Irrigation

Concept:

The transportation of water has been paramount to human life and civilization. Water is important for people to drink, as well as for maintaining fertile soil to keep food supplies growing.

This is a project that will flex your students' engineering muscles while relating it to a real world application. This is also topical, as it is still a focus of research and innovation.

Current irrigation techniques are always being refined but at its core, irrigation is simply moving large amounts of water from one location and spreading it out over a larger area.

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So, why not build a functioning model irrigation system with all of the challenges that come with it?

There are a few parameters to be set before your students get started.

First, what is the budget? In real life, everything costs money so we can simulate this by limiting the amount of materials that are allowed to be used in construction of the model.

Second, how will you get the water to spread evenly over your test area? Getting it from one location to another is one thing. Not drowning one section of your crops or washing away your soil is another.

Lastly, there could be obstacles that you can't lay pipes through, requiring a work-around. These kinds of problems can eat into your budget, so remind your students to allow for such things when selecting their initial materials.

Supplies:

- PVC pipe
- PVC pipe cutters
- PVC T-joints
- PVC elbow joints
- PVC end caps
- Buckets
- A hand pump
- A large test area (preferably outdoors)
- Graph paper and pencils
- Funnels
- Tape and/or string

Process:

1. Set up your test area. This can simply be a square area that you have marked off with tape or string. Within it, designate four different crop areas needing water. Also mark off two areas, located anywhere you choose, that you can't lay piping through. These will be your obstacles.

2. You will need a water source. Fill a bucket up with water and place it somewhere along the edge of your test area. (Make sure the bucket isn't so heavy you can't lift it up to pour from it later.)

3. Measure out your test area and using graph paper, design a blueprint for your irrigation system that should deliver water evenly to each of the four crop areas. Don't forget to have an initial opening in your system near your water source. It's best if this opening is positioned perpendicular to the ground.

4. Once your designs are finished, make an estimation of how many total feet of PVC you will need and account for any joints you need as well. This will be your budget.

5. Select or cut the specific lengths of PVC pieces you need for your plan and also collect the necessary joints. Now it's time to build!

6. Following the blueprints you made as closely as possible, assemble your PVC irrigation system inside the test area.

7. Test your irrigation system by pouring water from your bucket, through a funnel, into the initial opening you made. Watch to see if the water reaches each of your four crop designations and covers them evenly.

8. If your design doesn't work as you planned on the first test, go back and revise it to address the problems, modify your build, and test again.

Take it Further

One way can take this project further by turning it into a game, seeing which student can get a working model for the lowest budget.

Another thing you could do is add more obstacles or crop zones as an added challenge.

A more difficult challenge would be to make a scale model test zone of your school grounds or a local garden and design an irrigation system model for it.

Oklahoma Academic Standards

- ES.ESS3.2 Evaluate competing design solutionsfor developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios on large and small scales.
- EN.ESS3.1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate affect human activity.