**THE MESA MACHINE MODEL OF INSTRUCTION**

**Identify Problem/Needs:**

 *Engage*

Guiding Questions:

*What is a simple machine? What kinds of simple machines are there?*

 *What is “work?” What is “mechanical advantage?”*

*Why are simple machines useful?*

*What is a “Rube Goldberg” machine?*

 -Have students prepare engineering notebooks (to comply with MESA

guidelines)

 -Have students engage in Introductory ENGAGE activity challenge.

-Discuss results and devices created

Sample questions to ask: *Why did some work? Why did some didn’t?*

 *Would other materials make a difference?*

*What moved on the devices that helped throw the paper? Can you describe those movements?*

-Introduce unit to students *(eg. In this unit, we will be learning about simple machines, how they help us accomplish different tasks, and how they can help us build a complex “Rube Goldberg” type device)*

**Research/Explore:**

 *Explore*

 -Perform EXPLORE Activity-”A working challenge” This activity/challenge will

help students visualize what work is.

 -Define work formally for your students, and mathematically ( Work = Force x

Distance ). Discuss the types of simple machines. Use EXPLORE lesson-”The

Advantage of Machines” to guide your discussion.

-Do EXPLORE Activity-”Moving an Elephant”

-Do EXPLORE Activity-”The magicians catapult” as a way of showing how

compound machines can be built

-Do the MESA catapult challenge

-Use EXPLORE Activity-”Rube Goldberg and Machines” to guide an introduction

into “Rube Goldberg” machines.

**Develop Possible Solutions**

*Extend/Elaborate*

 -Review rules of The MESA Machine competition

 -Using what they learned (from ENGAGE activity, EXPLORE activities,

discussing rules), student teams conceive at least two potential prototypes for their competition device. Drawings/blueprints should be included of the designs developed. Potential budget for prototypes should also be considered.

**Choose Best Solution**

 *Explain* (at minimum, in their log book)

-Teams evaluate prototypes (Which idea makes most sense? Complies most

with rules? Could potentially work best?)

-Student teams choose one prototype, and in their notebooks, discuss why the design was chosen

-Students may also be asked to communicate their project choice via a short presentation to their classmates

**Create Prototype:**

 Build project (prototype) based on plans

**Test and Evaluate:**

 *Test*

 -Compare prototype to specifications and plans

 -Test prototype, per competition requirements

*Evaluate*

-Identify strengths and weakness of the device.

 -Assess knowledge gained from the experience: reflection

-Document these items and results in notebooks. Have groups communicate results to the class.

**Redesign (Make it Better):**

Repeat *Explain/Extend/Elaborate* based on findings of Test and Evaluation.

When pushing students to evaluate and re-build projects, please be cognizant of the nature of “Rube Goldberg” devices, as the MESA Machine is. These devices may be very complex, with many parts and facets. Students should not feel they need to build entirely new devices after the evaluation stages. Often, changes and adjustments to the many working parts of these devices is all they will need to do to optimize their devices.

*Lessons for this unit, especially in the EXPLORE section, came from curriculum developed by Teach Engineering, an initiative out of the University of Colorado, Boulder:* [*https://www.teachengineering.org/curricularunits/view/cub\_simp\_machines\_curricularunit*](https://www.teachengineering.org/curricularunits/view/cub_simp_machines_curricularunit)