5 E Lesson Plan in the Online Learning Environment

Marissa Solomon

Fall 2018 Leadership Seminar

Curriculum Topics: High School Science

School Name: California Connections Academy, Number of Educators: Grade Levels: 9-12

NGSS standards:

HS-LS2-1.Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales

HS-LS2-2.Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-6.Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS4-5.Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other

HS-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

HS-ESS1-1. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy that eventually reaches Earth in the form of radiation

HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate.

Summary of Project:

I work for an online school where almost everything is done online. Both teachers and students work from home. Our only means of interacting with each other is online, students and teachers rarely see each other in person. Our curriculum and

lessons are already written out and put together for us. However, we do have an online lesson room, a virtual classroom, where we can be creative and more authentic in our approach to working with our students. We are also not a STEM school, we rarely do cross-curricular activities and lessons. I decided to do a PD on using 5E lesson plans in the online classroom and utilizing links from NASA (specifically MARS) and NOAA to discuss using the 5E lesson plan. Since we have control over how we conduct our live lessons I thought it would be a great place for teachers to implement 5E lesson plans with lessons that are already created for us. From personal experience I have witnessed students get excited about live lesson and seem to be more engaged when I implement a 5E lesson plan or at least parts of one.

In this PD I will break the teachers into two groups, one will use climate change data from NOAA and the other group will use data from the MARS MAVEN mission to discuss and put together a brief 5E lesson plan.

Pre-question survey:

What tools/techniques do you use to engage your students?

Have you ever used a 5E lesson plan? If so, do you currently use 5E lesson plans?

Have you ever used authentic data in your lessons?

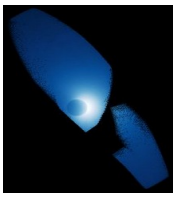
Description of the PD:

Overall the professional development went well. I started the PD off showing a video of the skittles diffusion color experiment to engage all in attendance. I then had a brief discussion for everyone to share some of the things they do to engage their students. I used this to introduce the first E, engagement, in a 5E lesson plan. We discussed what a 5E lesson plan is, what each E stands for, examples of each E and who has used it in their teaching experience. I then broke the teachers up into 2 breakout rooms (small group work). One breakout room had a link to the NOAA website, specifically looking at climate change data across the nation. They were instructed to think how using data from different states can be used in a 5E lesson plan and what concepts/standards it covers in science. The other group was given links to MARS NASA website, specifically looking at data from the MAVEN mission. The images/data presented provide evidence of life in MARS early atmosphere, this provided ideas for putting a 5E lesson plan together. I gave them 20 minutes in their breakout room to come up with a brief 5E lesson (come up with ideas for the 5Es) plan. I went between the breakout rooms to observe what each group was discussing and coming up with. After 20 minutes we met as a whole group and each group shared their lesson plans. At the end of the PD I put up poll pods for teachers to put how a 5E lesson plan can benefit students and what part of a 5E plan can they implement in their next live lesson.

NASA Data included in the PD:

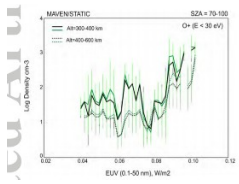
I used Mars NASA data, specifically from the MARS MAVEN mission:
https://www.nasa.gov/mission_pages/maven/main/index.html

http://lasp.colorado.edu/home/maven/about/



(Image: Zubritsky 2016)

This image is from the Imaging Ultraviolet Spectrograph on the MAVEN spacecraft. It shows sunlight scattering from atomic hydrogen in Mars upper atmosphere. This provides evidence of hydrogen from water.



(image: Brain, D., 2017)
Compares density of oxygen ions at different latitudes

Mean-**black** Median-**green**

Climate change data was used from NOAA:

https://www.ncdc.noaa.gov/cag/statewide/time-series

*selection of state(s) for climate change data was up to group

Follow up activities and post question survey:

At the end of the PD I asked the teachers to implement a 5E lesson plan, or at least parts of it into an upcoming live lesson, using authentic data from a NASA site (in addition to NOAA and Mars I shared some other links and resources they can use). Here are the post survey questions I asked the teachers in attendance:

Was the PD helpful?

Do you think incorporating authentic data from resources like NASA and NOAA will benefit your students and make teaching concepts more effective?

Will you use the 5E lesson plan and/or authentic data in your live lessons?

What else would you have liked to have learned about or spent more time on?

What did you think about the facilitation/delivery of the PD session? What changes would you make, if any?

