



Data Analysis of Concrete – Jovanca Smith

Purpose

This activity introduces students to the concept of data analysis through concrete design.

Overview

A sample data will be given to students consisting of results of different concrete strengths for an adjustment of water-to-cement ratio of a concrete mixture. An activity sheet is provided to guide students through the process of analyzing data that they graphed with Microsoft Excel, which includes obtaining average of different data sets, finding the best fit curve, extrapolating the best fit curve, and more.

Student Outcomes

- Students will apply the computational tool Microsoft Excel to plot graphs showing concrete data
- Students will learn how to formulate trends of graphed data by determining the effects of water:cement (w/c) ratio on concrete strength
- Students will learn how to analyze data by extrapolating strengths of concrete for given w/c ratio and w/c ratio for concrete with different strengths.
- Students will discuss the importance of using the average of data in science by comparing raw data of 6 concrete strengths for each w/c ratio with the average of the 6 concrete strengths for the w/c ratio.

Standards Addressed

MS-ETS1 Engineering Design

MS-LS4 Sedimentary rocks

Time

A double class period

Level

6th Grade

Materials and Tools

Technology – Microsoft excel, calculator, Internet access

Suggested resources or equipment needed – Chrome book or laptop or netbook (anything with access to Microsoft excel)

[Concrete Lab](#)

[Excel Template](#)

[Activity Sheet](#)

A [Completed Excel Template](#) is included as a resource for teachers



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Preparation

A Microsoft Excel template should be sent to all students before class so time is not taken up in class sending out the document.

Teachers must understand how concrete strength changes with water:

Cement reacts with water through a process called hydration. Only a certain quantity of water is needed for this chemical reaction, it is not just a mixture. Excess water will weaken the final produce. Also, too little water will not be sufficient to bond the material, but this weakness is not reflected in the given data. For very little water, other chemicals will need to be added which can be very expensive. The final product usually depends on cost and strength.

Prerequisites

If concrete was not previously introduced, a brief description of the material is needed. Sedimentation describes the origination of the concrete components. Cement is predominantly from limestone. A concrete lab is included if the teacher is so inclined to allow students to mix concrete for a class period to better understand the material. The quantities used can be halved just like a recipe if only half is needed, etc.

Background

Students will better grasp concepts if they understand how to perform basic plotting of data in terms of x- and y-axes and some types of graphs.

Teaching Notes

The excel spreadsheet table is setup with all the relevant data ahead of time, and students are given verbal instructions to plot a graph of the raw data. Once this is demonstrated and completed, a few minutes is spent in a class discussion about the accuracy of the raw data, and the reasons for repeating the same test over and over again. Students are then asked to think about how they will go from this raw data set, to a more accurate data value, prompting the discussion of average.

The code to obtain the average data is given to students, and after they obtain the average, a second graph of average data is made in excel. Students are also given verbal instructions to obtain the second graph. The importance of having various tests and finding the average value is discussed as a classroom with reference to the two graphs.

Students are then asked to think, pair, share with their neighbor about how they will find the strength for a given w/c ratio not specifically obtained through experimentation. A method of best fit of the data, and extrapolating data is also discussed in class.

An activity sheet is given that allows students to use critical thinking skills and analyze and compare the graphs. Students work with their neighbors to solve the activity sheet. The activity sheet is then discussed as a class. Every group is given the opportunity to answer a question, so that everyone feels included, and their worth to the entire class is reinforced.



Assessment

The teacher will evaluate if the objectives have been met by correcting the activity sheet for the students. Also, the teacher should not wait to the end to determine if students understand, because the think-pair-share during the lesson help the teacher to gauge what should be emphasized. Moreover, students are always asked how much they understand with thumbs up, thumbs sideways, and thumbs down for completely understand, not really sure, and totally lost respectively.

Additional Information

This website is a great resource to better understand the topic of concrete and the effects of water:
http://www.constructionknowledge.net/concrete/concrete_basics.php

This video describes sedimentation, where components of concrete are derived:
https://www.youtube.com/watch?v=mQGMgR_5jvc