An Assessment Instrument for Investigating Conceptual Changes in Students' Knowledge about Molecular Structure

Maria Vlacholia[1], Stella Vosniadou[1], Katerina Salta[1], Petros Roussos[1], Smaragda Kazi[2], Michael Sigalas[3] and Chryssa Tzougraki[1]

[1]National and Kapodistrian University of Athens, Athens, Greece

[2]Panteion University, Athens, Greece

[3]Aristotle University of Thessaloniki, Thessaloniki, Greece

We argue that the acquisition of chemistry expertise requires considerable conceptual changes (Vosniadou & Skopeliti, 2013), which amongst other things involve a change from reliance on visual-spatial thinking to the employment of analytic strategies (Hegarty, Stieff, & Dixon, 2013; Stieff, 2007). This shift is related to the development of chemistry expertise, and specifically knowledge about molecular structure, rather than to individual differences in visual-spatial thinking. Although, current assessment instruments use various tasks that allow us to make inferences about the kinds of strategies individuals use during problem solving, they do not directly and clearly capture this expertise - related visual/analytic shift in chemistry. The purpose of the present research was to develop an instrument that would consist of some items that could be solved only when analytic strategies are employed. The assessment instrument presently developed consists of two groups of items: In the first group, the items can be solved correctly either by visual or by analytic/chemical knowledge, whereas in the second the items required reliance on chemical knowledge and the adoption of analytic strategies. The items were pilot tested with 6 chemistry experts who could easily solve them. It was subsequently administered to 132 11th grade students (ranging in age from 16 to 17) who had been exposed to chemistry teaching for 4 years. The results indicated that the participants could solve the items in the first group with little difficulty but were not successful with the analytic items, providing evidence that they had not achieved the expected visual-analytic shift. We are currently in the process of validating the instrument by comparing it with other chemistry assessment instruments and with participants at various levels of chemistry expertise.

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