**Mars Farm**

**Lesson 10:** 2-D design phase

**Problem Statement:**

Students must work together in teams to create a design a growing environment on Mars that will sustain three researchers for three years. Students use their data from previous lessons to begin to design a 2D model that meets the criteria and constraints.

**Learning Objectives:**

Real world problems are often ambiguous and do not have a clear answer. Rather the problem is solved through iterations of a disciplined problem solving methodology called the engineering design process. Failing to immediately arrive at the right answer is part of the engineering process.

**Lesson Standards (NGSS, CCSS, CTE):**

MS-ETS1-4 Engineering Design

Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

#### [CCSS.Math.Content.6.RP.A.1](http://www.corestandards.org/Math/Content/6/RP/A/1/)

#### Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

CCSS.Math. Content 7. GA.1 Solve problems involving scale drawings of figures.

**Materials**

* Science notebooks with final crop plan revision
* Graph paper
* Rulers
* Calculators
* Whiteboard / Chalkboard / DocCam

**Lesson Preparation**

* The instructor should be familiar with the concepts of dimensional analysis i.e., using units of measurement to develop equations.

**Time Required**: 45 minutes

**Grouping of Students for Instruction**

As sixth grade teachers, we decided to predetermine our groups to balance for mathematical ability (lots of ratio/proportion work), engineering and design background, reading level, ELL vs. highly capable, social skills, leadership skills, organization, etc.). The students all share the same “team” roles in this PBL; however, we know some may naturally gravitate toward particular tasks.

**Procedure[[1]](#footnote-0):**

Determine Best Fit Solution

Using the area requirements from their final crop revision, student will select a scale and draw a layout for their crops on graph paper.

**Assessment:**

* Group has a 2-D crop plan that is drawn to scale.

**Accommodations:**

* Engineering profile could be turned into a Google Doc for word processing if handwriting an issue.
* Teacher will be reading and rereading assignment.
* Classrooms have microphones for hearing impaired.
* Teachers could also enlarge any documents under document camera.

**Extensions:**

* The instructor may choose to have students iterate their layout or consider vertical growing options.

1. The sub-sections of the procedure section (e.g., Understand the Problem, Explore the Problem) are from the Illinois Math and Science Academy’s PBL Teaching and Learning Template, however, the descriptions were developed by WABS and do not necessarily represent the views of IMSA. [↑](#footnote-ref-0)