

DEVELOPMENT AND IMPACT OF A PILOT PROGRAM AND EDUCATIONAL
CAMPAIGN TO ADDRESS FOOD WASTE AND RECYCLING KNOWLEDGE
AND BEHAVIORS IN A PUBLIC ELEMENTARY SCHOOL

by

Liesel Sumpter

Submitted in partial fulfillment of the
requirements for Departmental Honors in
the Department of Nutritional Sciences

Texas Christian University

Fort Worth, Texas

May 4, 2020

DEVELOPMENT AND IMPACT OF A PILOT PROGRAM AND EDUCATIONAL
CAMPAIGN TO ADDRESS FOOD WASTE AND RECYCLING KNOWLEDGE
AND BEHAVIORS IN A PUBLIC ELEMENTARY SCHOOL

Project Approved:

Supervising Professor: Gina Jarman-Hill, Ph.D., R.D., L.D.

Department of Nutritional Sciences

Ann Van Beber, Ph.D., R.D., L.D., C.F.C.S

Department of Nutritional Sciences

James Petrovich, Ph. D., L.M.S.W.

Department of Social Work

ABSTRACT

Objectives: 1) Create a sustainability pilot program that includes recycling, composting, and a Share Table to reduce cafeteria and other school waste. 2) Measure the impact of the pilot program on elementary school children's knowledge and behaviors related to waste.

Background: Approximately 40% of food produced in the U.S. goes uneaten each year. Meanwhile, 45% of food served in elementary schools is wasted.

Methods: A 52-question survey was developed to measure knowledge and behaviors related to food waste, composting, and recycling. Researchers administered the pre- and post-surveys to a convenience sample of elementary school children before and after an educational campaign and the implementation of an eight-week sustainability pilot program.

Results: First through fifth grade children served as participants and completed 191 surveys including pre-surveys (n=97) and post-surveys (n=94). Mean participant age was 8.62+/-1.6 years. Following the educational campaign and pilot program, total compost knowledge scores improved significantly ($p<0.01$). Additionally, subjective knowledge of food waste and subjective knowledge of composting both improved significantly ($p<0.01$). Participants were more likely to report that they shared food that they did not want to eat following the pilot program and educational campaign ($p<0.05$). Participants who agreed that composting fights food waste were more likely to report eating leftovers at home ($r=.29$, $p<0.01$).

Conclusions: Sustainability programs may be successfully implemented in schools to promote positive behaviors and improve knowledge among children related to recycling, composting, and food waste reduction efforts. These efforts may positively influence behaviors at both school and in the home. Ongoing education is necessary as evidenced by consistent inaccuracies following an educational program. However, sustainability efforts in schools can help address the current food waste crisis facing the United States.

Introduction

Each year approximately 40% of the food produced in the United States goes uneaten.¹ Nationally, this translates to 133 billion pounds of food waste with a cost of over \$161 billion according to the USDA.² Shockingly, the majority food waste in the United States occurs at the consumer level through household waste. Outside of the home, school cafeterias consistently put large amounts of food waste into landfills each year. Each day children who eat in schools, as well as the cafeteria employees, throw away pounds of uneaten food, plastic food containers, milk cartons, napkins, utensils, and more. While a small portion of the waste must go to a landfill to decompose, the majority of the waste by weight coming out of the school cafeteria could be recycled or composted. In fact, food waste accounts for the largest percent of material in everyday trash, or 22% of discarded municipal solid waste.³ If this material were successfully diverted from the landfill to be recycled or composted, the rate of the volume of waste piling up in landfills would decrease. This in turn would increase the lifespan of the landfill and produce fewer carbon emissions. Food waste also contributes to food insecurity, which refers to an individual being unsure of where their next meal is coming from. Reducing food waste may improve food insecurity. As leftover food is diverted from the landfill, that food can be used to feed people experiencing food insecurity.

