Organize . Summarize . Visualize

Role of Graphic Organizers in Chemistry Achievement

Veeraiah Kummari

Frankfurt International School, Oberursel, Germany

Background

I conducted my capstone project in a Grade 9 chemistry classroom at Frankfurt International School, Germany. There are 22 students in this class and 18 of them are non-native speakers of English of European and Asian background. They are highly motivated and easy to manage. The class average was a 5 on a scale of 1-7 on major summative tests. I noticed several of them struggled to answer higher order thinking questions on more than one occasion. They were not confident about transferring knowledge and applying concepts to new situations. Abstract reasoning and in-depth understanding are critical to academic success in physical sciences. The positive outcomes of this project should increase student motivation and strengthen their achievement in the chemistry classroom.

Methodology

Table 1
Data Triangulation Matrix

Focus Question	Data Source 1	Data Source 2	Data Source 3	Data Source 4
Primary Question: To what extent do graphic organizers influence the chemistry achievement of ninth grade chemistry students?	Students' scores on the Content Pre- and Post-Tests	Students' responses to Pre- and Post-Mapping Surveys and Post-Mapping Interviews	Teacher's observations	Students' artifacts, such as concept maps, mind maps, Vee and Venn diagrams
Sub-Question: Are some organizers more effective in deepening students' conceptual understanding than others?	Students' scores on the Content Pre- and Post-Tests	Students' responses to Pre- and Post-Mapping Surveys and Post-Mapping Interviews	Teacher's observations	Students' artifacts, such as concept maps, mind maps, Vee and Venn diagrams

Data and Analysis

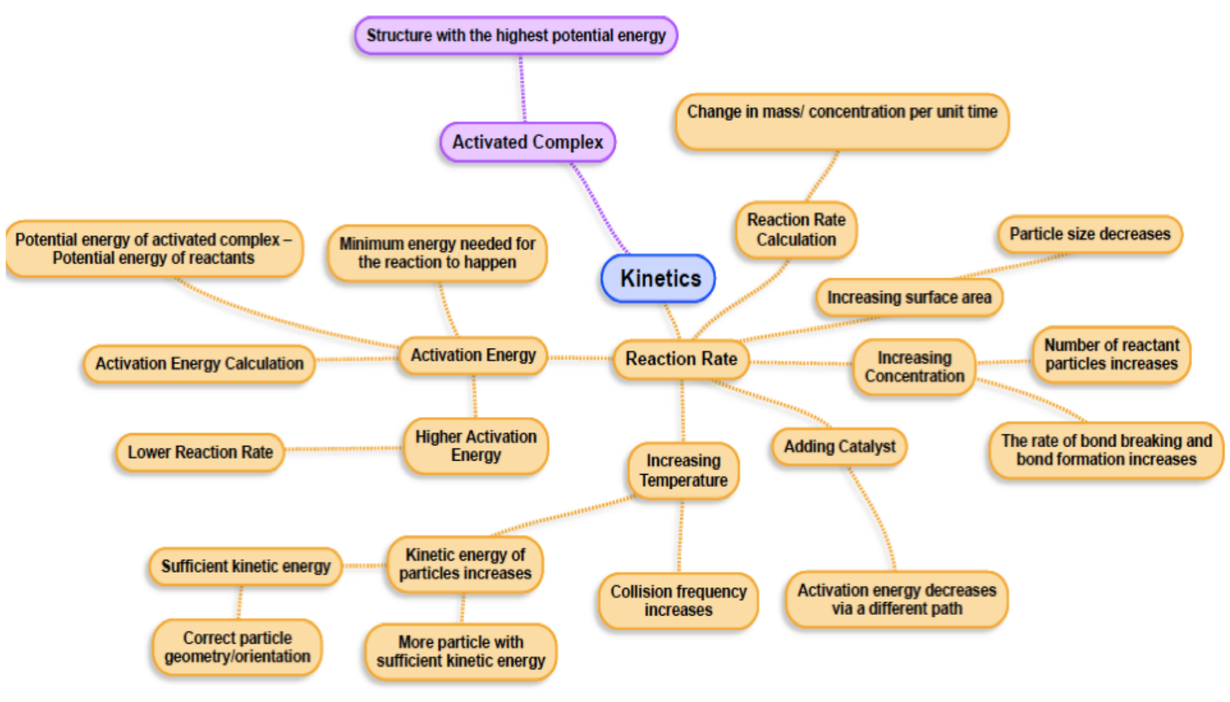

Figure 1. Kinetics concept map in the post-mapping period.

