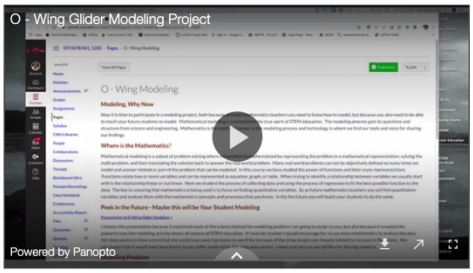
O - Wing Glider Modeling Project



Modeling, Why Now

Now it is time to participate in an engineering modeling project, both because as future mathematics teachers you need to know how to model, but because you also need to be able to teach your future students to model. Mathematical modeling is connected to the true spirit of STEM education. The modeling process gets its questions and structure from science and engineering. Mathematics is the teeth and power in the modeling process and technology is where we find our tools and voice for sharing our findings.

Where is the Mathematics?

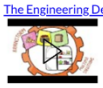
Mathematical modeling is a subset of problem solving where the problem is mathematized by representing the problem in a mathematical representation, solving the math problem, and then translating the solution back to answer the real world problem. Many real world problems can not be objectively defined, so many times we model and answer related or part of the problem that can be modeled. In this course we have studied the power of functions and their many representations. Functions relate two or more variables and can be represented as equation, graph, or table. When trying to identify a relationship between variables we usually start with is the relationship linear or not linear. Next students use the process of collecting data and regression to fit the best possible function to the data. The key to ensuring that mathematics is being used is to focus on finding quantitative variables. So as future mathematics teachers you will find quantitative variables and analyze them with the mathematics concepts and processes that you know. In the the future you will teach your students to do the same.

Engineering Design Process - Connecting Solutions to the Real-World

Engineering is the systematic practice of design to achieve solution to human problem (NGSS. 2013)

Video explaining the process. Refer to the steps of this engineering design process when explaining your steps in design your O-wing glider.

The Engineering Design Process: A Taco Party



Modeling Problem

Design an O- Wing Glider that will fly the farthest, given the following materials and rules (constraints).

Materials: 100 square inches of file material or less, 3 straws or fewer, scotch tape, 3 paper clips or less

Release of Glider: 1.5 meters from the ground (58.5 inches) and trust of elbow vertical to 45°.

The engineering design process will be focus of this project: Start by using this video to design and make an initial or control O-wing glider, test the flight length of the glider, and finally work together to use iteration to improve on your initial glider design. In the following video you will learn how to create an initial control glider and understand the scientific factors related to the aerodynamics of gliders.

Ring-Wing Gliders

Group Part of the Project

In your group design, build an initial control glider as directed in the above video. Test three flights of the control glider to find an average flight length. Then use the file (lesson_plan06) to discuss individual variables related to the flight of O-Wing Gliders.

lesson_plan06.pdf

Each person in the group will investigate a different independent variable for the design of the group O-Wing glider model. For example, the dependent variable will always be length of flight but the independent variables can be glider length (straw length), size of the rings, ratio of front and back rings, placement of paper clips for balance, overall weight of the glider, etc. Use the attached activity to guide your group and individual investigations. You will discuss and and share your findings with your group in the O - Wing Modeling group Discussion Board. Each person will be graded individually on their individual report to group. The group will take all the individual research projects and make a group glider from what you learned. The group will video tape three flights of your group glider. This video along with data analysis of your group glider will be submitted as the group assignment on CANVAS. I will then share the videos from each group on CANVAS so that the whole class can see each groups work. The data and analysis that must be shared about the flight of the group glider must include: Template Final Modeling Design Presentation.docx

- Name of the Glider Designers
- Horizontal Distance of the three flights
- Average distance of the three flights
- Picture of the Glider followed by measurements and calculations that the glider's specifications were within the required limits.
- At least two key features of the glider resulting from the individual function models and analysis to support the feature.

Individual Part of the Project

In the O - Wing Glider Group Discussion Board each group member will present their individual investigation report. This report should be an attached document that includes:

Template for Individual Testing Report.docx

- Your name
- Dependent variable will always be length of flight
- Independent variables (i.e. length glider (straw lengths), size of the rings, ratio of front and back rings, placement of paper clips for balance, overall weight of the glider, . . .)
- Explain your procedures
- Present your data in table, graph, and chart form
- Use a function to model the data (if you can not model the data explain why)
- Write your conclusion as a recommendation to the group about how to use your report to design the group glider.

Use the template for the report. You will also be graded on your comments and suggestions on the Discussion Board about how to incorporate all the reports into a group designed glider.