A Case Study of the Implementation of the *Schools Under 2C* Compost Program at *Tesla STEM High School* during the 2018-2019 School Year

https://www.schoolsunder2c.org/ https://tesla.lwsd.org

Arvin Thyagarajan and Siddharth Shende
Tesla STEM High School
Redmond, Washington

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Abstract:
This scientific paper aims to elaborate on the *Schools Under 2C (SU2C)* organization's compost program that was implemented at *Tesla STEM High School (Tesla STEM)* during the 2018-2019 school year. This paper aims to describe the process to set-up the program, results from its implementation, and key conclusions through analysis of the compost data. This paper provides a very specific approach to compost program implementation -- setting an example for partner schools and other places to have a guideline for effective implementation. By developing a sustainable and repeatable process for arranging bins, collecting compost, weighing it, and

placing it for pickup by the Cedar Grove Composting Company, a viable model has been reached. This model has been tested and refined during the 2018-2019 school year and is especially impactful and viable for schools and areas that are looking to implement a new compost program.

Introduction:

SU2C is an organization aiming to raise awareness of the urgency of climate change through both compliance and educational campaigns. *SU2C* began in 2016 in response to the political climate, students at *Tesla STEM* along with an Environmental Science teacher at the school created a five-point plan to divert carbon emissions for useful purposes, at *Tesla STEM* and partner schools. Specifically, we implemented the compost program at *Tesla STEM*, where *SU2C* is based. *SU2C* chose to implement a composting program due to the high volume of food waste in the trash that we observed, which, if not diverted, will ultimately be transported to a landfill [4]. When organic waste is diverted into the compost, the organic waste does not reduce the ultimate greenhouse gas emissions, given the same amount and types of organic material that is waste. Composting separates organic material from inorganic material and thereby provides potential source(s) of usable greenhouse gas. For example, Cedar Grove is a company that turns compost to usable soil (see **Figure 1**). By working with the janitorial staff at *Tesla STEM* and arranging for the proper materials (compostable bags, compost bins, and weighing scale) and a waste sorting system to be set up throughout the school, a process was developed. There was also the management of processing the compost through scheduling a set of students to help collect, weigh, measure, and reset the compost bins every day of the school year. The ultimate motive of this paper is to provide a model for implementation of a similar compost program at any other location (any school, college, workplace, etc.) Throughout the remainder of this paper, we discuss the specific process and materials needed to set-up the composting program, along with specific data collected, and conclusions with recommendations. This paper focuses on the tangible impact of establishing a similar compost program at any other location. Finally, this paper addresses future possibilities for the composting program and designs educational campaigns for awareness of climate change in response to the *SU2C* composting program.

Figure 1:

Cedar Grove's composting process

Materials and Methods:

