

**Reflection from student
Sara M.**

1. Describe (briefly) what happened in the repeated teaching rounds after teaching.

There were many problems that occurred before, and during the original lesson. Our first problem came when we ended up needing to change many aspects of the lesson right before we presented it to the first group of students. This resulted in us not knowing what our parts were or how the flow of the lesson would go. The second problem with the original lesson came from the plan itself. Laura and I didn't have a strong grasp on what this lesson was supposed to teach so the lesson ended up being more focused on the lemonade than on engineering, as it should have been. After delivering that lesson a lot of changes were proposed. Some of these changes involved making what engineers do explicit, giving each student in the groups jobs, providing material already measured and less time for the explore phase (designing an improved lemonade), editing the learning target and exit slips, and displaying the countdown timer on the board as well as others. Because of these changes, the second iteration of this lesson, the plan given above, went much smoother and had a much clearer central focus. This presentation of the lesson was also better received by the students and was reflected in their exit slips.

**2. Identify and explain the elements of the nature of engineering used in this lesson
(based on Pleasants & Olson, 2018).**

Our lesson was based of the definition that “an engineer is someone who is creative, uses mathematics, uses technology, works in teams, designs everything around us’ and ‘solves problems to help people’” (Pleasants & Olson, 2018, p. 147). In addition to providing a working definition for who engineers are, Pleasants and Olson (2018) also lay out nine elements of the Nature of Engineering (NOE). These include 1) Design in engineering, 2) Specifications,

constraints, and goals, 3) Sources of engineering knowledge, 4) Knowledge production in engineering, 5) The scope of engineering, 6) Models of design processes, 7) Cultural embeddedness of engineering, 8) The internal culture of engineering, and 9) Engineering and science (Pleasant & Olson, 2018, p. 154). This lesson wasn't able to cover all of these elements but it was aimed towards the first four elements listed above. Through the process of the lesson, students worked with design and sources of knowledge, were given specifications, constraints, and a goal, with a final task of producing their engineering knowledge. Based on the student responses during the lesson and in the exit slips we received I would say that this lesson was fairly effective in communicating at least some of the elements of NOE. If we were given more time I think we could add more design, research, and design revisions.

4. Assess your knowledge and understanding teaching the engineering design process.

Being able to give this lesson twice made all the difference and allowed for much needed revision and improvement. One thing that is hard about teaching, until you've been working for a few years, is that you only get one shot to perform that lesson for the year. You can always add onto the lesson that you've done but you can't simply start again with fresh minds. Being able to do the lesson multiple times with time to revise in the middle made this experience more positive by the end.

After the first lesson, I felt like we both had opportunities to grow in many areas. For that lesson, our lack of student knowledge and classroom management techniques showed. I had a few tricks that I've learned about classroom management from the program and from watching [her mentor teacher] teach but I feel like that is an area I need to grow in. Another area of growth for the first lesson was in time management. We started the lesson behind schedule so by the time we

fumbled our way to the end we were really behind schedule and ended up cutting parts of the lesson and going over time. Time management has always been an area I work on because time always feels so limited. I think we did much better with classroom and time management by the second lesson. I was much more focused on the clock in the second run of our lesson which paid off with us finishing on time. I like co-teaching because while Laura presents I can keep track of the time and gather my thoughts. I also feel more clear-headed when the responsibility doesn't lie solely with me (likely because of thinking time) so I believe that co-teaching with each other is a strength of ours. In addition to this, I believe that I am good at echoing student thought and giving students opportunities to ask questions. I believe that the second lesson ran very smoothly with our updated lesson plan and am happy with our final result.

In terms of teaching an engineering lesson, I learned that it is important to make it student focused. When we were able to connect the engineering content of this lesson with what the students knew about engineering and experiences that they've had with the topic, it was easy to keep the students in that mindset when we gave them an engineering experience. In today's culture we seem to be more focused on wanting to get kids excited about engineering and one way to do this is through a fun learning activity. It is better to have an experience than to just read about one and seeing how the students responded to the engineering experiment we presented to them helped me learn more about what made that experience important for both engagement and learning.

References

Pleasants, J., & Olson, J. K. (2018). What is engineering? Elaborating the nature of engineering for K-12 education. *Science Education*, *103*(1), 145–166.