Leadership Professional Development Proposal

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SCED 545: STEM Leadership Seminar

Fall 2021

- **Title:** Spectroscopy: An En*light*ening Tool for Exploring Topics in Physical Science
- **Why did you select the topic?**

The chemistry teachers at my school, including myself, incorporate a discussion of electromagnetic radiation in a unit on atomic structure and electrons. An understanding of the properties of light is needed in order to explain the behavior, location, and movement of electrons in the atom. We utilize gas discharge tubes and prismatic glasses to view the atomic emission spectra of various elements to explain how electrons absorb energy and emit light. It is a topic that students get excited about but one that we do not delve deeper into as electron arrangement is really the main focus of the unit.

Given student interest in the topic, this is a missed opportunity for students to explore real world applications of spectroscopy and light. I have been interested in finding additional activities or lessons that would allow students to follow their curiosity a bit further without deviating too far from our chemistry focus.

After some thought, I realized that a discussion of spectroscopy and electromagnetic radiation has applications in not just chemistry, but physics, astronomy, and earth science classes. Many of the teachers of other science courses that we offer at our school could find value in exploring light in different applicable contexts given the knowledge and tools to do so.

- **How does your PD integrate NASA assets and/or content from the Endeavor courses?**

  My PD utilizes NASA's Jet Propulsion Laboratory's activity "*Using Light to Study Planets."* This activity provides some background information and directions on how to make a spectrometer from simple, inexpensive materials. The spectrometer is fully functional and can be used to study light in a variety of content areas.

- **Who is your proposed audience? Which teachers will you serve with your PD and activities? What grades, subjects, and how many students do they teach?**

  The proposed audience for my PD is other science teachers in my building. This could include up to 12 different teachers that teach one or more of the following subjects in grades 9-12: chemistry, physics, astronomy, geology, and Earth/environmental science. The diverse range of teachers that could benefit from this PD teach approximately 1000 students each year at our school.

- **What STEM concepts or learning goals will you and your materials address which can potentially replace other classroom activities?**

  Colorado Academic Standards (CAS) 2020: Science

  <u>1. Physical Science</u>

  - **1.7.** Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.
  - **1.10:** Waves have characteristic properties and behaviors.
  - **1.11:** Both an electromagnetic wave model and a photon model explain features of electromagnetic radiation broadly and describe common applications of electromagnetic radiation.
  - **1.12:** Multiple technologies that are part of everyday experiences are based on waves and their interactions with matter.

3. Earth and Space Science

- **3.1:** All stars, including the sun, undergo stellar evolution, and the study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth.

Colorado Academic Standards (CAS) 2020: Mathematics

Standard 1: Number Sense, Properties and Operations

- **1.2:** Quantitative reasoning is used to make sense of quantities and their relationships in problem situations

Standard 3: Data Analysis, Statistics and Probability

- **3.1:** Visual displays and summary statistics condense the information in data sets into usable knowledge

- **How long will the session be? How will you recruit your audience? Where will you advertise your PD session?**
  - **Time:** 1.5 hours
  - **Recruitment and Advertising:** Most teachers at my school participate in PD on professional development/teacher workdays that are scheduled throughout the year. Some sessions are mandatory, but my PD would be considered optional. To make sure teachers are aware of my offering, I would contact our PD coordinator to get my class and an accurate (and exciting!) description of it listed for that day. I think the most effective way to recruit and advertise my PD would be to talk directly to the science teachers whom I see frequently. A department e-mail advertising the offering would also be helpful to reach those teachers that I see less often.

- **To demonstrate that teachers have learned something new, you will generate a pre- and post-survey. What, in general, will your pre-survey and post-survey ask?**
  - **Pre-Survey:**

    I will ask questions regarding general familiarity and knowledge of spectroscopy to get an idea of prior knowledge. How comfortable are you with teaching the topic currently? I would also inquire as to whether they already teach topics in light and spectroscopy and what they are. I might also ask how likely they think they might be to incorporate the topic and/or use of spectrophotometers in their classrooms.

  - **Post-Survey:**

    I will ask them to rate their knowledge of the topic after the session. Rate their comfort level teaching the topic. What units can you envision incorporating spectroscopy? How likely are you to try this in your classroom? What downfalls/problems would you anticipate if you were to try this with students?
- **What outcomes or expectations do you hope to see for your educators?**
  - An increase in comfort level with using a spectrophotometer
  - Generation of new ideas for incorporating light and spectroscopy into their content areas
  - Willingness to explore design/engineering activities in the classroom
- **How will you follow up with the teachers in attendance?**

  A post-PD email and/or face-to-face conversation inquiring about how I can help them implement and use the information presented or how they might be considering using it in the future.
- **What data collection methods will you use to analyze the PD's success?**
  - Survey: Google Form
  - Interviews: Informal interview/conversation

References

Jet Propulsion Lab (n.d.). *Using Light to Study Planets*. NASA Jet Propulsion Lab - California Institute of Technology. https://www.jpl.nasa.gov/edu/teach/activity/using-light-to-study-planets/