The goal of this research study was to effectively educate children about the importance of reducing food waste and other waste while increasing sustainability efforts. Purposes of this study include describing waste in a Fort Worth elementary school and creating a model to reduce waste that may be replicated in other schools. Researchers obtained Institutional Review Board approval for this study. Additionally, researchers received a Science and Engineering Research

Center, SERC, grant from Texas Christian University to cover the costs of the pilot program implementation.

At the beginning of the study, surveys for children were conducted to gain an understanding of initial knowledge, attitudes, and behaviors about composting, recycling, and food waste. Employees from Cowboy Compost, a local composting company, spoke to students and faculty at two separate all-school assemblies. Additionally, these employees met with each class individually over the course of a day and a half. After this introduction, an educational campaign began throughout the school to inform students, faculty, and parents about the correct disposal of food waste, recycling, and trash. This gave students hands-on practice in determining the correct bin for their waste. A Share Table was also introduced at this time which offered a location for students to place whole items of leftover food and unused, sealed utensil packages. At the end of the educational campaign, a follow-up survey was performed to assess whether knowledge, attitudes, and behaviors had changed due to the educational campaign.

Each component of this research study shared a common goal of diverting waste from the landfill. Overall, our study aims to see a reduction in waste at the school while developing a sustainability pilot program that can be replicated at other schools.

Literature Review

Food waste has a variety of detrimental impacts on society including greenhouse gas emissions, deforestation, water scarcity and pollution, soil erosion, reduced biodiversity, and the resulting individual health problems due to these factors.⁴ A reduction in food waste would have economic, environmental, and individual health benefits. With the population increasing, reducing food waste can help reduce food insecurity. By 2050, food production will need to increase by 70% to meet the needs of the estimated nine billion people living on the planet.⁵ If

food waste is cut in half by 2050, this will supply about one-quarter of the expected increase in demand to feed the growing population.⁴

The USDA defines low food security as reduced quality, variety, or desirability of a diet. Therefore, many children from food insecure households are likely exposed to a smaller variety of foods and therefore have a lower nutrition quality diet. Food insecure adults are more likely to purchase foods that are energy-dense with low nutrient density, which leads to reduced consumption of a variety of fruits and vegetables.⁶ Low-income families are also less willing to risk wasting money on food children may refuse to eat such as various fruits and vegetables.⁷ Waste issues with children are not uncommon since it can take a two-year-old child between five and ten exposures to a new food before the food is even accepted.⁷ Researchers have found that preferences for foods increase with exposure and humans have an inherent preference for sweet, energy-dense foods.⁷ Therefore, eating habits of food insecure adults likely impact child intake of highly processed, high fat, and high sugar foods. This in turn has an effect on food preferences, overall health, and food waste in schools. With a decreased acceptance of various fruits and vegetables, school cafeterias see increased waste of these foods by children.

There is little evidence of the effectiveness of implementing composting and waste reduction programs in U.S. elementary schools. A qualitative study by Blondin et al assessed reasons for waste in public elementary schools during breakfast. Researchers found that waste varied based on the students' age and the type of food served. The teachers who were interviewed reported that the largest amount of cafeteria food waste came from milk. Another commonly reported reason for elementary school food waste was some children's inability to consume certain foods due to inadequate motor skills, such as those required to peel an orange. A concerning factor of cafeteria food waste was that children did not have adequate time to eat at

school meal periods.⁸ While increased food waste is the primary concern of this study, it should not go unnoticed that food waste related to children's inadequate intake equates to their low consumption of necessary nutrients to fuel their brains at school.