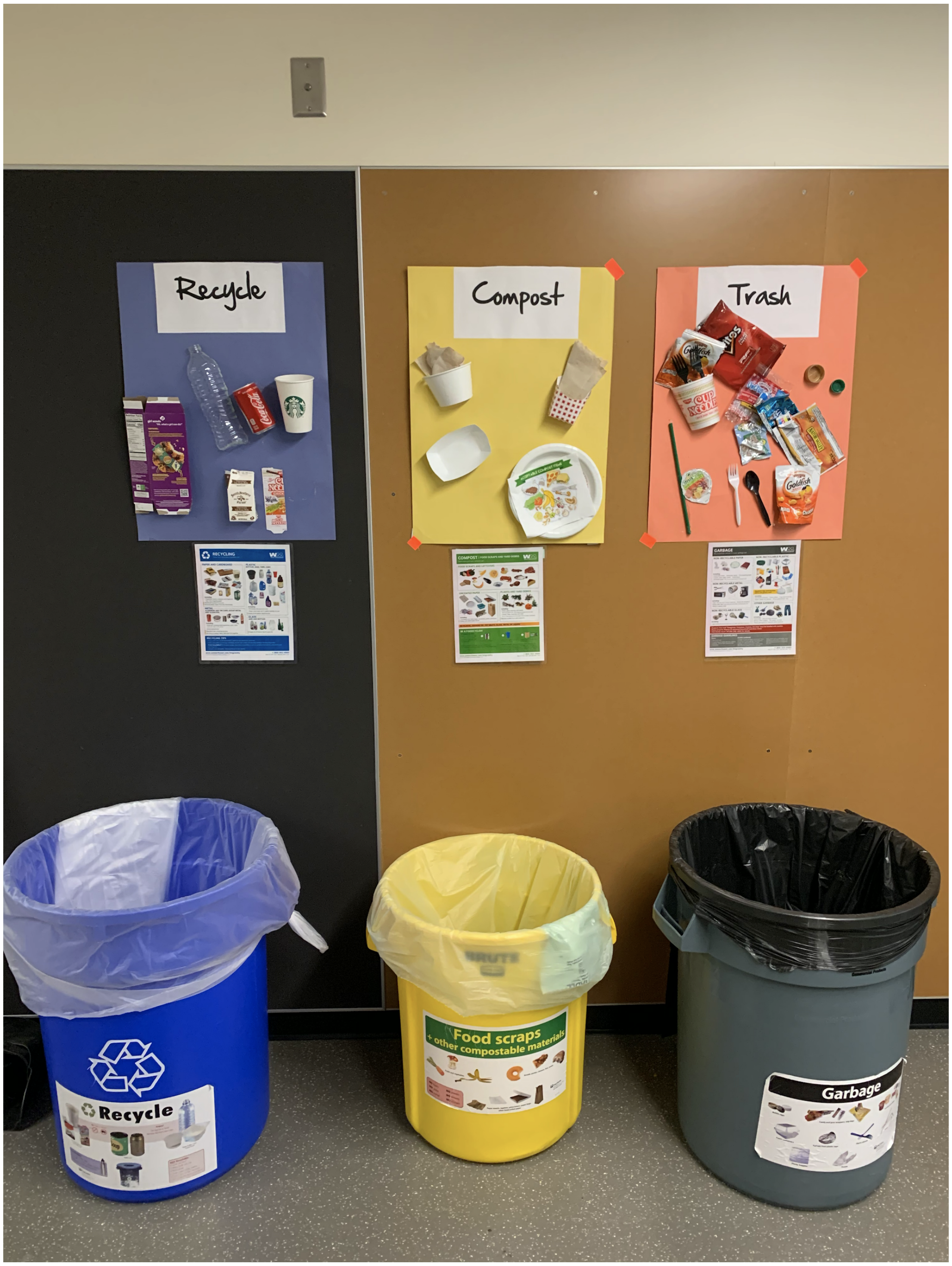
On every weekday (Monday, Tuesday, Wednesday, Thursday, and Friday) after school, all eight compost bins were gathered and taken to a single area. A process called "consolidation," which is combining bags in a bin that is not filled with other bags that are not full of compost. During the process, the composter looks in each bag for contaminants. These contaminants are any substance that cannot be composted, including but not limited to plastics (chip bags, water bottles, utensils, etc.), styrofoam, and metal. Then, a score was given--determined from zero, no contamination, to seven, all compost was contaminated. After gathering the bins, consolidating, and determining the contamination score, the bags are weighed and recorded on *Google Sheets*. This spreadsheet includes specific dates and data entries for total compost weight, contamination levels, and a comprehensive personnel schedule at the top of the document -- all for effective organization of all the data. The scale, illustrated below, was calibrated each month with a one-kg weight. A compost can would be placed on the scale and the scale was "zeroed" by using the "Tare" button on the control panel. Bags were placed in the bin, and the weight was recorded on the spreadsheet. After all the bags were weighed, they were placed in the outside compost bin awaiting pickup and processing by the Cedar Grove Composting Company. After pickup, liners were placed in the empty cans, which then were placed in their assigned positions.

