INVESTIGATION OF HIGH SCHOOL STUDENTS' COMPETENCE IN TRANSLATING BETWEEN DIFFERENT TYPES OF CHEMICAL REPRESENTATION

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Meaningful understanding in chemistry, among others, includes the ability of an individual to think simultaneously at macroscopic, submicroscopic and symbolic level, and this presupposes the competence to translate between different types of chemical representations[1,2]. This competence is an information processing task, requiring understanding of the underlying concept to the extent that the individual can interpret the information provided by an initial representation and infer the details required to construct the target representation[3]. In this study we investigated 11th Grade Greek students' ability to translate a chemical representation into another type concerning various chemical concepts, such as chemical element, chemical compound, solid physical state of matter, aqueous solution and chemical reaction, which have already been taught in earlier grades.

Students' performance (N=466) was measured by an instrument consisting of 10 multiple choice and one open-ended questions, which included real pictures (macroscopic), molecular types (symbolic) and submicroscopic diagrams. Various representations of the three types were given to students and they were asked to choose or to construct an equivalent one of different type. Our results show that students' capacity to move across the three levels of chemistry is very low. Students had lower performance in translations concerning the concepts chemical compound, aqueous solution and chemical reaction compared with those related with chemical element and solid state of matter. They also had the lowest level of performance in translating the submicroscopic representations into the symbolic ones. Although the majority of students were able to translate a submicroscopic representation into an equivalent macroscopic one, only half of them could achieve the reverse translation. Generally, our results indicate that translating between different types of chemical representations is a very demanding task and requires both conceptual knowledge and translating skills.

References

1. *Kozma, R., Russell, J. in Gilbert, J.K. (ed), Visualization in Science Education,* **2005**, *pp. 121-146, Springer.*

2. *Cheng, M., Gilbet. J.K. in Gilbert, J.K., Treagust, D. (eds), Multiple Representations in Chemical Education,* **2009**, *pp. 55-73, Springer.*

3. *Keig, P., Rubba, P., Journal of Research in Science Teaching,* **1993**, *30 (8), 883-903.*