

DISSERTATION: A Comparison of Two Instructional Methods for Drawing Lewis Structures

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Two instructional methods for teaching Lewis structures were compared – the Direct Octet Rule Method (DORM) and the Commonly Accepted Method (CAM). The DORM gives the number of bonds and the number of nonbonding electrons immediately, while the CAM involves moving electron pairs from nonbonding to bonding electrons, if necessary. The research question was as follows: Will high school chemistry students draw more accurate Lewis structures using the DORM or the CAM? Students in Regular Chemistry 1 (N = 23), Honors Chemistry 1 (N = 51) and Chemistry 2 (N = 15) at an urban high school were the study participants. An identical pretest and posttest was given before and after instruction. Students were given instruction with either the DORM (N = 45), the treatment method, or the CAM (N = 44), the control for two days. After the posttest, 15 students were interviewed, using a semi-structured interview process. The pretest/posttest consisted of 23 numerical response questions and 2 to 6 free response questions that were graded using a rubric.

A two-way ANOVA showed a significant interaction effect between the groups and the methods, $F(1, 70) = 10.960$, $p = 0.001$. Post hoc comparisons using the Bonferroni pairwise comparison showed that Reg Chem 1 students demonstrated larger gain scores when they had been taught the CAM (Mean difference = 3.275, SE = 1.324, $p < 0.05$), while Hon Chem 1

students demonstrated larger gain scores after learning the DORM (Mean difference = 1.931, SE = 0.848, $p < 0.05$). The DORM requires five mathematical operations, while the CAM only requires one. Honors Chemistry 1 students performed better with the DORM, perhaps due to better math skills, enhanced working memory, and better metacognitive skills. Regular Chemistry 1 students performed better with the CAM, perhaps because it is more visual. Teachers may want to use the CAM or a direct-pairing method to introduce the topic and use the DORM in advanced classes when a correct structure is needed quickly.