Figure 2:

Smart Digital Heavy-Duty Weight Scale [2]

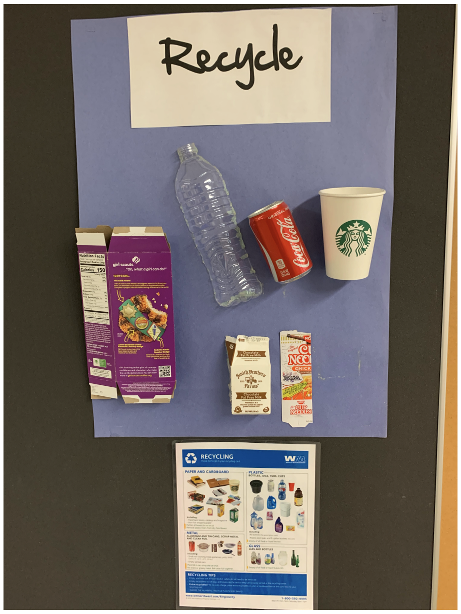
On the wall above where the bins are located, SU2C created posters, 24 inches by 18 inches (61 cm by 46 cm), that had physical examples of respective materials glued on them (what should be recycled, composted, and trashed) in order to provide a clearer picture of what bin the item should be sorted into. At *Tesla STEM*, the recycle bins are blue, **(See figure 4)** so the educational poster had a blue background. Similarly, the compost bin is yellow so the poster has a yellow background **(See figure 5)**. The only poster that has a different color than the bin was the trash bin, which was black, but the poster was orange, so the items on the poster could be seen easier **(See figure 6)**. In the first iteration of the posters, the whole item was hot-glued onto the colored paper backing **(See Figure 3)**. However, we soon found out that the larger items, like water bottles or the styrofoam Ramen, were falling off. Therefore, in the second iteration of the posters, we cut the big items in half in order to first, save money by reducing the amount of materials used, and second, increase the surface area of the poster backing.

Figure 3:



The *Tesla STEM* general bin layout with posters

Figure 4:



Picture of recycling poster at *Tesla STEM*

Figure 5:

Picture of compost poster at *Tesla STEM*

Figure 6:

Picture of trash poster at *Tesla STEM*

Result:

There was 3,644.20 pounds of compost over 113 days. The average (arithmetic mean) contamination score was 2.1[(summation of contamination scores)/113 days]. An estimated 3,644.20 pounds of compostable material (which diverts greenhouse gas emissions towards useful purposes) diverted from the landfill.

From 4/15 to 4/26, there are no posters at the bins to guide people where to throw their items. From 4/30 to the end (6/18), new posters were posted with additional items that should not be placed in bins after we observed those items that were being missorted from the disposable population, as well as more items to draw attention to them. For example, we placed multiple plastic straws on the poster instead of one so it’s easier to spot. The two anomalously high values in weight, 2/19 and 6/4, were mostly caused by an increase in kitchen food waste.

Figure 7:

