

Running head: Understanding Engineering PD

Felisa Alberts

SCED 545- STEM Leadership

NASA Endeavor

Engineering & Design Process Professional Development

October 24th, 2018

Engineering & Design Process

I. Title: Understanding Engineering

II-III. Background Information

I teach at Salk Elementary School in Arizona, at school of approximately 500 students and 19 teachers (K-6). Salk is a K-6th School and there are about three teachers at each grade level. My Professional Development centered around the Engineering & Design Process and took place on October 24th during our afternoon PLC/PD Development Time. I invited all teachers, so there were many grade levels present. Attending teachers included two second grade teachers, three third grade teachers, three fourth grade teachers, two five grade teachers and three sixth grade teachers.

We are not a STEM School, nor are we science driven. Therefore, my principal informed the staff the PD was optional, I had a difficult time guessing who would show up and planning around the standards. My goal was to inform teachers about the Engineering & Design Process, EDP, and connect it to literature. Each grade level has similar literature and writing standards, I hoped they could adopt the presented concepts and apply it to their grade levels. More specifically, one Arizona 5th Grade Standard is

5.RL.2- Determine a theme of a story, drama, or poem from details of the text: include how characters in a story or drama respond to challenges, how the speaker in a poem reflects upon a topic, and a summary of the text

Each grade level has a version of this standard. Even though second graders are not required to determine the theme of a poem, they are required to “Recount stories, including fables and folktales from diverse cultures, and determine their central message, lesson, or moral.” Therefore, if I used this standard, regardless of grade level, could focus on having students identify the theme or details from a story. Each teacher was told to find literature and let the story or details drive their engineering project. The specific example given to teachers involved a girl trying to save a turtle after living in contaminated water. The literature drives my project and students build a model to clean water. Ideally, teachers would use the conflict or challenge from the literature to create an Engineering Project along with their knowledge of the EDP.

Additionally, due to the fact I did not request teachers to RSVP, I had a difficult time choosing a specific NGSS Standard to address. My goal was to equip teachers with resources to implement engineering, not necessarily teach them to address a specific standard. The Engineering and Design Process incorporates most of the practices: Asking Questions, Using Models, Carrying out Investigations, Analyzing and Constructing Explanations and solutions. Throughout the PD, my focus on the NGSS Practice: Planning and Carrying out Investigations. I had hoped teachers

Understanding Engineering PD

would have students find solutions and complete investigations to address potential real-world problems.

IV. Summary

My goal during this PD was to introduce teachers to the Engineering & Design Process, discuss literacy strategies and help teachers brainstorm ideas for potential projects in their classroom. Originally, I planned to spend 5-15 minutes introducing engineering, explaining possible benefits of using engineering in the classroom and the seven steps of the EDP. Then I would show teachers a unit I taught which includes both a literacy and engineering component. I had intended to give them literacy strategies to use and briefly discuss them. Teachers would be given time to research, brainstorm ideas literature resources, plan a project based on literature then draft their five steps for their project. Finally, I had planned on teams sharing their project ideas, so each group would leave with an idea and potential other ideas.

V. Pre-Survey

1. Do you incorporate Engineering into your classroom?
 - a. Yes
 - b. No
 - c. Sometimes
 - d. Willing to try
2. Do you feel Engineering activities could be done in your classroom regularly (once or twice a week)?
 - a. Yes
 - b. No
 - c. Depends
3. Do you feel Engineering activities could be done in your classroom once a month?
 - d. Yes
 - e. No
 - f. Depends
4. Are you interesting in adding engineering components to your lessons?

Understanding Engineering PD

- a. Yes
- b. No
- c. Depends

My pre-survey included questions regarding background knowledge about Engineering. I gave this survey prior to the professional development through email. However, only five teachers responded. The data showed that overwhelming, teachers do not implement engineering lessons. Four teachers indicated they felt engineering activities could not be done in the classroom regularly. One teacher indicated it “depends”. The survey did not provide me with enough data to drive the PD and target what the teachers needed. I regret not asking more open-ended questions. Ideally, it would have been beneficial I had asked teachers what they thought Engineering was prior to beginning in order to understand if their perceptions changed. Overall, I regret giving a multiple-choice survey and not targeting the interests of the teachers.