To measure waste on a quantitative scale, Schupp et al conducted waste audits at two high schools, two middle schools, and 14 elementary schools in King County Washington. Of these schools, ten had already implemented composting programs, fourteen had initiated Share Tables for leftover food, and twelve had a monitor to ensure that food was correctly sorted into the appropriate disposal bins. The results of this study demonstrated that waste was more thoroughly sorted into the correct bins in schools that had composting programs.⁹

Lauri et al examined the effectiveness of partnerships between nonprofit Washington Green School, TerraCycle, Waste Management, and the Public Utility District's Education Team. Researchers conducted a food waste audit before educating students and staff on sustainable practices such as recycling, composting, and waste reduction. After the educational component, researchers performed a post-implementation waste audit following the same protocol as the first audit. A "Green Team" composed of students helped implement the waste-reduction program. At the conclusion of the study, researchers found that after three months landfill-bound garbage from the school decreased by 62%. This reduction was largely due to recycling milk and juice containers and refraining from using Styrofoam trays.¹⁰

Substantial literature reviewed either reported qualitative aspects of the waste activities in schools or reported quantitative waste audits exclusively. This research study gathered both qualitative data assessing student reasoning for food waste in addition to gathering quantitative data used to assess all forms of waste. Additionally, an educational program was implemented and data was gathered before and after the program. To the researchers' knowledge no study has

been done in the Fort Worth, TX area, making this research a unique addition to current knowledge about the effectiveness of waste management programs in Texas schools.

Methods

Participants in this study included elementary school students at North Hi Mount Elementary school. Students from each grade level (kindergarten through fifth grade) participated. Participants were recruited through flyers sent to parents and faculty via email from the school principal and posts made in online parent group message platforms. Parents then consented for their children to participate. At the start of the study, a preliminary survey was given to participants to assess their initial knowledge, attitudes, and behaviors pertaining to composting, recycling, and food waste. The children were surveyed in their classrooms with hard-copy, paper surveys consisting of 52 questions. A PowerPoint presentation was shown at the front of the classroom that displayed pictures aligning with each question. Students were instructed to silently complete the survey questions with the aid of the images on the slideshow for reference. Researchers read each question aloud and displayed the PowerPoint. Students were encouraged to honestly answer the questions to the best of their ability.

After initial survey data was collected, an educational campaign began within the elementary school to inform students, faculty, and parents about the correct disposal of food waste, recycling, and trash. At the beginning of the campaign, employees from Cowboy Compost, a private composting company in Fort Worth, TX, and the study's faculty researcher, Dr. Gina Jarman-Hill, spoke to the entire school during separate assemblies to announce the project and discuss food waste. The presentation was given to an assembly of kindergarten through second grade classes and then to third grade through fifth grade classes. Following the assembly, Cowboy Compost and Fort Worth Waste Department employees met with each class,

composed of 17 to 23 students per class, in the library over the course of a day and a half to educate students on composting and recycling practices in the school cafeteria. Students were given a hands-on activity to aid in learning about recycling and composting.

To bolster the campaign, posters, infographics, and marketing materials were created and displayed around the school's building to promote sustainability efforts. Waste separation in the cafeteria continued at both breakfast and lunch periods. Children were instructed to separate their waste into collection bins for garbage, composting, and recycling. The cafeteria portion of the study lasted eight weeks. In the cafeteria, a specific adult monitor was assigned to instruct children in the school lunchroom and assist with proper disposal of school breakfast and lunches. Volunteers were also placed in the cafeteria to aid the monitor in supervision and instruction over the course of the eight-week cafeteria portion. The educational campaign included the introduction of a Share Table program. The objective of a Share Table is to divert potential food waste from the landfill and while simultaneously making this food available to another hungry student. Students are encouraged to place any uneaten, pre-approved foods on a table in a neutral space of the cafeteria. Unused, sealed plastic utensils and napkins are also approved of for placement on the Share Table. Other students are then allowed to take food off of the Share Table for their meal or snack. Approved foods include whole fruits and vegetables and uneaten, non-perishable foods.

Following the educational campaign, a second survey was conducted within the classrooms to assess whether or not changes occurred in participants' sustainability-conscious knowledge, attitudes, and behaviors after the educational campaign had concluded.

Results

Upon the completion of data collection within the school, participant survey data was coded for data analysis. Coded survey data was analyzed using IBM SPSS Statistics data analysis software to examine frequencies and correlations in participants' knowledge, attitudes, and behaviors before and after the educational campaign.