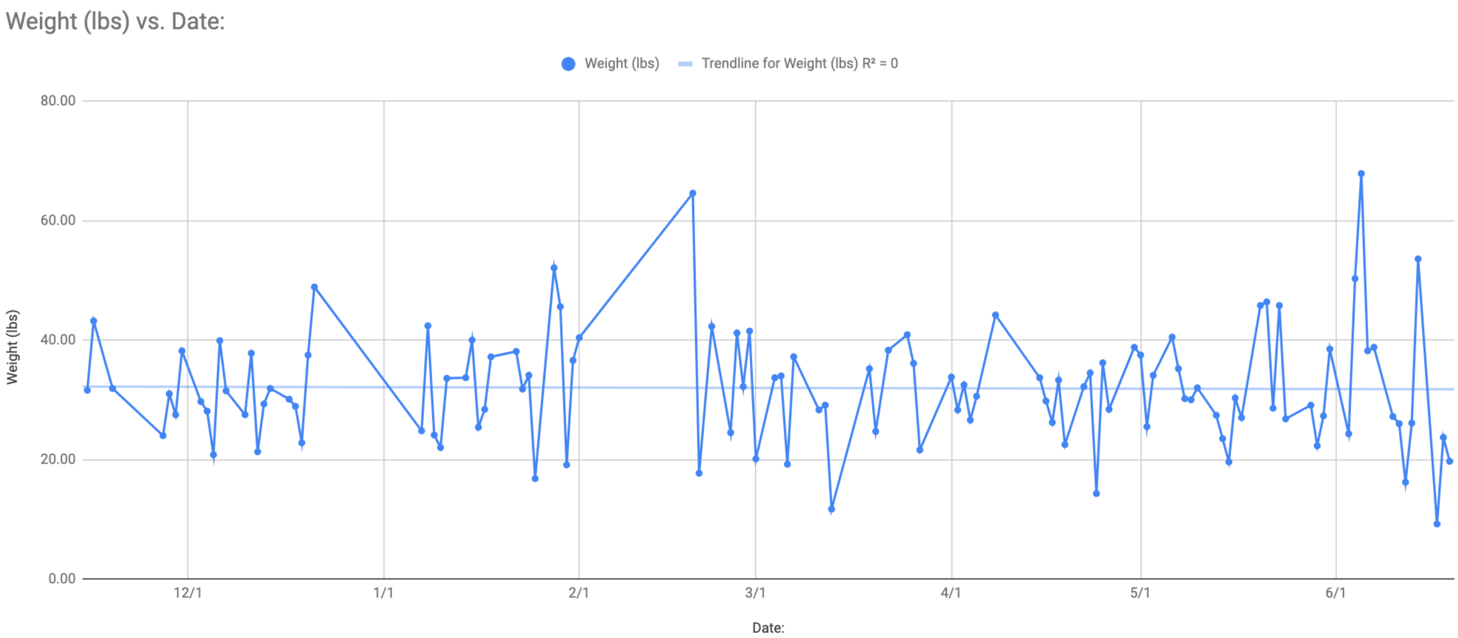
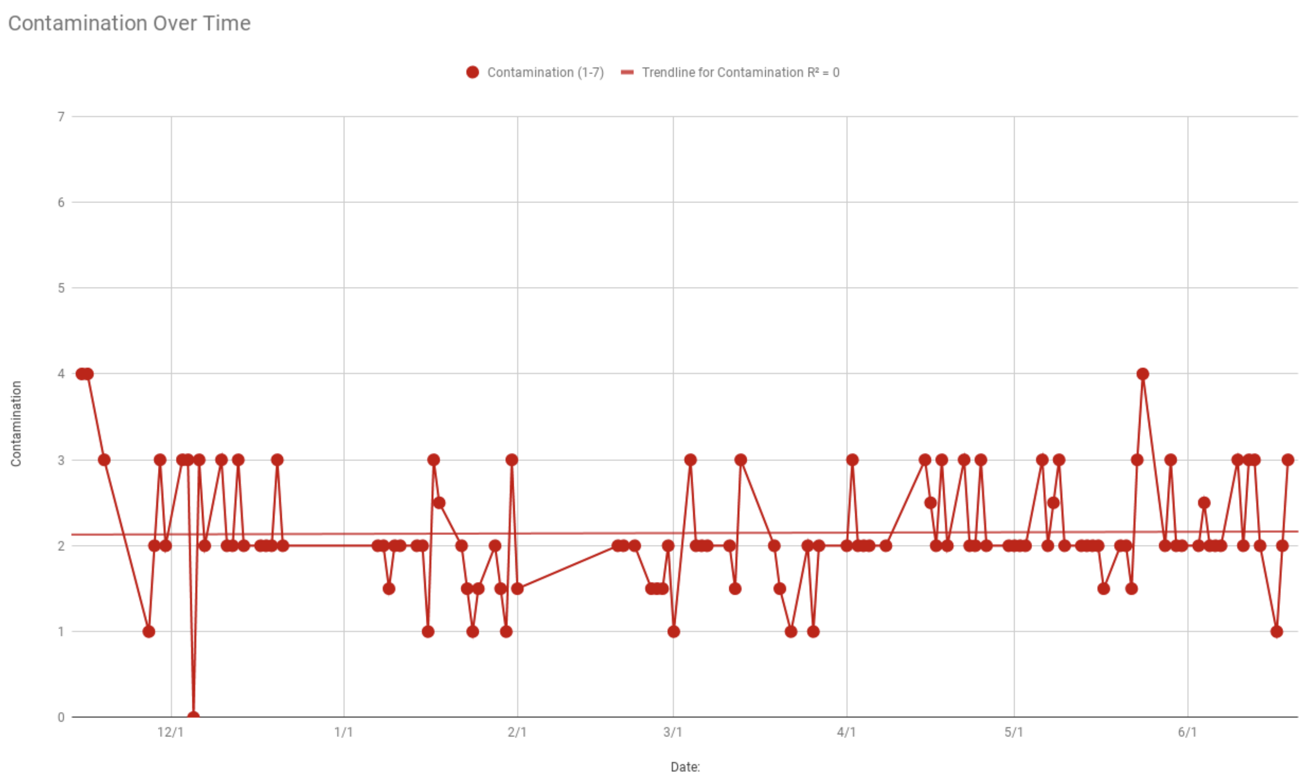


