STEM 101 in the Online Learning Environment

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The curriculum topics for the PD will be pretty board that covers high school science, math & English at California Connections Academy (CalCA). CalCA is an online public charter school that serves students from kindergarten through 12th grade. There are about 5500-6000 students enrolled at CalCA, and at the high school lever, there are roughly 3500 students.

There were 12 educators who attended the PD. There were 5 science teachers, 4 math teachers and 3 English teachers, all of which teach high school subjects. For our math and science teachers, they can have a range of high school students depending on their level of math, and what science course(s) they have taken previously to be placed in a certain science course. Of the 5 science teachers, 2 teach biology, 1 teaches marine science, 1 teaches chemistry and 1 teaches physical science. Of the 4 math teachers, 2 teach geometry, 2 teach algebra. Of the 3 English teachers, 2 teaches 11th grade, and 1 teach 12th grade.

Here are some of the standards addressed in the PD:

- ❖ **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-PS1-2** Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
- ❖ **HS-PS1-7** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
- ❖ **HS-PS2-6** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials
- ❖ **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- ❖ **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.
- ❖ **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- ❖ **MP.2** Reason abstractly and quantitatively.
- ❖ **MP.4** Model with mathematics.
- ❖ **HSA-SSE.A.1** Interpret expressions that represent a quantity in terms of its context.

- ❖ **HAS-CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph expressions on coordinate aces with labels and scales.
- ❖ **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- ❖ **WHST.9-12.5** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
- ❖ **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

Summary of Project

I wanted to call it STEM 101 for the professional development because I am unsure how many teachers are familiar with what implementing STEM entails. I work for an online public charter school and our curriculum is already set for the students and the teachers. However, during our LiveLessons, that is when teachers are able to do activities and discussions with students to supplement what they are learning. Being in the STEM program, we have received resources such as websites that provide lesson plans for implementation, or websites that provide data, etc. I want to be able to share those resources with the teachers so they can try to implement some of these activities in their live sessions to enhance students' learning.

Pre-questions Survey List

- ❖ Do you have any knowledge of what STEM is?
- ❖ What activities do you use, if any, during your live lessons currently to engage students?
- ❖ Have you incorporated any other subjects into your live lesson teachings?
- ❖ Have you used any authentic data in your live lessons?

Brief Description of the Actual Professional Development Training

I invited 12 teachers total from the science department, English department and math department to join my STEM 101 Professional Development. Before the PD session, I sent out a Google form of my pre-PD questions survey list for my colleagues to fill out, which provided me a sense of how much knowledge they have of STEM. Their responses helped me prepare my PD session. At the start of PD, I spent about the first 10-15 minutes going over what STEM is, showed a

couple of resource pages of various websites that contain projects, activities, lesson plans for teachers to implement a STEM lesson. I then put 4 teachers into breakout rooms in Adobe Connect, to have a total of 3 breakout rooms. In each breakout room, I have a different STEM lesson plan URL link provided for the teachers to explore and discuss how they can incorporate the lesson, or part(s) of the lesson into their LiveLessons. I gave the teachers 15-20 minutes to explore and discuss the lesson plan. During the breakout, I popped into each group to see how the discussions went. After the breakout session, I asked one teacher from each breakout room to share what they discussed and how they can incorporate it into their live lesson; we spent about 5-8 minutes sharing out. The last portion of PD, I shared an applied math project with my colleagues that I have done previously. The lesson plan is a 5E lesson plan that covers cross-curricular standards, including something that an English teacher can implement.

Brief Outline of the Activities in the Pick-up Unit

The activity I chose to share with my colleagues was from a 5E lesson plan I put together from the Math Connections in the STEM Classroom. The activity was to have students design and build an air-filter device to recycle and convert carbon dioxide to breathable oxygen. The lesson plan gives the teachers instructions of how to implement the lesson. Students will be using certain materials to create an air filter and will have a worksheet to complete for the lesson/activity. For the final activity of this lesson, students will write a mock proposal to NASA regarding their filtration design and the effectiveness of the filter.

What NASA data did you include?

