Summer 2016

UTM Middle School STEM Workshop

**Workshop Facilitator**: Dr. Louis Kolitsch

**Subject/Grade**: Solving a linear equation in two variables; looking for patterns.

**Estimated time**: 1 hour

**Standard(s)**: TN Mathematics Standards

Grade 8: **8.EE.C.8** Analyze and solve systems of two linear equations.

**c.** Solve real-world and mathematical problems leading to two linear

equations in two variables.

(We will actually be solving one equation in two variables.)

**Objective**: Use real world data to set up and solve a linear equation in two variables and then use the possible solutions to solve a related problem.

* I can set up an equation in two variables.
* I can find integer solutions of an equation in two variables.
* I can interpret solutions of an equation to solve a related problem.

**Materials and Resources**: Bucky the Badger Video <https://mrmeyer.com/threeacts/buckythebadger/>

**Motivating Students/Anticipatory SET:** This activity demonstrates a real-world application of setting up linear equations.

**Instructional procedures**:

* Show Act 1 of Bucky the Badger Video
* Have the students guess the solution of the question posed in the video.
* Ask the students what information they would need to know in order to accurately answer the question. (The students will need to know the number of touchdowns and field goals scored. They will also need to know if there were any safeties, missed extra points, or 2-point conversions. Make the students explain to you why they will also need to know the order in which the points were scored.)
* Tell the students that only touchdowns (7 points) and field goals (3 points) were scored and ask them to construct a two variable equation that can be solved to determine the possible ways in which the 83 points were scored.
* Based on their possible solutions ask them to list possibilities for the number of pushups Bucky could have done aiming to determine the maximum and minimum number possible. (This will take some time and you should record their answers with the corresponding sequencing that yields the claimed number of pushups to set target values for them.)
* Tell them that the team scored 11 touchdowns and 2 field goals and ask them how many possible scoring sequences they would need to check to determine the maximum and minimum number of pushups possible.
* Tell the students the correct sequencing of scoring (field goals were scored on the 2nd and 10th scoring plays) and ask them to calculate the number of pushups Bucky did.

**Questioning/Thinking/Problem Solving:**

To find the integer solutions:

1. Do you need to consider all integers when you are finding solutions?

2. Give me a number for *x* (or *y*) that you know is too high. Give me a number for *x* (or *y*) that you know is too low. How do you know your number is too high or too low? (Hopefully, your students will be able to tell you that, in this case, both *x* and *y* must be positive.)

3. Once you have one integer solution, how can you use your equation to find another integer solution?

To find the minimum and maximum number of pushups that Bucky must do:

Think about what would happen if the team scored fewer points. For example, what could happen if the team only scored 17 points? What happens if the team only scored 28 points? Is there a pattern for the minimum and maximum number of pushups?

**Follow-up Activities/Extensions**:

1. Suppose only 7-point touchdowns are scored. If x is the number of 7-point touchdowns scored, create a function p(x) that can be used to determine the number of pushups Bucky will have to do.

2. Ask the students to determine what numbers cannot occur as the number of push-ups when scoring is limited to 7-point touchdowns and field goals.

**Accommodations/Adaptations:**

You may give students a smaller number of points to consider (but remember that a different number will not correspond to the numbers in the video). You may also give students a table or chart to complete.

**Closure:**

* Emphasize how to use the slope of the line to find additional integer solutions once you know one integer solution.
* Emphasize that the order in which the points are scored affects the total number of pushups Bucky must do.
* Discuss the pattern in which the points must be scored to minimize and maximize the total number of pushups Bucky must do.

**Assessment:**

* Give students a different number of points that were scored.
* Give students a different real-world problem. For example, you could give them the total cost of mailing a package and two different amounts of stamps and ask them how many of each amount you would need to mail the package or you could give them the total number of wheels in a bike shop and ask them how many bicycles and tricycles the bike shop could have if all of the wheels are used.

**Teacher Reflection:**

To be completed once the activity has been conducted.