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STEM Leadership Seminar

**More time for Science and Engineering Practices**  
Professional Development Proposal

The concept of 3 dimensional instruction integrated into the Next Generation Science Standards has intrigued me because it brings focus on skills as a method of providing students access to the content. Personally this is a very appealing instructional concept, and being a hands-on person who prefers to learn by doing I understand how this method works particularly well for many students. This method also develops valuable skills which are necessary for students growing up in an information age. For the past few years my colleagues and I have been aligning our curriculum with NGSS but I don't think enough attention has been given to the SEPs or truly being 3 dimensional in our instruction, we still latch onto content to drive instruction and skills are secondary. The restrictions in place due to covid-19 has forced us to adopt new technology tools at a far faster rate than we have in the past, we are also being forced to think more deeply about the content we deliver and what is most important for students. The tools we use are in many cases being used as replacements for in person instructional practices we did in the past, but some are truly enhancing our instruction and we need to look carefully at the technology we are using and evaluate it for the benefit it provides our students now and how it might be adapted for future instruction.

Considering the rapid adoption of technology, the recent and developing delivery of NGSS curriculum, and the opportunity to reflect on our practices provided by the current restriction; I am hoping that we can find time in our instruction, by thinking carefully about developing lessons, that focus more on the SEPs attached to our performance expectation. The effort will focus as much as possible on collaborative and hopefully hands-on experiences that can also tie in the engineering design process, the scientific method and hopefully also frame our instruction with the 5E method.

Several of my courses during the STEM leadership masters program asked for curriculum development and lesson planning using the 5E method. We also focused on the 3 dimensional learning concept. I took courses which aligned most closely with my curriculum of physical sciences and also recognize that there are SEPs in all of the standards including the Earth and life science standards. The E in stem course was geared towards students using the engineering design process and in particular making engineering notebooks. The physical science course and the coding, robotics and 1 to 1 device course both looked carefully at the use of technology, and simulations as they can be used to enhance instruction and not simply replace other methods.

I plan to deliver my professional development session to the entire HS science staff at my school which encompasses all science disciplines in grades 9-12. I have been collaborating with the district science curriculum coordinator to think about when PD could be offered and to which teachers. I want to make sure that the plan is timely and appropriate for the audience and meets the goals of curriculum development in our district. I could deliver this PD to any grade level teacher and could consider bringing in other departments and disciplines like the technology education department or math department at my school. Most teachers in my district have 5 courses with 20-25 students per class. Because this will be across a wide range of content areas I am focusing on SEPs and not specific content.

In the 3 dimensional model of instruction the Science and Engineering Practices (SEPs) are integrated across the performance expectations defined by NGSS and I will not be limiting teacher exploration during my lesson. However, I would like to draw participants' attention to the SEPs asking questions and defining problems, mathematical and computational thinking and designing solutions. Particularly, I want to make teachers aware of the breakdown of progression in the development of these skills pointed out in appendix f of NGSS. I plan to start with asking questions and defining problems as we have focused on this in the past and then suggest we move on from this SEP for this particular PD and help focus our attention on other skills.

Common Core State standards which are associated with this Professional development are as follows.

- CCSS.ELA-LITERACY.RST.9-10.7  
Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- CCSS.ELA-LITERACY.RST.11-12.7  
Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- CCSS.ELA-LITERACY.RST.11-12.9  
Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

The current plan for this PD session will be after school during one of my department meeting times. It will be an hour long and hopefully will start conversations in the department that last longer than that. Because of the timing I will not need to advertise or recruit. If I were to be recruiting I would be sharing it through social media to organizations where the PD will be of interest, if necessary it would also be included in options during the district planned PD.

To assess effectiveness of my PD session I plan to use pre and post survey questions as well as conversations with individuals in the following week. The pre and post survey will consist of a series of very similar questions with likert scales asking teachers to rank their understanding, experience, integration and level of development of SEPs in their instructional practices. A couple of additional questions will be added to this Post survey in an effort to solicit further reflection and information about the effectiveness of the session. Because a survey is an incomplete tool for gathering information about PD effectiveness I will also make a concerted effort to have casual conversations with my colleagues to gather further information. I want to keep these interactions casual because I know the past year has already pushed teachers to a significant level of frustration. I don't want my PD to feel like one more thing on their plate. Overall, I am hoping to hear the session helped teachers develop more ideas and reflection on how we can more completely integrate the SEPs across the curriculum at the appropriate level of complexity and sophistication described in the NGSS.

References:

- Cheung, R., Reinhardt, T., Stone, E., Little, J.. (2018). Defining teacher leadership: A framework. Phi Delta Kappan. November.
- Darling-Hammond, L., Hyster, M. E., Gardiner, M., & Espinoza, D. (2017). Effective Teacher Professional Development. Learning Policy Institute.
- Desimone, L. M. (2011). A Primer on Effective Professional Development. Phi Delta Kappan, 92(6), 68.
- NGSS Lead States. (2013). Next Generation Science Standards: For States, By States (insert specific section title(s) being used if not referring to entirety of the NGSS). Retrieved from <https://www.nextgenscience.org/>
- National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core State Standards*. Washington, DC: Authors.

I want to start my PD looking at

Proposal Submission. Submit a 2-page project proposal plan which includes the following:

Option 1 & 2 :

- ~~What is the title of your STEM professional development?~~
  - ~~Why did you select the topic?~~
  - ~~How does your PD integrate NASA assets and/or content from the Endeavor courses?~~
  - ~~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?~~
  - ~~What STEM concepts or learning goals will you and your materials address which can potentially replace other classroom activities? List NGSS and CCSS or your state standards.~~
  - ~~How long will the session be? How will you recruit your audience? Where will you advertise your PD session?~~
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- To demonstrate that teachers have learned something new, you will generate a pre- and

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post-survey. What, in general, will your pre-survey and post-survey ask?

- What outcomes or expectation do you hope to see for your educators?
- How will you follow up with the teachers in attendance?
- What data collection methods (e.g. surveys, interviews) will you use to analyze the PD's success?