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EDU 535
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Lab implementation analysis

Freezing and melting of water

The characteristic physical properties of freezing temperature are the temperature at which a substance turns from liquid to solid, and melting temperature, the temperature at which a substance turns from a solid to a liquid.
In this experiment, the cooling and warming behavior of a familiar substance, water, will be investigated.
By examining graphs of the data, the freezing and melting temperatures of water will be determined and compared.

Objectives

In this experiment, students should:

- Collect temperature data during the freezing and melting of water.
- Analyze graphs to determine the freezing and melting temperature of water.
- Determine the relationship between the freezing and melting temperatures of water.
- Examine the effect of using sodium chloride on the melting and freezing point.
- Familiarize the use of technology, by using Vernier computer interface, Logger Pro, and temperature probe.

Prior knowledge, reports and assessments:

Students studied physical and chemical changes in two different chapters of the chemistry book; students also studied ionic compounds such as sodium chloride.
Students were going to study Intermolecular and Intramuscular forces after conducting this lab; also they will study the phase change graphs.

In the beginning of the lab course, students spent two periods working on the Vernier Probes, interfaces, and making some graphs. I reviewed the lab write up template from the lab manual with my students, and asked them to write a pre-lab and submit it before the lab day.

After we finished working on the lab, which took two different periods (more than what was planned for), we had a post lab discussion about the freezing and melting graphs, and why these graphs show a plateau. This represents a phase change; something students didn't expect to see in their graphs.

Lab strengths and weaknesses:

This lab took more time than the original plan. Lab work should be done in 45 minutes. The main reason for spending more time on this lab is some students in my lab are from different chemistry classes, and they have a different teacher. They didn't use Vernier Probes before like my students, so it took them more time to finish their lab. Another reason relates to fixing any computer problem, such as connecting probes. Also, there is a large group of students in this new chemistry lab.
This lab is a perfect tool to investigate phase change, and to use the graph analysis as evidence for the intramuscular forces and the existence of the hydrogen bonds. Students didn't expect to see a plateau, and this lab led the class to an open discussion about the intramuscular forces.

I believe this lab would fit younger students (middle school age), as well as high school students; the difference would be the depth in studying the graphs, and the concept of the hydrogen bond.
The exact same lab could be used in different areas, such as physical science classes to study physical change. It also could be used in some math classes to study graphs.

Improvement:

I would spend more time to familiarize all my students with Vernier technology; apparently two periods were not enough to do this. On the other hand, I would use another material beside water, like dry ice, to compare two different graphs between water and dry ice melting points (for dry ice will be the sublimation point).

Fewer students would be much nicer and give me more of a chance to help them. This would give me a chance to ask my students some questions to guide them through the lab. Also, I'd like to not keep occupied with taping the class, but instead install the camcorder in one corner and move freely in my room.

Video analysis

Most of the students were engaged in the lab. They worked in groups of two. The lab work required cooperation between students. The main tools for this lab were computers, interfaces, probes, and the materials were ice and table salt. Students were given the main role in this lab. The lab is well-written, self-guided and self-explanatory. Honor students were asked to help other groups if they had any problem with using Veriner technology since they are familiar with these kinds of labs.

These students are familiar with using ice to increase the freezing point of water. All students live in the Delaware area, and they are familiar with snowstorms and the effect of use of salt on their driveways. Some students from overseas (Pakistan), never having been in this situation before, or for students who live in apartments and don't have to worry about cleaning off sidewalks, or driveways were not familiar with these elements. I believe this part of the lab shows the effect of the community in the form of the climate, income, or even homeland.
Rules for any lab work were given to the students: safety requirements for each lab, and individual lab-reports, as well as finishing on time. Students were allowed to stay after school to either finish work or make it up. For this lab safety goggles were not a requirement.

Overall, the outcome of this lab was as expected. This lab created more questions. This lab also increased students' abilities to read and analyze graphs, and this lab made a connection between the use of salt to clean

after a storm as well as both chemistry and physics work. In the post-lab discussion we talked about the chemistry behind the plateau in the graph and using salt to increase the freezing point.

The thing I liked most about this lab is it being an investigating lab. It touches on new areas never being covered such as intermolecular forces. This lab perfectly fits into the curriculum. Using table salt as an ionic compound, it opens a new door to talk more about the hydrogen bond and connects science to students' environment; this was a big factor in making this lab a successful one.