

INCORPORATING ENGINEERING DESIGN IN STEM

Origin

The incorporation of Next Generation Science Standards (NGSS) standards are only beginning in my district. Generally observing, the staff members at my school are operating under the previous constructs of the curriculum, which had been deficient to define the outcomes between science and engineering principles respectively.

Several members of the staff at my school were informally polled about the aspects of developing a science program they were most interested in developing further. According to the conversations, the apparent need in development for the members of the staff is incorporating engineering design. This professional development is intended to encourage teachers to explore a portion of the NGSS learning outcomes and cross-cutting concepts to develop an activity which satisfies the engineering design standards within a lesson plan they currently utilize in their science programs.

NASA Assets Integration

[NGSS Engineering Design Standards for Kindergarten Through Second Grades](#)

[NGSS Engineering Design Standards for Third through Fifth Grades](#)

[NASA Exploration Design Evaluation Rubric](#)

[Jet Propulsion Lab "Teach" Activities Website](#)

Other Resources

[JPL Ring-Winged Glider Activity](#)

[Ring-Winged Gliders Engineering Integration Presentation](#)

Audience and Presentation

The intended audience for this professional development is any teacher not familiar with NGSS standards, the difference with science and engineering principles, or with implementing engineering activities in their classroom. Grade level teachers from kindergarten through fifth grades, who teach STEM, will have opportunities to review NGSS standards and curate materials from NASA's assets designed for their own grade level clusters and for others, at their own inquiry. Teachers will have opportunities to work vertically when analyzing the NGSS engineering design standards and composing engineering design activities.

This PD will be conducted at the school, in the Library-Media Center, using a GooglePresentation format supported by Pear Deck, recorded using the Screen-cast-o-matic interface. Presenting through the Pear Deck format will enable real-time instructional decisions and succinct data analysis. Participants will be asked to access lesson designs which they intend to employ in the near future in science, will have their computers for research and lesson design, and access to a number of materials in the school and their classrooms to attempt to stage the engineering design they choose to develop.

The PD will be designed for 60 minutes: 5 minutes presentation pedagogy and NGSS Engineering standards; 15 minutes to allow teachers to explore the Engineering standards at their grade level, interpret and discuss the outcomes, and evaluate their understanding and use of engineering principles in their classroom; 5 minutes to present the integration of “Ring-Winged Gliders” activity into 4th grade curriculum; 25 minutes to explore JPL website and develop engineering integration into an existing lesson plan; 10 minutes to present artifacts.

STEM Learning Outcomes to be Addressed

Students who demonstrate understanding of STEM engineering design can:

- K-2-ETS1-1.** ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2.** develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3.** analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

- 3-5-ETS1-1.** define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Teachers who demonstrate understanding of incorporating NGSS engineering design standards can:

- define engineering practices distinctly from science practices.
- evaluate their lesson design according to NGSS standards and cross-cutting concepts
- compose more of their own science lessons incorporating NGSS standards and cross-cutting concepts.
- compose activities for their class encompassing engineering design, using previously employed science lessons.

Survey, pre- and post- results accounted for:

- Define the difference between science and engineering.
- Rate your expertise using NGSS standards in lesson design.
- Rate your comfort level conveying engineering techniques in your classroom.

Survey, in exploration of NGSS Engineering Standards

- With a science activity in mind which you previously taught this year, rate the effectiveness of the incorporation of any of the Engineering standards and practices. Elaborate.

Survey, follow up

- Share engineering integration activity and an artifact at the end of the PD.