VI. Actual Professional Development Training

On the day of the professional development, thirteen teachers from 2nd-6th Grades attended. Originally, I had only intended to spend 20 minutes “talking” but the day of I felt nervous and realized there was more to say than I had intended. The whole PD felt very rushed because I talked for 30 minutes and teams only had 30 minutes to pick a book/novel and try to brainstorm a project. I also feel I could have done a better job explaining the literacy strategies to teachers. I wish I would have modeled using these strategies or included a video of some type. I had intended on having them look at resources on <https://www.jpl.nasa.gov>, for ideas.

VII. Outline of Activities

- Using the PowerPoint, we discussed:
 - What is Engineering?
 - Ask: Identify the Problem/Challenge along with constraints
 - Imagine: What are solutions? Brainstorm
 - Plan: Draw a diagram, make a list of needed materials
 - Create: Follow your plan and create! Test it out!
 - Improve: What works? Adjust and retest if possible.
- Show Water Filter Unit and lesson plans from last year, along with materials. Discuss the literacy component of the unit. The unit is based on the story “Saving Salia’s Turtle”. Students read the story and complete literacy activities such as the QAR Strategy and TWA Strategy. Give teachers the literacy handout of potential reading strategies.

Understanding Engineering PD

- Model finding resources on: <https://www.jpl.nasa.gov/edu/teach/>
 - Teachers will use the website to find possible writing assignments, engineering scenarios or activities
- Teachers were given time to work together to find resources and decide on an Engineering Project Idea
- Groups shared their ideas for potential engineering or writing activities involving data from NASA's JPL Website.

VIII. NASA Resources

Presented in NASA Astronomy and Space Science, Brandon Rodriguez, the instructor used NASA's JPL Website as a tool for units. I thought this website could be beneficial to teachers as they look for Engineering Project Ideas. This website is also NGSS Standards Based. Although Arizona is not an NGSS State, I thought it would be informative to include this resource. Teachers were also given the literacy tools worksheet for potential strategies they could use if they include a reading component. These strategies were presented in the Reading and Writing Across the Science Classroom Course.

IX. Follow Up Activities

The only follow up I conducted with my staff was through my Post-Survey which was emailed to teachers. I also spoke with teachers informally the days after my delivering my professional development. Teachers were polite but seemed hesitant regarding engineering. Many liked the concept and thought doing Engineering Projects could help teachers ease into trying Project Based Learning. Teachers voiced that they liked the idea of doing hands on projects but seemed to lack the confidence to actually apply it. One teacher commented that "Salk is not a STEM School", so the material did not necessarily apply.

Post-Survey

1. What supports do you need in order to incorporate engineering practices into your classroom?
2. Would you like to meet one on one or in a small group for additional information?
3. Did you find the information beneficial? Why or why not?
4. Did you find the information relevant to your content area? Why or why not?
5. Do you find the Engineering & Design Process useful?
6. To make this PD better, what could be added or done differently?

7. Please list a “take away” from the PD. What stuck with you?

X. Outcome & Analysis

Regarding the Engineering & Design Process, eleven out of thirteen participants expressed they did not want to meet one on one for further information or help. Nine participants noted time or money as a concern. Eight teachers also expressed that they did not find the information beneficial because they felt they had little time to implement projects within their classrooms. Informally I was told the material was interesting, “but what are we going to do with it?”. In particular a 6th Grade Teacher expressed concern over supplies and finding project materials for engineering. That teacher also noted planning, gathering and organizing materials as a concern.

