dr. Ebru Demir, for their extraordinary dedication and meticulous efforts in managing this process alongside me from the very beginning.

In this issue, one review and four research articles have been published. In the review paper, Thimmappa (2025) presents a study related to future perspectives on quantum science and technology. He provides a broad overview of recent developments and highlights the importance of research with diverse applications in the field, offering solutions across various sectors.

In the second paper, Çiftci and Aydın (2025) examine the extent to which the 5th Grade Science Curriculum, developed within the framework of the Türkiye Yüzyılı Maarif Modeli (Century of Türkiye Education Model, 2024), aligns with Seligman's PERMA model. The research was conducted using document analysis, one of the qualitative research methods, and systematically analyzed the interdisciplinary components and skills included in the curriculum units. The findings revealed that the program is highly integrated with the well-being indicators of positive emotions, engagement, positive relationships, meaning, and accomplishment. In particular, it was observed that students' cognitive, social, and emotional development is supported through interdisciplinary interaction, game-based learning, and values education. The results suggest that the PERMA model can provide an effective framework for the design of contemporary curricula.

In the third paper, Karabacak et al. (2025) primarily aim to classify chemicals used in depots and laboratories and to develop a database and augmented reality (AR) application firstly. Using the ADDIE instructional design model and artificial intelligence tools, the impact of the AR application on the attitudes of students aged 10 to 12 toward AR technology was examined. Statistical analyses revealed that the AR application significantly improved students' attitudes, with no observable effects of age or gender on the results. Overall, the application contributed to a safer and more effective experimental process by helping students grasp abstract chemistry concepts in a more concrete and engaging manner.

In the fourth paper, Pekdağ and Azizoğlu (2025) examine Turkish high school students' attitudes towards chemistry in terms of gender, achievement, and grade level (GAG). The study was conducted with 495 high school students attending the 9th through 12th grades across five schools in the city of Balıkesir. The "Attitude Scale Towards Chemistry" was used as the data collection tool, and non-parametric statistical methods were employed. The analyses revealed that the majority of students had positive attitudes towards chemistry, and a statistically significant positive relationship was found between chemistry achievement and students' attitudes. Furthermore, statistically significant differences in attitude were observed based on gender and grade level. These

results were conceptualized as the GAG effect. The discussion was grounded in the updated Turkish high school curriculum and international literature. Additionally, recommendations were provided for researchers, teachers, and curriculum designers.

In the final paper, Teke and Sözbilir (2025) aim to develop a highly valid and reliable achievement test that measures ninth-grade students' level of understanding of the topics and concepts covered in the "Interactions between Chemical Species" unit. Designed using a survey method, this study collected data from 10 experts in chemistry education and 174 high school students, and CVI validity values were calculated according to the Lawshe technique. The CVI value for the second version of the achievement test, from which the opinions of two field experts were obtained and necessary corrections were made, was found to be .95. The pilot application of the test was then conducted with 174 high school students. After corrections and analyses, the final version of the achievement test, which initially contained 27 questions in the item pool, resulted in a 26-item achievement test. It is assessed that the developed achievement test can be used as an effective tool for determining student achievement within the relevant topic area.

Finally, I hope that the interest in JOTCS-C will continue increasingly in the following years. It was important to publish a qualified chemistry education journal in our country, and especially to carry out this process within the Turkish Chemical Society for us. I would like to thank on behalf of our editorial board all the authors who submitted articles, and all reviewers for their professional comments.

See you in the new issue in March 2026

Kind regards,

Prof. Dr Canan NAKİBOĞLU
Editor-in-chief, JOTCS-C

References

- Thimmappa, B. (2025). Perspectives on Quantum Science and Technology of the Future. *Journal of Turkish Chemical Society Section C: Chemistry Education (JOTCS-C)*, 10(2), 121-138.
- Çiftçi, B., & Aydın, A. (2025). 5th Grade Science Curriculum from a positive psychology perspective: A program analysis based on the PERMA Model. *Journal of Turkish Chemical Society Section C: Chemistry Education (JOTCS-C)*, 10(2), 139-166. (Turkish)
- Karabacak, H., Akar, B., Akar, S., Aksan, E., & Özden, S. A. (2025). Development of an AI-Supported Augmented Reality Chemistry Assistant and Investigation of Its Effect on Students' Attitudes toward Augmented Reality Technology. *Journal of Turkish Chemical Society Section C: Chemistry Education (JOTCS-C)*, 10(2), 167-208. (Turkish)
- Pekdağ, B., & Azizoğlu, N. (2025). The GAG Effect: Modelling High School Students' Attitudes Towards Chemistry. *Journal of Turkish Chemical Society Section C: Chemistry Education (JOTCS-C)*, 10(2), 209-234.

Teke, D., & Sözbilir, M. (2025). "Kimyasal Türler Arası Etkileşimler" Ünitesine Yönelik Bir Başarı Testi Geliştirme Çalışması. *Journal of Turkish Chemical Society Section C: Chemistry Education (JOTCS-C)*, 10(2), 235-260. (Turkish)