

GOVERNOR'S STEM ADVISORY COUNCIL



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Science

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2016 Award Recipient

South Central Region

1) Activity/Lesson: Biogeochemical Cycles in Classroom Aquariums

- a. **Process:** Students monitor and graph Ammonia, Nitrite, and Nitrate (using cheap testing strips) levels in a newly started fish tank, then design a filtration system to remove the nitrates from the water.
- b. **Key Concepts:** Biogeochemical Cycles (Nitrogen Cycle), Watersheds, Water Pollution, Fisheries Biology, Clean Water Act
- c. **Possible Extensions**
 - i. Monitor, chart, and compare fish growth rates and feed efficiencies for the fish in the tank
 - ii. Debate: Form “Legal teams” representing both the farmers and Des Moines Water Works and have a class debate about the Water Works Lawsuit – have the class try to find a solution that appeases both sides.

2) Activity/Lesson: Mini Farm

- a. **Process:** Student groups design, market, and grow a small farm plot (1 square foot) raising lettuce and/or herbs. (Lettuce works well because it grows fast and requires low light levels). Prices per gram are calculated from local grocery stores. Students can use soil or DIY hydroponic systems and any sort of fertilizer that want. Students compete to earn the highest profits
- b. **Key Concepts:** Plant biology, cost-benefit analysis, sustainable agriculture methods
- c. **Possible Extensions**
 - i. Have students actually sell the products to willing teachers and have a “farmers market”, as a class, decide how to donate the money collected.
 - ii. Experiment with different types of light sources (window sunlight, fluorescent, LED,) or spectrums (blue, red, green, etc) and see how it impacts growth

3) Activity/Lesson: Skype with a scientist

- a. **Process:** Invite scientists who have areas of expertise in the area you are studying and invite them to skype with your class. Have your class lead the discussion but help them formulate and organize their questions before hand so you can give them to the scientist a few days before. Some of the best discussions we have had as a class while skyping with a scientist were the discussions on college and career pathways that the scientists took. Skyping is usually cheaper and easier to do than getting a speaker to come in.
- b. **Key Concepts:** Any scientific concepts, Science Careers, Science Majors
- c. **Possible Extensions:**
 - i. If willing, have the scientists look over student work and provide feedback, or if local set up “job shadows” for students

4) Activity/Lesson: DC Motor Engineering Olympics

- a. **Process:** Give groups of students a small (1-3 Volt) DC motor. They are to go through 3 design challenges related to sustainable energy. Electricity production is measured with a multimeter. The first challenge is to create a working hydroelectric generator using flowing water from a classroom sink, the second is to create a working wind turbine using wind from a fan, and the third is to create a working electric car that runs off of batteries. Time and supplies are determined teacher (I usually just use junk lying around the school) Rank students by voltage produced for the first two, then by either distance or speed for the car. Have a medal ceremony with prizes when finished.
- b. **Key Concepts:** Alternative energy sources, engineering/design
- c. **Possible Extensions:**

- i. Have students power their car from a solar panel (Junior Solar Sprint specs work well for this project)
- ii. Incorporate a 4th competition that involves students designing a strategy that saves the school energy while being cost effective. Awards go to the most kWh saved per year per dollar spent.

5) Activity/Lesson: “Do Science”

- a. **Process:** Essentially this is open inquiry. I do this twice a year, once at the beginning of the school year after the “welcome to a science class” unit and then also once at the end of the year as a final project. This is done entirely outside of school by the student, but I’m there to meet and help along the way. I simply tell them to “Do Science” and give them a due date a few weeks away. Some students respond with enthusiasm for the freedom and others respond with anger and despair. A grade is based on some sort of professional science turn-in piece like a journal article or presentation of research. You can be as wide open or narrow as you want – I usually restrict research questions to the field of my class. A key aspect to this assignment is your support as a teacher and an emphasis on revising and improving – essentially modeling the real life process of doing research and trying to get published. Stressing the aspect of progress towards the best possible research and flexibility with due dates and revisions helps to alleviate stress for the students who enjoy just being told exactly what to do.
- b. **Key Concepts:** Any and all!
- c. **Possible Extensions:**
 - i. Have a scientific conference where students present their research, create a classroom peer-reviewed journal that students can “publish” in.