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Engage & Explore: Empowering Students in the Biology Classroom

5E lesson planning has been around for many years, but effective implementation can be difficult. I chose to focus on the "Engage" and "Explore" aspects for two different reasons. The "Engage" phase is based phenomena. Many teachers are aware of phenomena, but the "Engage" portion of my PD allowed me to expose teachers to some novel ideas for phenomena and allowed the participants to have fun and interact with each other. I also wanted to work with teachers on the "Explore" aspect of 5E planning. It's somewhat easy to find phenomena, but it can be very difficult to get students to explore the related concepts before we give it away by *providing* the explanation! It's definitely the "E" that often gets skipped over. I wanted to provide some examples, tips, and practice for teachers to better approach this aspect of 5E planning.

Nine participants showed up to my workshop. Five teachers were current classroom biology teachers, and three teachers were pre-service undergrads- one physics, one earth science, and one biology major. The workshop was intended specifically for biology teachers. I was initially struggling to find participants, so I reached out to my college advisor. I did specify to invite any pre-service biology teachers, but I ended up with the two others as well. One participant runs professional development programs for STEM teachers at Cornell University.

My workshop was divided into two parts: Part 1- "Engage" and Part 2- "Explore." Each part followed the same basic format. First, a 10-minute mini lesson in which I provided an explanation of the facet (Engage / Explore) and I used a specific example from my own classroom to illustrate best practices. Then, teachers were sent into breakout rooms to collaborate and complete tasks for ~10 minutes. Teachers were provided with a record sheet for group note taking and a task sheet. The task sheet included various phenomena for the participants to choose from.

In Part 1 (Engage), the first task was to "Act Like Students" and engage with a phenomenon- write observations, make inferences and ask questions. In Part 1, the second task was to "Act Like Teachers" and to brainstorm biological concepts related to the phenomena that could potentially be used to anchor lessons. In Part 2 (Explore), the task was to continue with the phenomena that was initially investigated, and to brainstorm potential ways to get students to explore the concepts of the phenomena (authentic data, parallel examples, images, diagrams, brief texts, etc.). After the breakout rooms, we did group share out.

This workshop was greatly inspired by the final projects that I've completed in the Endeavor course, which really introduced me to 5E planning. I was particularly inspired by the Methods of STEM course, where I developed the ability to cognitively think about the "Explore" aspect of 5E lesson planning. In the phenomena that I presented to the teachers, I used a NASA resource that was presented to me in the Methods of STEM course. The data is a record of carbon dioxide levels over the course of the year. What is interesting is that CO_2 levels significantly decrease during the summer, which lends itself so well to exploring photosynthesis. I muted the audio from the original clip (which actually explains the trend and reasoning) https://youtu.be/k4Z3aXbZPzQ I provided the participants with the original clip as well.

Overall, I think the workshop went very well. It could have been improved if I were able to find more participants. I provided a Google Form to collect feedback at the end. Out of the 9 participants, 8 said that the *clarify of the presentation* was "exceptional," 7 participants said that *breakout room timing* was "sufficient," 8 people described the *phenomena* as "engaging," 6 people said that they "definitely" are going to *use the information/example in their own classroom*, and 4 people said that the workshop "greatly changed their way of thinking." The other "votes" were for more neutral choices- I received no negative feedback. Something fantastic that came from the

workshop was an opportunity to present again. Looking for participants, I blasted an email to a professional network that I am part of. The outreach coordinator from Cornell Institute for Biology Teacher (CIBT) (a decommissioned program) caught the email and reached out to me. When the CIBT program was running, I used to attend and present at workshops each year. There is now a new program in place of CIBT (I don't know exactly what it is), and the director asked if I would be willing to do this presentation again this summer for the program at Cornell. Of course I said yes, and I am looking forward to finding out more information about that opportunity!

Participants (I did not know any of the participants personally, except for Florianna):

Florianna Blanton- I don't actually know what her official title is at this time. fgb29@cornell.edu

Shoshana Berkovic-Biology Teacher- sberkovic2@schools.nyc.gov