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BALLOONIZATION – TEACHING SCIENCE EFFECTIVELY WITH MODELS AND ANALOGIES

Marina Stojanovska

Ss. Cyril and Methodius University in Skopje, Faculty of Natural Sciences and Mathematics
Archimedes 3, Skopje
marinam@pmf.ukim.mk

Models and analogies play a central role in the teaching and learning of chemistry, as they provide an essential bridge between abstract scientific concepts and students' prior experiences (Jones, 2013; Tasker & Dalton, 2006). Through the use of models, students are able to better understand phenomena and processes that cannot be directly observed, such as molecular structure, particle behavior, or the spatial orientation of orbitals. According to the typology proposed by Harrison and Treagust (2000), various types of pedagogical models are used in science teaching (scale, theoretical, mathematical, and symbolic) which function both as explanatory tools and as supports for the learning process. Within this framework, analogical models play a particularly important role in the development of students' conceptual understanding. However, research indicates that students often interpret models differently from what teachers intend (Treagust, Harrison & Venville, 1998). Therefore, it is important in the teaching process to explicitly address which attributes are shared between the model and the phenomenon it represents, and which aspects do not correspond. Such an approach helps students recognize the limitations of models and reduces the risk of developing misconceptions.

In this plenary lecture, effective strategies for the use of models and analogies in chemistry teaching will be discussed. Particular attention will be given to approaches based on the Teaching–With–Analogies (TWA) model and the Focus–Action–Reflection (FAR) framework. These approaches emphasize that the successful use of analogies requires careful planning, clear presentation, and critical reflection during the teaching process. As an illustrative example, the balloon analogy will be demonstrated to explain molecular geometry and hybridization. This analogy provides a visual, dynamic, and tactile representation of electron-pair repulsion and orbital orientation, helping students more easily understand the three-dimensional organization of molecules. The lecture will also emphasize that all models represent simplified representations of reality. Nevertheless, when used thoughtfully and critically, they can significantly contribute to deeper conceptual understanding and to the development of students' scientific reasoning.

Keywords: analogy, chemistry teaching, conceptual understanding, models, molecular geometry.

References:

Harrison, A. G. & Treagust, D. F. (2000). A typology of school science models. *International Journal of Science Education*, *22*(9), 1011–1026. https://doi.org/10.1080/095006900416884

Jones, L. L. (2013). How Multimedia-Based Learning and Molecular Visualization Change the Landscape of Chemical Education Research. *Journal of Chemical Education*, *90*(12), 1571–1576. https://doi.org/10.1021/ed4001206

Tasker, R. & Dalton, R. (2006). Research into practice: visualisation of the molecular world using animations. *Chemistry Education Research and Practice*, *7*(2), 141–159. https://doi.org/10.1039/B5RP90020D

Treagust, D. F., Harrison, A. G. & Venville, G. J. (1998). Teaching science effectively with analogies: An approach for preservice and inservice teacher education. *Journal of Science Teacher Education*, *9*(2), 85–101. https://doi.org/10.1023/A:1009423030880