

## **Mandatory 3: Proposal Plan for PD “Engineering Design & STEM for All”**

### **1. What is the title of your STEM professional development?**

My project’s title is “Engineering Design & STEM for All.”

### **2. Why did you select the topic?**

I teach in a title I Urban school district. I feel that there is an urgent need to educate science teachers about Engineering design. By doing this allowing my students to get exposed to STEM activities in a true sense. My students, predominantly Hispanics and African American populations, are not getting exposed to STEM and are not pursuing STEM careers. Even if we see nationwide data, the numbers of Hispanics and African American population seeking STEM field is significantly low. In addition, women and people of color are—and historically have been—underrepresented in STEM fields. I want to encourage my students to pursue STEM careers, and there is no better way than training science teachers who are teaching our students.

### **3. How does your PD integrate NASA assets and content from the Endeavor courses?**

My PD will integrate NASA resources for Engineering Design Process. I will introduce them to NASA’s best and JPL Engineering design process and to actively engage the targeted audience. I will focus specifically on the engineering design process and other NASA resources in the Endeavor classes. To have them actively engaged in the PD teachers (audience) teams will explore the engineering design process by modifying a paper cup to carry a marble down a zip line and drop it precisely on a target. They will learn to brainstorm, test, evaluate, and redesign their devices to improve accuracy. Audience questions are discussed throughout the activity. This activity also fits well with NASA’s Best engineering design model, and the connection to NASA’s LCROSS allows for meaningful real-world applications of the concepts.

### **4. 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?**

My proposed audience is science and Math Teachers from STEM Academy high school in Elizabeth, NJ. STEM Academy is a brand-new school and will provide access to STEM activities and resources to underrepresented students of color. We only have grades 9 & 10 as of now. So, my targeted audience will be science and math teachers, including the Bilingual teachers who teach grades 9&10.

### **5. What STEM concepts or learning goals will you and your materials address to replace other classroom activities potentially? List NGSS and CCSS or your state standards**

Students will work in pre-assigned groups and can support their peers while collectively solving the problem., Also, this activity incorporates collaboration and teamwork to optimize and troubleshoot solutions, which is essential in the professional world.

#### **Primary Learning Objectives: Students (Teacher audience) will:**

1. Apply the engineering design process
2. Modify a cup to carry a marble down a zip line by modifying a paper cup to zip down the line and drop a marble onto a target.
3. Test their cup by sliding it down the zip line, releasing the marble, and trying to hit a target on the floor

**Goals achieved by learning objectives: By the end of this lesson:**

Students will use the engineering design notebook and use the iterative engineering design method for problem-solving using NASA resources.

1. Students will work in cooperative groups to follow the engineering design process by modifying a cup to carry a marble down a zip line, drop it on a target, testing their system, and improve their strategy based on test results.
2. Students will discuss what happened, how they solved problems, and what parts of their design proved vital in getting the marble to hit the target.
3. Students will describe how the marble moved after it was ejected (trajectory).
4. **Extension:** How was this challenge similar to NASA's LCROSS mission to the moon? Students can view a 4-minute conceptual animation of LCROSS [GMS: LRO/LCROSS Launch, Deploy, and Mission Animation](https://www.nasa.gov/mission/lcrossevents/launch_deploy_and_mission_animation), which involves a remote-controlled system devised to cause something to crash precisely into a surface using trajectory calculations.
5. To show that an object's speed is constant as it follows a trajectory (a curved path), students will record a video of the marble falling from the cup and play it back on a TV or computer one frame at a time. Next, they will tape transparency to the TV or computer screen and make marks from frame to frame to measure the horizontal distance traveled by the marble each time, which should be a constant distance per frame.

**NASA Resources & Activity Link:**

<https://www.jpl.nasa.gov/edu/teach/activity/on-target/>  
<https://www.youtube.com/watch?v=fza6p9FJDaw&t=17s>  
<https://www.jpl.nasa.gov/edu/learn/project/land-a-spacecraft-on-target/>  
<https://svs.gsfc.nasa.gov/10334>  
<https://pbskids.org/designsquad/build/target/>  
[https://www.nasa.gov/sites/default/files/544862main\\_E2\\_OnTarget\\_C2.pdf](https://www.nasa.gov/sites/default/files/544862main_E2_OnTarget_C2.pdf)  
[http://www.aps.edu/sapr/documents/resources/Webbs\\_DOK\\_Guide.pdf](http://www.aps.edu/sapr/documents/resources/Webbs_DOK_Guide.pdf)  
**Self-reflection survey Link:** <https://forms.gle/qRiB43BNUGy2nHgr8>

**Relevant State Standards for the PD activity.**

<p><b>NGSS Science Standards</b> <a href="#">HS-ETS1-2</a> : Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. by breaking it down into smaller, more manageable problems that can be solved through engineering.</p>	<p><b>Common Core State Standards for Mathematics</b> CCSS.MATH.CONTENT.HS.N.VM.A.3-Solve problems involving velocity and other quantities that can be represented by vectors. CCSS.MATH.CONTENT.HS.N.Q.A.1- Use units as a way to understand problems and to guide the solution of multi-step problems; choose and</p>	<p><b><a href="#">ISTE Standards for Students</a></b> <b>Empowered Learner</b> - Students leverage technology to take an active role in choosing, achieving and, demonstrating competency in their learning goals, informed by the learning sciences.  <b>Creative Communicator</b> - Students communicate clearly</p>
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<p><a href="#">HS-ESS3-2</a>. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</p>	<p>interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays</p>	<p>and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats, and digital media appropriate to their goals.</p>
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**6. How long will the session be? How will you recruit your audience? Where will you advertise your PD session?**

My session will be about 3 -4 hours. I have already discussed this with my principal and would have this on the district PD Day. I will advertise the PD session via email that my principal will forward to the staff.

**7. To demonstrate that teachers have learned something new, you will generate a pre-and-post. Post-survey. What, in general, will your pre-survey and post-survey ask?**

I will create a pre-survey to ask the teachers how much they know about the Engineering design process and using NASA resources in their classes. I would ask them if they are interested in the PD where I would have them experience the iterative EDP and experience solving a problem like how scientists and engineers do.

I will also create a post-survey where I will ask them if they liked the PD and what suggestions they have for improving other PD. Finally, I will ask them if they need more time so I can accommodate further PD sessions.

**8. What outcomes or expectations do you hope to see for your educators?**

I would see if my targeted audience learned and achieved learning the engineering design process and using NASA resources. I would like to see how interested they are and would talk about any help they need. I will provide them a compiled list of NASA resources that I made during all my Endeavor classes to research in their free time and use the NASA resources.

**9. How will you follow up with the teachers in attendance?**

I will follow up with them by giving reminders pre-PD and after PD. In addition, I will record the PD and stream it in school LMS for others to access.

**10. What data collection methods (e.g., surveys, interviews) will you use to analyze the PD's success?**

I will use the self-reflection survey to analyze the PD Success and positively take any criticism to improve in the future. Here's the link for my self-reflection survey that my audience will take after the PD experience.

**Self-reflection survey Link:** <https://forms.gle/qRiB43BNUgy2nHgr8>