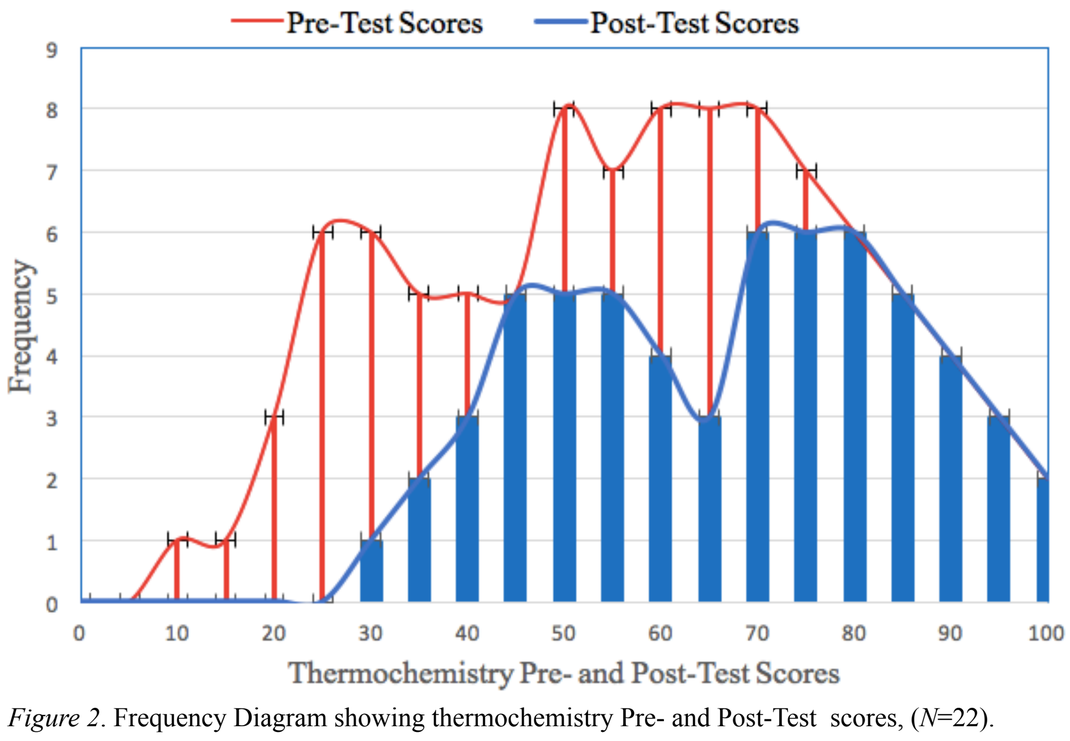

Figure 2. Frequency Diagram showing thermochemistry Pre- and Post-Test scores, (*N*=22).