Outcomes:

Overall all of the teachers that attended really enjoyed the PD. At our school we rarely have a chance to get together and do activities that are course specific in the science department. About 75% of the teachers in attendance had heard of a 5E lesson plan, but 100% have not used a 5E lesson plan at our school since all of the lessons and curriculum are written for us. All of the teachers found the PD to be helpful especially when we collaborated on how we would implement a 5E lesson plan into current lessons and curriculum. Three out of the twelve teachers that attended said they would use a 5E lesson plan in at least one upcoming live lesson. All teachers said they would at least incorporate parts of the 5E lesson plan into their live lesson and most said in some way they already incorporate parts of a 5E lesson plan into their live lessons. Some of the teachers in attendance said they would have like to spend more time on looking at 5E lessons in various science subjects and they also felt twenty minutes was not enough time to come up with a 5E lesson even if it was brief and/or only ideas for the different parts. Everyone said they thought I did a great job delivering the PD and were thankful to me for hosting it. They really liked spending time in breakout rooms and the idea of utilizing authentic data from NASA into their lessons, however some said that that could be a

challenge as it would be in addition to what is already written in the lessons. Almost all of them thought using authentic data was an excellent way to engage and give students a more “hands-on”/real world learning experience. Several of the teachers said that 1 hour was not enough time to go over using a 5 E lesson plan and that it should have been 2 sessions. Yes the PD was successful. The part about it that the teachers liked the most was that they were able to be a part of a PD that was specific to science and were able to share ideas. Reflecting on this experience and all of the readings for the discussions it really opened my eyes to how effective and non-effective professional developments can be. The article *Experienced secondary science teachers perceptions of effective professional development while pursuing national board certification,* really justified the thought that teachers will be more present, involved and engaged when they can collaborate, it affects them directly in their personal and professional growth and it is specific to their needs and wants. (Lustick, D.S.) The article *A Primer of Effective Professional Development,* was also a great reading to use as guidance when coming up with my PD as it discussed core factors that make up a good PD. (Desimone, L.M.) I really took the core values discussed in the article to heart to make my PD engaging and worthwhile for the teachers that attended. I really did experience a genuine enthusiasm from the teachers that attended my PD because it was specific to our science department and went over something that teachers could, almost immediately start using with their students. The part about designing and conducting this PD that was the most challenging for me was the limitations at my school and an online learning environment. All of our curriculum and lessons are already put together for us and put into student grade books, therefor we are limited on how much we can modify. That is why I chose the follow up activity to be done in a live lesson room (virtual classroom) because that is where we get the most freedom to be creative with our lessons.

Appendix:

PD activity:

*The activity we did during the PD was in breakout rooms hence why it is called “Breakout room activity

Breakout room activity:

- Break up into two groups of 6 (Group M and Group N)
- Spend 20 minutes coming up with a 5E lesson plan or ideas for the 5Es:

  Engage, Explore, Explain, Elaborate and Evaluate
- Use the following template to guide you (for the sake of time focus on just the 5Es and not the other parts such as standards, learning objectives, prior knowledge, etc..) 5E Sample Lesson Template NGSS
  *you will outline your lesson plan/ideas in the notes pod provided for you in the breakout room. Make sure to title each part (“Engage”, “Explore”,...) and give an idea for an activity and possible questions you can ask for each part
- **Group M** will look at Mars MAVEN data project for 5E Lesson Plan. Lesson plan should be about Mars early atmosphere providing a hospitable environment for life on Mars:
  - Mars MAVEN data project

- **Group N** will look at statewide climate change data on NOAA (you may choose to focus on one state or more than one state:
    - https://www.ncdc.noaa.gov/cag/statewide/time-series
    - Please look at the following lesson for ideas:
    - Climate change and standard deviation
      *note you do not need to come up with ideas for standard deviation, the above lesson is to just give you ideas on what you can do:)
- Pick one team member to represent your group and give a brief explanation of the 5E plan or ideas for the 5E plan that your group came up with

Pick-me-up/Follow up activity:

- Create/design and implement a 5E lesson plan or parts of the plan in an upcoming live lesson
- Consider using one of the following resources in your plan:
  https://www.nasa.gov/
  https://www.noaa.gov/climate
  Free Earth Science Bulletin Board for Educators
  Environmental Topics
  The Science of Speed
  Black Hole Math
  Mars Activities
  Is there water on Mars?
  Mars for Earthlings
- After the live lesson please answer the following questions:
    - Did you utilize any of the links provided? If so how?
    - What, if any, challenges/struggles did you have creating and implementing the plan?
    - Where students receptive to the lesson?
    - Where students engaged? How did you measure student engagement?
    - How would you compare student engagement in this lesson to other non 5E lessons?
    - Was the lesson a success? Would you do it again?

Four teachers in attendance:

Rebecca Fagundes: rfagundes@calca.connectionsacademy.org

Paromita De: pde@calca.connectionsacademy.org

Jessica DiMizio: jdimizio@calca.connectionsacademy.org

Matt Wilkes: mwilkes@calca.connectionsacademy.org

References:

Lustick, D.S. (2011). Experienced Secondary Science Teachers' Perceptions of Effective Professional Development while Pursuing National Board Certification.

Desimone, L. M. (2011). A Primer on Effective Professional Development. Phi Delta Kappan, 92(6), 68.

Zubritsky, E. (2016, October 19). *MAVEN Observes Ups and Downs of Water Escape from Mars.* Retrieved from http://lasp.colorado.edu/home/maven/2016/10/19/maven-observes-ups-and-downs-of-water-escape-from-mars/

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