

GIFTS: Concrete Is My Jam!

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My career in higher education started in the fall of 2021 when I was hired as the lab director for the civil engineering program at the University of Tennessee at Chattanooga. My enthusiasm for teaching was quickly realized and I was granted the opportunity to teach the Introduction to Civil Engineering course; along with the laboratory courses that I instruct. My goal for instructing this introductory course was to develop a curriculum that is fundamentally informative and, borderline, overwhelmingly engaging. I want my students to learn about civil engineering to ensure their intended career field, and for most of the learning to occur through participation. It is this mindset that helped me create "Concrete Is My Jam!" and many other similar activities. While I have been excited about my style of teaching, I am interested in learning about different approaches to engineering education and the realm of pedagogical research pertaining to first-year engineering students.

GIFTS: “Concrete is My Jam! – A Creative Introduction to Concrete Constituents and Mixing Processes”

Activity Overview

“Concrete is My Jam!” is an activity on how jam ingredients and mixing processes relate to that of concrete. This activity was inspired to teach concrete to a range of student levels in a safe and clean manner, without the need for laboratory equipment and hazardous materials. All that is needed is some preferred fruit, sugar, no-cook freezer jam pectin, water, lemon juice, freezer bags, measuring cups, and knowledge to present the analogous relationships shown in Table 1.

Table 1. Analogous relationships between concrete constituents and jam ingredients based on their primary function in the mixing process and performance of concrete and jam, respectively.

Concrete Constituents	Jam Ingredients	Analogous Function
Coarse Aggregate	Fruit	Primary substance
Fine Aggregate	Sugar	Provides durability
Cement	Pectin	Binder for mix
Water	Water	Hydrates binder
Admixture (Accelerator)	Lemon Juice	Aid reaction and performance

The fruit represents the *coarse aggregate*. Strawberries are appropriately large yet easily break down to proportionally smaller particles. This relates to the manufacturing of aggregate particle sizes, especially considering that fruit chunks are characteristic of jam. Aggregate density and interparticle voids can be discussed with reference to the fruit (pre-smashed) and the flavor of the fruit related to the strength contribution of coarse aggregate, in terms of predominant substance. Granulated sugar is “fine” and angular which makes for easy comparison to *fine aggregate*. Sugar preserves jam and fine aggregate increases the durability of concrete; both extending the lifespan of the products. Grain size distribution and particle friction can be discussed in this comparison as well as a continued conversation on density. Water is analogous to, well, *water* and is incorporated as the fruit is crushed. The primary purpose of water is to catalyze the binder hydration reactions. However, before leading into the binder discussion, conversations on moisture content, aggregate pores and levels of saturation, and moisture correction factor can occur. Pectin and *cement* are the binders that solidify the mix into their “performance” states. The explanation of hydration reactions can vary to fit the educational level of participants but, regardless, introduction to the water-cement ratio and its effects on workability and strength should be included. While pectin is being mixed with the previous ingredients, the hydration reaction discussion can progress to cover set time and curing. A thicker consistency of jam should be forming inside the students’ bag which can be related to the set time, and constructability, of concrete. As is typical in the case of jam, if the reaction is slow, an *accelerator* (lemon juice) can be used to reduce the set time. Other types of admixtures and their effects on concrete can be mentioned to the class as well. Students are left with the instruction to place their bag of jam in a freezer for a specified time to allow development of the desired consistency. This is analogous to the curing time allotted for concrete which enables full development of its strength. Lastly, it is imperative to state the importance of proportions. Just as specific measurements were used in making jam, concrete designs are a recipe.