TITLE: INTEGRATING MATHEMATICS AND SCIENCE THROUGH THE USE OF VERNIER LABPRO☺

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Today's Presentation Agenda

- 1:30 – 1:40
  - Introductions and Explanation of each of the Laboratory Exercises
- 1:40 – 1:50
  - PowerPoint presentation and Vernier probeware Introduction and Orientation
- 1:50 – 2:10
  - Participants Perform Laboratory Exercise
  - Share Results Back with Class (if time)
- 2:10 – 2:15
  - Conclusions

Interdisciplinary Lessons… Science and Mathematics

"Making connections and transferring ideas to a new context are difficult processes that many students cannot accomplish on their own…

The opportunities to make such connections does not always arise in the context of single-subject classes unless teachers take time out… "

(Marrongelle, Black, Meredith, 2003)

Common Core State Standards: Mathematics

- Make sense of problems and persevere in solving them (Mathematical Practice #1).
- Model with mathematics (Mathematical Practice #4).
- Use appropriate tools strategically (Mathematical Practice #5).

Science

- National Science Education Standards (NRC, 1996) notes “coordination of science and mathematics programs provides an opportunity to advance instruction in science beyond the purely descriptive. Students gathering data in a science investigation should use tools of data analysis to organize these data and to formulate hypotheses for further testing” (p. 218 – 219).

“Real-World” Mathematics & Science

- Mathematics and Science are intimately interconnected. Scientific principles and laws are tested, analyzed, and confirmed experimentally through mathematics.
- CBLs/LabPro Systems provide opportunities to conduct a wide range of data-collecting activities relatively inexpensively.
- Teachers should incorporate technology as a tool to examine mathematics and science ideas

(Randall, 1998)

Scientific Inquiry

- **LEARNING SCIENCE IS AN ACTIVE PROCESS.**
  - Learning science and math is something students do, not something that is done to them.
  - In learning science, students describe objects and events, ask questions, acquire knowledge, construct explanations of natural phenomena, test those explanations in many different ways, and communicate their ideas to others.
  - In the *National Science Education Standards*, the term "active process" implies physical and mental activity. Hands-on activities are not enough—students also must have "minds-on" experiences.

What is inquiry?

Student-centered and/or student-directed is a means to which students can create meaningful knowledge, comprehension and critical thinking skills

- Guided Inquiry
- Structured Inquiry
- Open Inquiry

LabPro/CBL Probes

- Distance (motion detector)
- Force
- Pressure
- Temperature
- pH
- Microscope

Mathematical Ideas

- Functions
  - linear
  - quadratic
  - logistic
  - piecewise
  - sinusoidal…

(data analysis, predictions, graphing, modeling…)

Science Ideas

- Velocity
- Water Quality
- Air Pressure
- Harmonic Motion
- pH Change
- Digital Microscopy

Station #1 – Graphing Your Motion

- Graphs made using a Motion Detector can be used to study motion.
- In this experiment, you will use a Motion Detector to make graphs of your own motion.
- Objectives
  - Use a Motion Detector to measure position, velocity, and acceleration.
  - Use a computer to produce graphs of your motion.
  - Analyze the graphs you produce.
  - Match position *vs.* time and velocity *vs.* time graphs.

Station #2 – The Greenhouse Effect

- Greenhouses allow gardeners to grow plants in cold weather.
- This is because a greenhouse stays warmer than the outside air. You can feel this effect in a car parked in the sun.
- On a larger scale, the greenhouse effect helps keep our planet warm. It makes Venus one of the hottest planets in our solar system.
- In this experiment, you will use Temperature Probes to measure temperatures in a model greenhouse and in a control as they are heated.
- You will then calculate the resulting temperature changes.

Summary Thoughts?

- What did you enjoy about this type of "inquiry" themed laboratory experience?
- How do you think your students would respond to this type of technology integration?
- Are there implementation barriers that teachers would need to be aware of?
- What was the math and science content? Was the content understood?
- Would you be willing to work in an interdisciplinary team in the future?

Conclusion

- Questions?
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