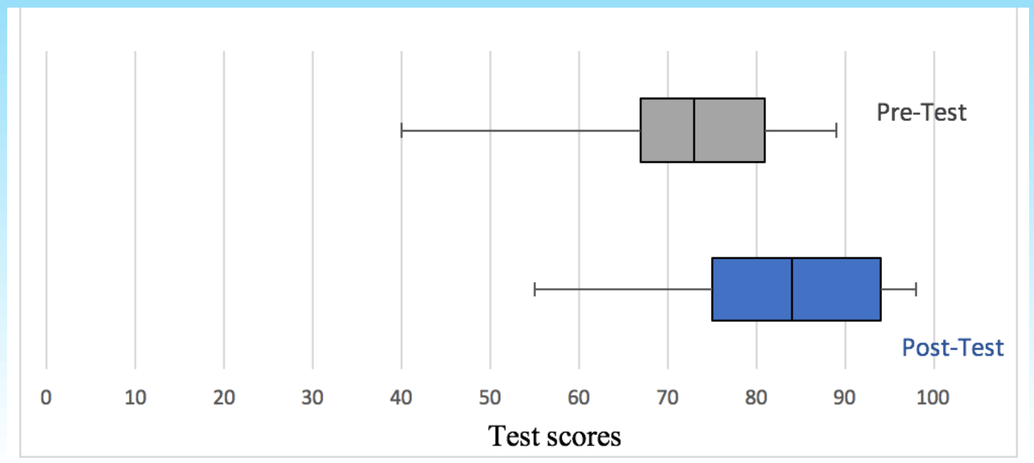

Figure 3. Box-plot showing the thermochemistry test scores in the pre- and post-mapping period, (*N*=22).

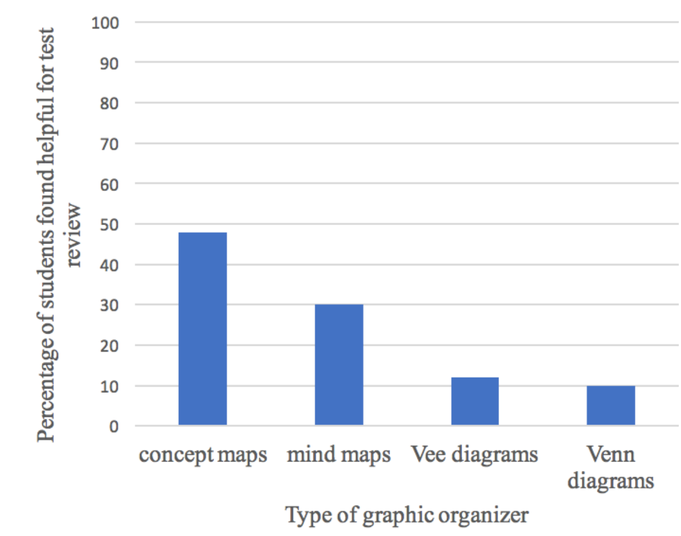

Figure 4. Post-Mapping Interview results, (*N*=22).

Results and Discussion

The average of the normalized gains for the Content Pre- and Post-test scores on the physical chemistry units, thermochemistry, kinetics, and acids and bases were found to be 0.33, 0.35, and 0.42, respectively. These values were found to be of medium significance (Hake, 1998). This means that the students gained 33%, 35%, and 42% of the possible points they could have gained. The students' academic gains in the post-mapping period were further reinforced by their median test scores on thermochemistry, kinetics, and acids and bases. These scores increased by 13%, 16%, and 22%, respectively in the post-mapping period thus showing that the graphic organizers positively influenced their assessment outcomes.

The students' improved test scores in the post-mapping period were validated by their responses to Post-Mapping Interview questions. 18% of the students viewed concept maps as a more effective graphic organizer than mind maps to understand the conceptual connections. They mentioned that the concept map is comprehensive and helped them understand the connections better. They also felt concept maps enabled them to successfully answer application questions on the test. The increase in test scores in the post-mapping period and their responses to Post-Mapping Interview questions were clearly complimented by the students' artifacts. The concepts maps, mind maps, Vee diagrams and Venn diagrams created in the post-mapping period illustrate a more insightful understanding of content and in-depth conceptual connections made by the students as opposed to those in the pre-mapping period.

References

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six- thousand-student survey of mechanics' test data for introductory physics American Journal of Physics, 66(1), 64-74.

Kahari, J., Mr. (2016, November 10). Kinetics Concept Map [Digital image]. Retrieved June 3, 2017.

Upper School. (n.d.). Retrieved June 3, 2017, from http://www.fis.edu/

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