How do high school students develop an understanding of chemical bonding as guided by the new Israeli curriculum in chemistry?

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Chemical bonding theory is central to general chemistry. Past studies have shown that many existing curricular approaches are simplistic, not aligned with current scientific models, and do not support a deep understanding of chemical bonding (Levy Nahum, Mamlok-Naaman, Hofstein, & Krajcik, 2007). In 2006 a new high school chemistry curriculum, aligned with current scientific knowledge in chemistry and education, was introduced into the Israeli educational system.

This study investigates how students' understanding of chemical bonding theory develops over time, guided by the new curriculum. The first stage of the research consists of building a learning progression that describes different possible levels in the understanding of chemical bonding which will be used to assess the cognitive development of students (Scalise, Claesgens, Wilson, & Stacy, 2006). Based on the findings, the learning progression will be revised. This learning progression suggests that understanding the chemical bonding requires a coherent understanding of three main ideas: (1) structure of matter at the nanoscopic level (2) electrostatic interaction between particles and (3) chemical energy. These are acquired along with the development of the chemical language and use of the periodic table of the elements.

During the pilot study, assessment items such as learning activities, exams and interviews were developed. These items are calibrated by construct maps that describe the learning progression.

Based on the findings of this study, recommendations on ways to improve the implementation of the new curriculum, such as modifying professional development on the curriculum or revising existing activities will be proposed.

Levy Nahum, T., Mamlok-Naaman, R., Hofstein, A., & Krajcik, J. (2007). Developing a New Teaching Approach for the Chemical Bonding Concept Aligned With Current Scientific and Pedagogical Knowledge. *Science Education, 91*(4), 579-603.

Scalise, K., Claesgens, J., Wilson, M., & Stacy, A. M. (2006, October 2006). ChemQuery: An Assessment System for Mapping Student Progress in Learning Chemistry. Paper presented at the Proceedings of the National STEM Assessment Conference.