Dustin Lengning

STEM Leadership Seminar

9/10/2018

I.

The title of my STEM professional development is going to be, “Come Fly With Me: A Day of Flight.” When I put this out as the title of my Professional Development, I got some weird email responses back, however most were excited about the details within the email.

II.

- Curriculum Topics:
    - Forces and Interactions (NGSS)
    - Engineering Process (NGSS)
    - Reading & Writing Standards (CCSS)
- School Name: Santa Clarita Valley International Charter School
- Number of Educators: (50 educators total)
    - Pre-K-5th (15 educators)
    - 6th-8th (12 educators)
    - 9-12 (15 educators)
    - Support Staff (aids, resource, Sped.Ed, Admin, etc…) 8 people

III. Standards Addressed

- (see appendix I)

IV. What did I set out to do:

I thought this would be a great topic because I feel like everyone, no matter their age or ability, is intrigued by the idea of flight. As children, we look up at the sky and point at birds and planes in wonder, taking for granted their ability to fly. Many of us have fantasies of flying. Tapping into our curiosity about flight, this PD will hopefully take all learners, K-12 into the forces behind flight, answering the age old question, “how do things fly?” Aerodynamics introduces learners to the forces described by Newton and Bernoulli to make sense of how our physical universe works. This topic is of major interest to me and I hope that this will inspire some of our learners (or adults) to be bitten by the aeronautics bug. My goal is for the entire school to participate in a “Day of Flight.” My second goal in designing this PD was to bring the school together. And of course, competition helps with that (read the PD training portion for additional info).

V. Pre-Survey Questions

Next week, we will be having our “Come Fly With Me!” PD regarding a school-wide flight day for the entire school. Each grade level will be coming up with designs, building a paper airplane design, and spending the day discovering the world of flight.

- From 1-5, what is your interest level with flight?
- From 1-5, do you think your learners are interested in flight?
- From 1-5, What is your comfort level in teaching concepts of flight?

(1-not with a 10-foot pole, 2-hesitant, 3-comfortable, 4-savvy, 5 master)

- Can you easily think of ways to integrate flight history, art, ELA to this science-based day? (Y/N)
- Have you taught anything to do with flight? (y/n) (sci, history, art, etc..)
- Do you teach aerodynamics in any capacity? (y/n)
- From 1-5, what do you think is the initial buy-in for building airplanes from your students?
- What content area is your expertise? Even if you are multiple subject, what is your bread and butter? (Think about possible connections to flight that you can present to the group regarding flight for next week).

VI: The PD: 2.5 hours on a Friday (12:30 pm working lunch-3:00pm)

First Hour: I started the Professional Development by discussing my love and interest of flight and how we live in the best area in the world for flight. “How many of you saw an airplane in the sky in the last week?” Most raised their hands. I asked them to sit at their table groups and discuss, in their best attempt, how airplanes work. We then shared out loud our thoughts, and I posed the question: “How do you think our students would answer that question?” After some share outs, we had some giggles and realized that everyone has some base knowledge and a place to start. I then put up countless pictures that show, at each of the educational levels (k-3, 4-5, 6-12) how the four forces of flight dictate a plane’s actions, Newton’s Laws, and even the basics of fluid dynamics. I put up the Glenn Research Center Website (https://www.grc.nasa.gov/www/k-12/airplane) and showed some amazing resources on there for learners of all ages. It has a section called, “Beginner’s Guide to

Aerodynamics," which contains interactive simulators, activities, and a great index that takes you to lesson plans, activities, games, or specific scientific fundamentals of flight. I opened many of them up, showed them what they need and made my resources available for whatever they may need. What I like about these most is that educators and scientists came together to create not only work suitable for learners, but also suitable to beginning educators to teach from. Our high school staff doesn't have to worry about gearing it up, these lessons go all the way up beyond calculus and trigonometry. Our lower school staff will also not feel intimidated as many of the activities are broken down into scavenger hunts, timeline activities, and games to familiarize the learners with aero. By the end of this hour we made sure to discuss the forces of flight, parts of an airplane, how lift happens (wing design, etc…)

Second Hour: Teams are broken into grade-levels after a short break and I disperse out the NGSS standards for each grade level, as well as the CCSS grade chunks and task each group with our competition. I give each group a piece of foam board, X-acto knife, hot glue gun, and some ballast. I task them with creating a flying object knowing what they know now from our PD time. I tell them I will assess them in three areas and the winning wing will be proudly displayed in the front lobby of the school. While they are working, I am walking around prompting conversation about the four forces of flight, Newton's Laws, and wing design. I cut them off at 30-minutes so we can fly and debrief. I then had each group fly and we lightly assessed on accuracy, flight time, distance, and overall design aesthetic.

Last 30-minute block: In this block, I had each group talk amongst themselves and share out about how we can bring this to each grade level, make the content accessible, and come together as a school. Each grade level was tasked with the goal for finding as many ties as they could for the day while hitting their academic goals for the week.

