**PROSTHETIC ARM MESA MODEL OF INSTRUCTION**

**Identify Problem/Needs:**

 *Engage*

-Have students prepare engineering notebooks (to comply with MESA guidelines)

-Do the “Pick-up Challenge” from resource folder. Students should be grouped in teams of 2-3 (for the activity, and remainder of unit).

-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 did this teach you about how your own hand/ arm works?

-Introduce unit to students *(eg. In this unit, we will be learning about the anatomy and function of a human arm, and will build an arm for a competition)*

**Research/Explore:**

 *Explore*

-Give general overview of prosthetics/prosthetic arms (General Overview) AND/OR videos provided below:

<https://youtu.be/fITEtWtgjHg>

*Concise overview from Vox.com*

<https://youtu.be/GqY8Oiljawk>

*STAR WARS Science. Longer video, but provides comprehensive interview and*

*a subject (Star Wars) students easily connect with*

 -Students conduct their own research on existing prosthetic arms and

technology. Ask students to consider the following questions:

*What is the history of prosthetic arms?*

*What are some of the most significant challenges with creating prosthetic arms?*

*What are some at least two current examples of prosthetic arm technology?*

-Explore anatomy of the human arm using EXPLORE activities resources (first 13 pages of document) provided *(ie. Bones of the Upper Extremity and Hand, Joints, Muscles of the Upper Arm, Forearm, and Hand).*

Students may also use websites:

 [www.innerbody.com](http://www.innerbody.com) or <http://teachmeanatomy.info/>

or apps to explore the arm/hand anatomy.

App Store

Visual Anatomy Lite

3D Bones and Organs

Essential Anatomy

Android/Google

Visual Anatomy FREE

 3D Bones and Organs

 Once research is concluded, have students do EXPLORE Activities 1 and 2.

 -Do EXPLORE Building Activity 3.

-Discuss how an arm moves (kinematics, motion degrees of freedom)

 through Activities 4 - 7 in EXPLORE Activities

**Develop Possible Solutions**

*Extend/Elaborate*

-Give overview of MESA prosthetic arm competition. Identify constraints,

including costs. (Prosthetic Arm rules).

-Students build a prosthetic arm, using a common set of materials (“Prosthetic Arm Build” document)

-Using what they learned (from research, EXPLORE activities, discussing rules

and building arm), 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*

-Teams evaluate prototypes (preliminary build and test functionality)

-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 arm based on plans and cost analysis (itemized budget sheet)

**Test and Evaluate:**

 *Test*

 -Compare prototype to specifications and plans

 -Test prototype, per competition requirements

*Evaluate*

-Identify strengths and weakness of the design.

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