Four teachers mentioned they liked the example I gave about using the water filter project in my classroom. In particular, one teacher commented that the example made the Engineering seem less overwhelming because “these are discussions are already happening in classrooms, engineering just makes it more hands on”. She went on to explain engineering forces students to think through real scenarios and apply their thoughts. This is a little more intense than the “turn and talk” with your neighbor about a topic.

I think I’m probably harder on myself than needed. However, going through this PD experience made me feel like I was a first-year teacher again. The day of, I was nervous and rambled on. I wasted time on the “direct” instruction part and teachers did not have enough time to try and apply the concepts I was presenting. This PD was the complete opposite of my teaching style. I felt there was little engagement for half the PD. Looking back, I could have used time more effectively if I had given teachers a short 10 to 15-minute Engineering Challenge before introducing the topic. I feel like this would have been more effective and teachers would have summarized the steps, saving me 30 minutes of talking. This also would have been far more engaging than listening to me. Ultimately, I do not think my professional development was successful.

This PD experience reminded me of Kaniuka’s article regarding substantial transformational leadership. That week I had a hard time determining whether there was a substantial transformation within the study. This led me to critique my own PD. I could definitely tell there was no transformation on my campus afterward. If there is no buy in or follow through on the content presented, even the best professional developments are forgotten about. I particularly thought this quote was most relevant:

“As an example, Attard (2007) documented his experiences as a teacher and found that, “habitual routines tend to distance the practitioner from consciously developing and learning, and subsequently changing and improving professional practice” (p. 147)”

If teachers can get away with not changing or modifying their daily habits, they will. Nobody enjoys change, especially if they feel there is no need to change. In my situation, nothing is motivating teachers to change. My principal offered the PD as an option, a professional courtesy to me I believe. Nothing is driving teachers to implement engineering practices in their classrooms. There was no event or next step with the material. This was definitely the “sit and

Understanding Engineering PD

get” type of professional development. Additionally, I was also reminded of Daughtery’s Engineering article. In the article it stated: “The assumption being that that “good” curriculum translates into “good” professional development and “good” teaching”. Professional Developments begin as a really great idea and can either turn into a negative or positive experience. Simply because you have good resources or a great proposal, that does not guarantee your PD will be a success. I felt I had a good idea, and a topic I was passionate about. Unfortunately, my passion did not translate into a smooth and meaningful professional development.

This professional development experience was an eye opener. It taught me to be more accepting and less critical of my administrators. Although some concepts seem clear to me, explaining them to a room full of teachers definitely shook my confidence. Teachers can be some of the most difficult judges. I know because I hear them critique my principal weekly. My own confidence was huge factor during my professional development. Overall, I think I gave teachers information. I haven’t heard or seen any Engineering happening on campus over the past month. Teachers were cordial, but I have yet to see follow through or effort implementing. I don’t believe teachers will use this again because there is nothing pushing the changing.

XI. Appendix: Classroom Activities/Unit with Assessment

- A. I used materials from the Engineering is Elementary Unit provided by the Mesa Public Schools SSRC Department. Resources can be previewed at:
<https://www.eie.org/eie-curriculum/curriculum-units/water-water-everywhere-designing-water-filters>
- B. See additional uploaded documents for Literacy Summarization handout given to teachers

XII. Attendees

- Kathy Hines
 - 5th Grade Teacher, (708) 553-0052
 - Kshines@mpsaz.org
- Alishia Sechez
 - 5th Grade Teacher, (480) 703-7890
 - agsechez@mpsaz.org
- Stephanie Solis
 - 6th Grade Teacher, smsolis@mpsaz.org

8

Understanding Engineering PD

- Stephanie Cox
 - 3rd Grade Teacher, (602) 312-7137

References

Daugherty, J. L. 2009. Engineering professional development design for secondary school teachers: A multiple case study.

Kaniuka, T. (2012). Toward an understanding of how teachers change during school reform: Considerations for educational leadership and school improvement. *Journal of Educational Change*, 13(3), 327-346.