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Narrative Describing How STEM is Implemented in my Classroom

In my eighth grade classes, students create solutions to simulated and real problems, using STEM elements. They investigate the liquid waste from an imaginary metal plating company that wants to dump it in a local stream. Using a variety of chemical tests and Pasco's SPARKS sensors for temperature and pH, students determine that the wastewater is acidic and contains iron. In developing procedures to clean it up, they learn about dissolved substances, concentration, neutralization, precipitation and filtering procedures, meeting many of the national standards for middle school chemistry.

Students use knowledge gained from this simulation to collect actual data from a nearby creek. Observations about water temperature, pH, dissolved oxygen and conductivity are recorded and analyzed along with weather observations and UV levels. Over several months, students use this real-world data to note trends and propose explanations.

As students observe phase changes and chemical reactions, they hand-draw graphs and with the SPARKS units, instantly check their graphs for accuracy. Graphing changes from being an abstract concept to a useful tool as students see data develop in "real-time". They follow this hands-on experience with a computer simulation to observe the molecular motion during phase changes. (*States of Matter,* PHET, University of Colorado)

In our physics unit, my students build catapults and compete against each other for distance and accuracy. They calculate projectile paths, using algebraic principles while meeting the national standards for physics. SPARKS motion sensors help them analyze their projectile paths and improve their machines. The process they follow of design, test and redesign, reinforces engineering principles they learn throughout the year.

Among my students' many open-inquiry investigations is observing, and experimenting on ice balloons. They noticed salt made the ice crack and it "burned" their fingers. Although we are a Title 1 school, where more than 50% of our students are low-income and 20% of students speak a language other than English at home, when asked, "What is your evidence?" virtually every group collected SPARKS units and measured the temperature. Within seconds they could see the graph decrease and concluded the salt actually made the ice *colder,* even though it felt hot. Collecting quantitative evidence transcends genders, economics and ethnicities.

Students participate in a culminating Capstone Experience, exploring a personal or societal issue of interest. Using the internet for research and creating online surveys to gather data, students individually investigate topics such as the thinning of the ozone layer and then measure UV radiation under different conditions. They explore deforestation, then measure the CO^2 levels when organisms live in differing amounts of vegetation. They analyze the effects of energy drinks or video games on heart rate and relate it stress, diet and health. SPARKS sensors collect

the data. In presenting their project technologically, students use Web 2.0 tools such as SCRATCH, Powerpoint, Prezi, and Go Animate. Engagement is evidenced by the fact that all 200 students have completed this project every year we have done it. I believe integrating STEM principles and incorporating technology has lead to this success.