VII. (these are some activities the kids are doing, some of the adult stuff is up top)

- Kinder-5th Grade learners (my notes I took during PD):
    - Decided on a similar plan of creating a timeline with pictures after reading *To Fly: The Story of the Wright Brothers* to get the kids excited.
    - Learners were going to work in whole-group with each teacher and do a directed draw of an airplane (attached the actual lesson). This will help build important context, vocabulary, and spark interest in the upcoming activity. They then color them, label them, and post them on a "runway" on the wall.
    - After, learners are led whole-group to design paper airplanes. As the teacher at the front folds and shows the group, aids/volunteers are around to help make sure learners are ready for the next step.
    - Learners then work together whole group to "trim" their airplanes. Great conversations start to help planes that are turning left, turning right, falling too early and peers work together for a shared understanding. This is a great time to talk about push/pull and unbalanced forces.
    - K-5 will compete against one another at the event (flying competition).

- 6th-12th (some notes I took as they talked and shared out):
    - In Advisory (like homeroom) Each group decided on a variety of neat youtube videos to spark the interest (instead of the read alouds). They also create their Aero name (using aero alphabet)
    - *In Science:* The teachers wanted to also go over four forces of flight and many of the infographics at the GRC NASA website at first then jump into a lab.
    - Our High School Science educators loved the Foil Sim activities that I showed them on GRC and plan to do this as a lab for the day of https://www.grc.nasa.gov/www/k-12/problems/foilindex.html
    - *In History*: MS and HS classes are going to create a school-wide timeline of the most important events in aviation history and talk about the importance of aero history.
    - *In ELA:* Teachers are back and forth, but have mostly settled on some interesting persuasive topics (to fund NASA or not, most important event and why, etc…)
    - *In Math*: Learners will run a multitude of activities like: Mapping the distance between two points, plotting and graphing altitude and speed, mapping a cross country flight with variables (weight, fuel, ratio change as it is in flight)
    - *Art class:* Perspective Drawing where they are looking at a landscape from a plane above (super awesome!)

Our overall consensus was that we would have a K-5 and a 6-12 competition. K-5 through paper airplanes and 6-12 with foam board wing creations. We decided that we can hit the same engineering goals and scientific principles with the differentiation for the age groups.

• **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.**

With talking about flight, each grade level in regards to NGSS will have specific areas to pick from as this is going to be more of a physical science-based PD. Motion and Stability: Forces and Interactions are crucial here. The DCI's are all in place for each grade level with looking at Forces and Motion. The neat part is that we can have grade dive deep into the Crosscutting concepts for each grade level, as well as the Science and Engineering Practices. During my professional development, I will print out each of the NGSS relevant sections for each grade level and have those ready for them before they sit down. I will have not only have the NGSS standards ready for all of the Science staff, but also the Common Core Standards Connections ready for all of the staff as well. This will help the English, Math, and History educators help find ways to support what we are doing for our Aeronautics Day.

VIII. NASA data & resources

This was one of the hardest parts for me to incorporate because I couldn't really use much data from NASA. However, I used quite a few NASA resources. Through the physics for beginners course at Endeavor, I created a multitude of labs for middle school learners and I hope to be able to scale this down for our younger learners as well before our flight day. The Glenn Research Center Website (https://www.grc.nasa.gov/www/k-12/airplane) has some amazing resources on here for learners of all ages. It has a section called, "Beginner's Guide to Aerodynamics," which contains interactive simulators, activities, and a great index that takes you to lesson plans, activities, games, or specific scientific fundamentals of flight. What I like about these most is that educators and scientists came together to create not only work suitable for learners, but also suitable to beginning educators to teach from. Our high school staff doesn't have to worry about gearing it up, these lessons go all the way up beyond calculus and trigonometry. Our lower school staff will also not feel intimidated as many of the activities are broken down into scavenger hunts, timeline activities, and games to familiarize the learners with aero.

IX: Follow-up Activities & Post-Questions Survey List

- **Post-Survey**
    - Did you walk away with a solid plan for our Aeronautics day? (Yes/No)
    - From 1-5, Do you feel more comfortable with flight and the principles of flight?
    - Do you think your learners will be excited with the activity? (yes/no)
    - Did you have fun today? (Yes/no)

- From 1-5, how useful was today's PD for you? Did you walk away with something useful in regards to content for your grade level?
- Would you like to continue using the NASA resources to build interest in flight with your learners? (yes/no)
- Which principle do you feel I did not cover well enough for you to explain to a class? (list: Bernoulli's principle, Newton's Laws, Axis of Flight, Forces of Flight, Engineering)
- Would you like additional trainings on how to inspire learners with NASA resources? (yes/no)

X. Outcomes Final Data Collection and Analysis

A. S*urvey results/Content* (how does the PD help teachers understand the content)

a. When I asked the question: "from 1-5, do you feel more comfortable with flight and the principles of flight?" over 70% stated that they are at a 4 or greater.

b. When I asked: Which principle do you feel was not explained well by myself during the PD? (I listed principles of flight) Over 80% stated Bernoulli's Principle. I think it was mainly because they forgot the name, but understand the ideas.

B. S*urvey results/Pedagogy (how are STEM activities implemented)*

a. Over 88% of those polled showed a that they had fun, enjoyed the activities, and took something away useful for their learners. I couldn't believe it, but 96% said they would take additional training if it were

offered. This tells me that the pedagogy is present to where they feel effective in bringing it back.