After the surveys had been conducted, researchers removed the kindergarten participants' data from analysis due to excessive incomplete surveys and reports of confusion by researchers among kindergarten classes at the time of survey administration.

For the purpose of data analyses, the study's participants included first through fifth grade children who completed 191 surveys including pre-surveys (n=97) and post-surveys (n=94). The mean participant age was 8.62 \pm 1.6 years. Following the educational campaign and pilot program, total compost knowledge scores improved significantly ($p < 0.01$). Findings from the study showed a significant increase ($p < 0.01$) in students' subjective knowledge of composting with a mean change from 3.63 \pm 1.283 on the first survey to 4.33 \pm 0.964 on the second survey. A significant increase ($p < 0.01$) was also seen for the question, "I think composting helps fight food waste," with a mean change from 4.00 \pm 1.267 on the first survey to 4.76 \pm 0.569 on the second survey. Participants who agreed that composting fights food waste were also more likely to report eating leftovers at home ($r = .29$, $p < 0.01$).

Participants reported improved learning in recycling, composting, and food waste at school. All three questions were found to have increased significantly ($p < 0.01$) between the first survey and the second survey. Additionally, subjective knowledge of food waste and subjective knowledge of composting both improved significantly ($p < 0.01$).

Following the campaign, participants were more likely to report that they shared food that they did not want to eat. Improvement in students' attitude and behaviors towards food waste

was found regarding the statement: “I share food that I do not eat”. For this survey question students’ answers showed a significant increase ($p < 0.01$).

Discussion

Data analyses revealed areas where improvements were made, as well as areas where more accurate data is needed and continued education is necessary. Students’ total composting knowledge did increase before and after the educational campaign, meaning that on average students had more correct answers on the second set of classroom surveys. This evidence provides a basis for continued composting in the school cafeteria because of the hands-on learning experience children received when actively engaged in composting at school. Furthermore, data showed that subjective knowledge of composting and food waste also improved. This means that participants believed they knew more about food waste and composting at the conclusion of the educational campaign and supports that their knowledge of composting improved because of the educational campaign and cafeteria intervention. Upon analyzing the survey results, total food waste knowledge did not change significantly. However, this is because students’ objective knowledge mean scores were high on the first survey as well as the second survey.

Limitations within the study include staff changes and kindergarten students’ limited understanding of the content. During the educational campaign and cafeteria training portion, the cafeteria monitor changed. This change had the potential to interfere with consistent instructions to children regarding what can and cannot be composted or recycled. Another limitation was the requirement of recruiting dozens of volunteers to assist every meal period. The volunteers in the cafeteria were constantly changing, leading to a lack of consistency and the potential for information being conveyed incorrectly. However, abundant signage was available to help

volunteers follow the directions to understand the process. The last limitation was working with the school's schedule. The composting and recycling during breakfast were discontinued as a result of student tardiness to class with a short breakfast period. Another limitation related to the survey was that some questions were not relevant to items encountered at school such as pizza boxes, tea bags, and cans.

One of the first barriers to the implementation of the pilot program included the cost of commercial composting. Using Cowboy Compost for compost collection services at North Hi Mount Elementary School cost approximately \$150 per week with a generous company discount. These funds were covered by the TCU SERC grant; however, the grant funds were not intended to pay for long-term use of Cowboy Compost services. Another barrier was that recruiting volunteers to instruct students in the cafeteria at every meal period over the course of eight weeks can be difficult. Receiving approval from the Fort Worth Independent School District and Fort Worth Waste Department was an initial barrier to starting the pilot program, especially one requiring expenses, volunteers, and approval from school and city officials. The last barrier present in the study was related to managing the allergies of elementary school students when establishing the Share Table program. North Hi Mount Elementary is a smaller school, so larger schools would face a larger number of potential food allergy concerns. There are not absolutely accurate ways to ensure that a student with a food allergy does not accidentally pick up a food item from the Share Table that triggers their allergy since the Share Table is not consistently monitored.