My main goal for the PD is to share STEM resources that I have learned/received from taking NASA Endeavor courses to some of my colleagues so they can try implementing lesson plans/activities with their students. Here are a few NASA data that I shared with my colleagues during PD:

- ❖ Math Connections to STEM Education:
  http://www.us-satellite.net/nasa/endeavor/resources/mathlinks.html
- ❖ Exploring Mars:
  http://www.us-satellite.net/nasa/endeavor/resources/marslinks.html
- ❖ Global Climate Change, Resources for Educators:
  https://climate.nasa.gov/resources/education/
- ❖ NOAA Education: https://www.noaa.gov/education

Follow-up Activities & Post-questions Survey List

The follow up activity I asked the teachers in attendance to do was to find a lesson plan from the resources I provided and incorporate it into one of their upcoming LiveLesson. I also provided the post-PD survey link at the end of the PD and asked the teachers to complete it. Here were the questions asked:

- Was the PD was informative/helpful?
- What strategies/ideas might you have now to incorporate STEM into your teaching?
- What STEM topic(s) might you want to do in you LiveLessons?
- What did you think about the delivery of the PD session?
- Was there anything else you'd like to know more about that I didn't go over?

Unfortunately, when I checked in with the teachers after 2-3 weeks on whether they picked a lesson plan or activity to implement into their LiveLesson, they told me they didn't get a chance to or didn't have the time. There are many new tasks this year that teachers are needing to carry out on a day-to-day basis, so while they were all interested and excited for new resources, they simply didn't have the time to spend to change up a unit that's already established.

Final Data Collection and Analysis

From my pre-PD survey, 100% of the teachers knew something about STEM, however little or a lot. About 30-40% of the teachers incorporate another subject into their live lessons. About 10-20% of the teachers use authentic data in their live lessons. From my post-PD survey, 100% of the teachers thought the PD were informative/helpful and that they didn't know there were so much resource available on STEM. However, about half of the teachers weren't sure how practical it would be to implement a STEM lesson plan into their lessons since the curriculum for our school is already put together for us. All of the teachers thought the delivery of the PD session were professional and engaging. There were visuals (i.e. showing a few websites of resources), they carried out a discussion in small groups and explore an assigned website together, they shared out after the breakout, and we looked at a specific lesson activity as a whole at the end.

I believe the PD was 50-70% successful because the science and math teachers found it more applicable to their curriculum, whereas the English teachers found it a bit more challenging to incorporate STEM lesson plan into their live lesson. One of the main reasons that English teachers find it difficult was because of their comfort level at delivering the science content. Even though the lessons plans may be clear and easy to follow, if their students have questions regarding the science content, they might not know the answer to them.

My PD project related to Jenkins' special education article in the sense that, these STEM lesson plans/activities are engaging on many different levels for general education students and special education students. One thing that I always think about when attending a PD session is, are there anything useful for me to use for my own class. With providing website resources to teachers, it's similar to the special education teacher providing the Brief to GenEd teachers. My PD project also relates to the STEM Teachers in Professional Learning Communities because PLC is huge within our school. All teachers are part of 1 or sometimes 2 PLCs depending on what they are teaching. Teachers that are in PLCs have shared values and goals in helping students achieve their best. Teachers look at student data regularly and discuss implementation of certain strategies, whether it'd be lesson activities or ways of getting students to complete an assessment. The article mentions trust and focusing on one single school subject within the PLC will be most effective, and for our school, that is how our PLC teams are set up.

The science and math teachers would do the activity with their students because often times the activity can be better integrated into what they are teaching. However, it is not so much the case for English teachers unless they change the entire unit that they are teaching.

I think overall hosting the PD was a good experience. The teachers I invited were interested in finding out more about STEM resources and how they can possibly implement some of the content into their live lessons. I liked that my colleagues were genuine with their feedback with how the PD went. Our school already puts together monthly PD sessions and most of the time teachers do not find it helpful/useful. Many of the PD content provided were not new to the teachers who have been teaching for many years. With Common Core being the focus now, and STEM being promoted in many school districts, they appreciated the exposure to STEM resources. At least 80% of the teachers shared that if one day they go back into the brick and mortar teaching, they will have some ideas of where to look to incorporate STEM into their teaching.

Appendix

Applied Math Project pick-up unit: Click here.

Jenkins, A.A. & Yoshimura, J. (May, June, 2010). Not another inservice! Meeting the special education professional development needs of elementary general educators. *Teaching Exceptional Children, 42*(5), pp. 36-43.

Fulton, Kathleen and Britton, Ted. (2011). STEM teachers in professional learning communities: From good teachers to great teaching. Washington, DC: National Commission on Teaching and America's Future.

4 Educators who attended the PD:
- ❖ Paromita De – pde@calca.connectionsacademy.org
- ❖ Saul Villela – svillela@calca.connectionsacademy.org
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