

# Progression of the Conception of Chemistry Students Regarding the Presentation of a Chemical Reaction †

Christos N. Papadopoulos<sup>1</sup>, Parthena Katikaridou<sup>1</sup>, Pericles D. Akrivos<sup>1,\*</sup>

<sup>1</sup> Department of Chemistry, Aristotle University of Thessaloniki GR-541 24 Thessaloniki, Greece; papadocn@gmail.com (C.P); akrivos@chem.auth.gr (P.A);

\* Correspondence: akrivos@chem.auth.gr (P.A);

† Presented at 4<sup>th</sup> Chemistry Conference of Graduate, Postgraduate students and Ph.D. candidates of the Aristotle University of Thessaloniki (20-21 March 2021)

Received: 10.03.2021; Revised: 12.03.2021; Accepted: 15.03.2021; Published: 19.03.2021

**Abstract:** The study refers to the concepts and ideas of future teachers regarding the abstract representation of the key topic of the chemical reaction. University graduates fulfilling the requirements for a teaching job in secondary education should use such representations throughout the education program they have to follow. Of course, every teacher is better suited to teach aspects best integrated into his/her background and will do so in the manner best conceived by him/her. The study investigated the progression of ideas among undergraduate and postgraduate students of the Chemistry Department of Aristotle University of Thessaloniki, Greece, in relation to the pictorial representation of a simple reaction. The synthesis of water was set as a target, and the participants were encouraged to utilize any available source, including web pages. All the participants followed the same curriculum during their undergraduate studies. The evolution of their ideas about the best manner to describe water formation reflects the degree of assimilation of the curriculum content to their cognitive background. Categorization of the answers was performed by setting specific key points in their content as sketching atoms in scale, clearly presenting the overall geometry of molecules, additional information given as to the bond angles, the energetics of the reaction as well as indications of the utilization of internet sources for the preparation of the work, etc. The resulting representations, studied in this way, provided solid evidence for the gradual progression of the undergraduate students' attitude towards how to describe basic chemical information. Lewis structure depictions are becoming less common, space-filling presentation is preferred over the ball and stick, and the energetics of the reaction gain in importance with the advance of the students within their four-year curriculum.

**Keywords:** chemical reaction; conceptual models; teaching chemistry; chemical representation.

© 2021 by the authors. This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## Funding

This research received no external funding.

## Acknowledgments

This research has no acknowledgment.

## Conflicts of Interest

The authors declare no conflict of interest.