While limitations and barriers present in this research study required additional thought and attention to manage, numerous positive factors point to the success of the pilot program. As of March 2020, the program at North Hi Mount Elementary School had continued at every lunch

period. Other schools in the Dallas-Fort Worth metroplex have initiated their own sustainability programs and requested information from North Hi Mount's campaign. Additionally, students conveyed that they were sharing the information about waste at home with their parents, which could have a larger impact on overall waste and food waste habits in Fort Worth households.

Conclusion

Conclusions from this study support an increase in elementary school students' knowledge through the implementation of a pilot program including an educational component. Beyond an improvement in knowledge, participants reported improved attitudes and behaviors towards sustainable practices. The implementation of this pilot program can benefit schools and students by decreasing food waste and thereby reducing food insecurity as well. Limitations and barriers of program implementation include funding, volunteer recruitment, and approval processes. However, other schools have successfully replicated aspects of the pilot program since its initiation in February 2019. While other research has concluded that nutrition education is minimally effective at reducing food waste in schools, future research should explore the impact of nutrition education in combination with food waste education on waste behaviors.¹¹

References:

1. Vogliano, C. Brown, K. The state of America's wasted food and opportunities to make a difference. *J Acad NutrDiet.* 2016;7:1199-1207.
2. OCE | U.S. Food Waste Challenge | FAQ's. *USDA.*
<https://www.usda.gov/oce/foodwaste/faqs.htm>. Accessed May 2, 2019.
3. Sustainable Management of Food Basics. *EPA.* <https://www.epa.gov/sustainable-management-food/sustainable-management-food-basics>. Published April 26, 2019. Accessed May 2, 2019.
4. Food and Agriculture Organization of the United Nations. Mitigation of food wastage societal costs and benefits. <http://www.fao.org/3/a-i3989e.pdf>. Published 2014. Accessed December 2019.
5. Research Program on Climate Change, Agriculture and Food Security (CCFS): A global hotspot analysis on food loss & waste and associated greenhouse gas emissions-Working Paper No 290.
<https://cgspace.cgiar.org/bitstream/handle/10568/106249/WP290.pdf?sequence=3&isAllowed=y>. Published 2019. Accessed April 2020.
6. Spees CK, Clark JE, Hooker NH, Watowicz RP, Taylor CA. Dietary intake contributions of food and beverages by source and food security status in US adults. *J Nutr Educ Behav.* 2017;49(8):667-673. <https://doi.org/10.1016/j.jneb.2017.01.009>.
7. Connell PM, Finkelstein SR, Scott ML, Vallen B. Preventing food waste and promoting healthier eating among lower-income families in industrialized nations. In Preedy V.R, Patel VB, eds. *Handbook of Famine, Starvation, and Nutrient Deprivation* Pages. Springer International Publishing; 2017:1-17.
https://www.researchgate.net/publication/319035800_Preventing_Food_Waste_and_Promoting_Healthier_Eating_among_Lower-Income_Families_in_Industrialized_Nations; Accessed April 2020.
8. Blondin SA, Djang HC, Metayer N, Anzman-Frasca S, Economos CD. 'It's just so much waste.' A qualitative investigation of food waste in a universal free school breakfast program. *Public Health Nutr.* 2014;18(9):1565-1577. doi:10.1017/S1368980014002948.
9. Schupp CL, Getts KM, Otten JJ. An evaluation of current lunchroom food waste and food rescue programs in a Washington state school district. *J Agric Food Syst Community Dev.* 2018;8(1):167-186. <http://www.foodsystemsjournal.org/index.php/fsj/article/view/573/554>. Accessed May 3, 2019.

10. James L. Facilitating lasting changes at an elementary school. *International Electronic Journal of Elementary Education*. 2016;8:443-454.

11. Byker Shanks C, Banna J, Serrano EL. Food waste in the national school lunch program 1978-2015: A systematic review. *J Acad Nutr Diet*. 2017;117:1792-1807.