C. W*as it a successful PD?*

a. For me, the PD was successful. Although it was a bit ambitious to think I could complete everything I wanted to complete in the course of time, I saw excitement in my staff and everyone having energy for the first time in a long time. I think this was something we needed; we have been in a rut of data, testing, and reauthorization for a long time and forgot the bigger picture. Why do we do what we do? Looking at the data, unless they were just being nice, the overwhelming majority found use and purpose in what we did. This made me feel good! I had a lot of great feedback about taking tough concepts and making them accessible, especially to the younger grades. Many of our staff also didn't know that NASA has such quality educational resources out there (completed lesson plans, labs, etc…).

D. <u>Relating to the Readings</u>

a. **<u>Example 1</u>**:Lustick's paper: *Most Effective PD experiences.* I found this to be pertinent because Lustick discussed throughout the paper the engaging points of any PD. One of them I tried to stick to as I was planning my PD was to allow my staff to individualize their learning under the umbrella of flight. Some of the best discussions came from our Art teachers and even our support staff on great ways they can use this in the classroom to support the bigger picture of our event. They got to look at it

through THEIR LENS and allow others to see through it. I would have never imagined having an art component, or a history component; I'm a science teacher! Each teacher has their own specialty and this gave them the outlet to lead a directed draw because this is something they have background in (and show others how). I liked how also the staff felt excited about the PD and are going to bring that excitement to the kids. This wasn't a monotonous PD dealing with behavior management or data protocols with zero direct connection to kids.

b. **Example 2**: Jenkins (2010): *Special Education PD* I felt led us on a great path of discussion on how we accommodate, modify and reach all of our kids. What was great about this PD is that I invited all of our staff, this includes the special education team in order to have their take on how to support learners in our inclusive environment. They are the ones as we were sharing out that helped keep things in mind for those kids that need minor, as well as major modifications to curriculum. They were not working with their own teams, I had them integrated throughout the grade levels.

E. Will the teachers do these activities again:

a. Good question. I am not sure if the entire staff will want to complete these again, however, many commented on the ease of the resources and how much fun these activities appear to be. It is always our hope that PDs continue to be relevant; just like the stuff we do with the learners will hopefully stick with them forever. I made all the resources available by

email and I want the staff to contribute to a shared Google Folder to house all of the info for later use by all.

F. **Reflection**:

a. Well, I am not sure where to start. I hope that the day goes well for the event itself; I am anxious about the Fly Day. The PD itself I felt was very ambitious, probably too much for a session. I always try to shoot high and end lower if need be. I think that the staff had a great understanding of what I was doing and wanted it to work, therefore it helped my results a tad. I also think that getting them moving around was also a great idea as they didn't simply receive a "sit and get." If I were to do this again, I would probably run a series of PDs that would span the course of a few weeks. I wish I had that time (although my time was more than most I am sure). I know as well that although I used a lot of NASA resources, I did not exactly use data from NASA as I should have. I had this end goal in mind and I put blinders on. I started to think about some of the NASA data from SOFIA (UV-spectrum, Astronomy, Star classifications, etc…) and I could have squeezed that in as I was thinking after the fact.

XI Appendix: Classroom Activities

- https://www.grc.nasa.gov/www/k-12/aeroact.htm
    - In this link, I showed countless activities with full lesson plans (student and teacher pages) that gave them the resources they needed to work with aeronautics.

- I also shared with them countless labs I created and fun activities that helped with the more complex ideas in aeronautics. Bernoulli's Principle is super fun! I even shared this fun one with our IB Physics teacher that wanted something challenging. NASA Physics: Newton's Laws
- Directed Draw is attached
- Flow Lab is attached

XII: Include the names and contact information of four educators

keith.faulkner@scvi-k12.org

casey.sansevieri@scvi-k12.org

Michelle.guire@scvi-k12.org

victor.carone@scvi-k12.org

Appendix 1: I showed the group some of the standards that I typically hit and allowed them to find standards that would work for their grade level. I then opened up each topic area in the NGSS and CCSS to show them quickly how and where to find those strands for Kinder-High School standards (it seemed like overkill, but had a few light bulbs go off, oddly enough).

MS-PS2-1-- Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects
MS-PS2-2-- Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
MS-PS3-1-- Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
MS-ETS1-3--Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

CCSS.ELA-LITERACY.WHST.6-8.4
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CCSS.ELA-LITERACY.WHST.6-8.8
Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
CCSS.ELA-LITERACY.WHST.6-8.2.F
Provide a concluding statement or section that follows from and supports the information or explanation presented.
CCSS.ELA-LITERACY.WHST.6-8.2.E
Establish and maintain a formal style and objective tone.
CCSS.ELA-LITERACY.WHST.6-8.2.B
Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
CCSS.ELA-LITERACY.WHST.6-8.1.D
Establish and maintain a formal style.
CCSS.ELA-LITERACY.WHST.6-8.1.A
Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
CCSS.ELA-LITERACY.SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence.
Engineering ETS1- Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
Engineering ETS2- Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
Engineering ETS3-Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.