Figure 8:



Discussion:
As a result of implementation of the *SU2C* compost program, the school has seen widespread student involvement in composting efforts and expected diversion of greenhouse gas emissions towards useful purposes. Improving existing elements of the composting program, utilizing relatively larger compost bins (i.e., marginally larger than the surrounding recycle and trash bins) can elicit attention from unaware or compost-uneducated students. Having a planned schedule for various volunteers, especially students to stand near compost bins and enforce rules and to educate persons visiting the bins in the real-time would potentially decrease compost contamination levels across the board. A major purpose of any compost program and associated campaign is to educate the student or people at any given location. This can primarily be achieved by establishing new student outreach and presentations regarding specific sorting questions and educating people on the basics of what to compost; this undoubtedly will lead to decreased contamination levels and longevity of the program. A specific example of this at *Tesla STEM* was freshman outreach presentations (involving composting demonstrations and recreational quizzes related to proper composting practices). There is a valid and defined reduction of uncontrolled greenhouse gas emissions as a result of implementation of a *SU2C* compost program, saving both significant amounts of money while definitively contributing toward environmental improvement.

Conclusion:
This scientific case study aims to illustrate the successful *SU2C* compost program that was implemented at *Tesla STEM* and the various specific aspects of it. Through following these guidelines and suggestions, any location or school can divert greenhouse gas emissions for useful purposes. Throughout implementation of the *SU2C* compost program, the prevalence of a defined structure and adherence to those guidelines is critical to maximum reduction of compost contamination levels and reduction of uncontrolled greenhouse gases through efficient composting.

Citations (APA):

1. The Eco Guide, J. (2016, September 17). How much can composting help to reduce my carbon footprint?. Retrieved from https://theecoguide.org/how-much-can-composting-help-reduce-my-carbon-footprint (2019, December 10).
2. Smart Weigh. Digital Heavy Duty Shipping and Postal Scale with Durable Stainless Steel Large Platform, 440 lbs Capacity x 6 oz Readability. Retrieved from https://amazon.com/gp/product/B0153I0418/ref=ppx_yo_dt_b_asin_title_o05_s00?ie=UTF8&psc=1 (2019, November 12).
3. **Figure 1:** Cedar Grove. Retrieved from https://cedar-grove.com/about-us (2020, January 12)
4. Schools Under 2C. Retrieved from https://www.schoolsunder2c.org/our-mission (2019, November 15).