A STUDY OF THE EFFECTIVENESS OF USING MODELS IN HIGH SCHOOL CHEMISTRY INSTRUCTION

MONTANA STATE UNIVERSITY
Master of Science in Science Education

Deborah Price, Andrean High School, Merrillville, IN

ANDREAN HIGH SCHOOL

Background

This study was conducted at Andrean High School, a private high school in Merrillville, Indiana. In the past decade, the Next Generation Science Standards and Advanced Placement science standards have encouraged science teachers to teach science processes as well as science content. I wanted to investigate how the use of models in chemistry affects student achievement, higher-order thinking, and student engagement.

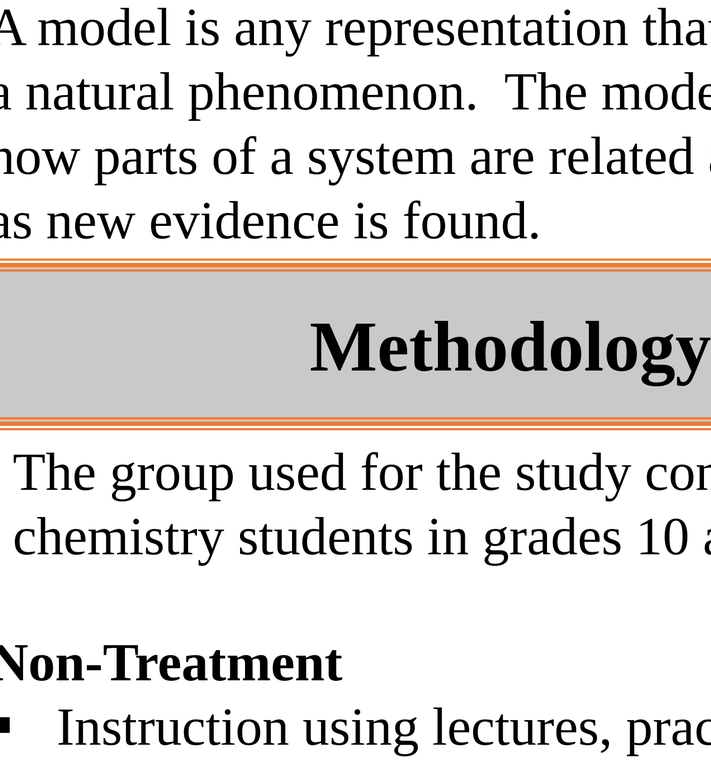
A model is any representation that helps explain a natural phenomenon. The model demonstrates how parts of a system are related and is revised as new evidence is found.

Methodology

The group used for the study consisted of 45 chemistry students in grades 10 and 11.

Non-Treatment

- Instruction using lectures, practice problems and laboratory experiences
- Baseline data collected for achievement, engagement, and higher-order thinking



Abt of different variations of acetic acid was added to fluid in each of the 4 flasks. All of the balloons got inflated to different amounts, even though balloon C & D were almost identical. The ratios of acid to liquid was different in each flask. We were able to figure out how much powder was added through the use of stoichiometry. The actual data was the amount of gums added in each flask, the theoretical was what we thought was added before the reactions took place. I think this lab happened the way it did through stoichiometry, percent yield, & limiting reagents.

Figure 1. Student model of phenomenon.

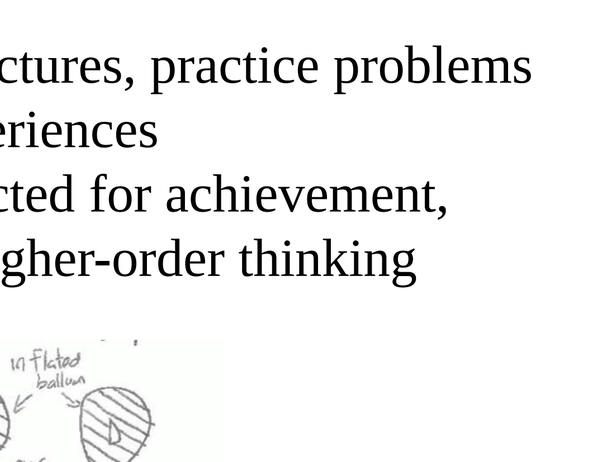


Figure 2. Students using a model.

Treatment

- Instruction using a phenomenon, direct instruction, hands-on activities, practice problems, and laboratory experiences
- Students created, evaluated and revised a model that explained the phenomenon
- Data collected for achievement, engagement, and higher-order thinking

Data

Engagement:

- Students stayed on task more when using models
- Survey indicated higher engagement

Table 1
Engagement Results

Measurement	Results (%)
On task during direct instruction	85
On task during modeling	92
Students reported being engaged during lecture	58
Students reported being engaged during modeling	87

Achievement:

- No significant gain in test scores
- Students met expectations for creating a model
- Students said using models helped them understand

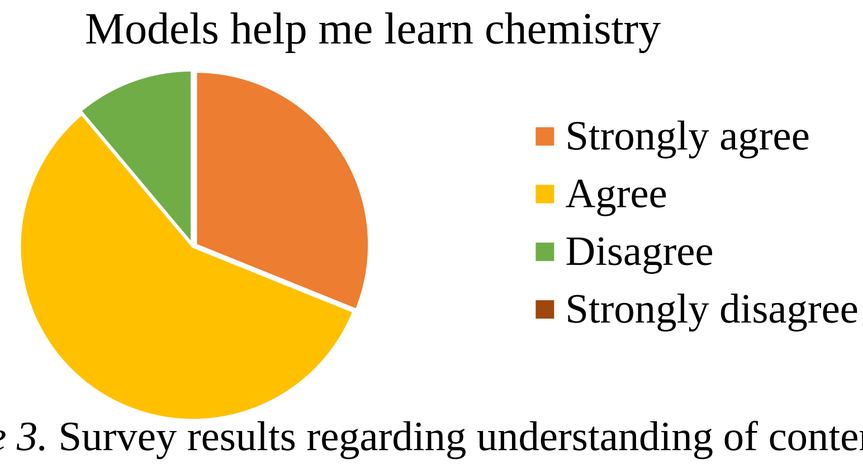


Figure 3. Survey results regarding understanding of content.

Higher-order thinking:

- Students showed improvement on higher-order test questions
- Revision of models using new information

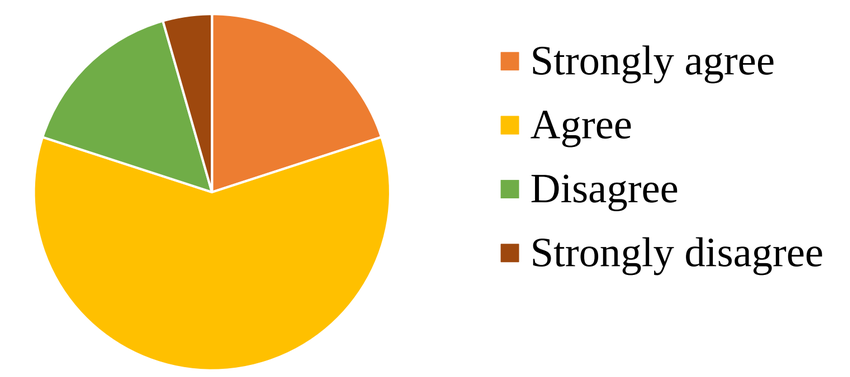


Figure 4. Survey results regarding higher-order thinking.

Conclusion

This study showed that using models in chemistry instruction improves student engagement and higher-order thinking.

The students felt that using models increased their understanding, but test scores did not show significant improvement.