

## **Haste To No Waste: A Multi-Component Food Waste Study in a University Dining Facility**

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### **Abstract**

In universities across the United States, about 3.6 million tons of food is wasted annually. Food waste accounts for the largest landfill deposit and an average annual loss of \$100 billion. Some food waste research has been conducted in university settings, yet additional work is necessary to understand food waste perceptions and behaviors of young adults. Among this population, text messaging is the most common form of mobile communication and an emerging means of education. The primary aim of this pilot study was to determine university students' knowledge, attitudes, and behaviors about food waste. The secondary aim was to evaluate the impact of a text message based educational intervention on individual food waste. The survey instrument was developed in Qualtrics using validated questions identified in the literature and additional study specific questions regarding participant food waste knowledge and behaviors. A convenience sample of female university students living on campus with meal plans (n=55) was recruited during fall 2014. At baseline (October 2014) and post intervention (December 2014) participants completed an online survey and individual plate waste was measured by research staff in an al-la-carte cafeteria setting. Educational text messages were disseminated to participants using cell phone technology over a 4-week period and focused on four food waste themes identified from the baseline survey results: environmental effects, use-by-dates on food, impact of one person, and make a change. Data will be analyzed to measure the effectiveness of the educational intervention by assessing the pre/post plate waste differences and changes in knowledge, attitudes and behaviors towards food waste. Participants (mean age= 19 years) were primarily white (63.4%), in their first year at the university (56%) and had either the largest or second largest meal plan offered (87.5%). Mean baseline food waste was 17.9 g (n=39). Baseline data suggest that participants often keep leftovers (80.5%) and follow use-by dates on food packages (70.7%). Environmental sustainability is very important to participants (70.7%) yet only 51.2% reported an excellent understanding of environmental sustainability. Post intervention data collection is in progress. To our knowledge, this novel nutrition education approach targeting food waste knowledge, attitudes, and behaviors of young adults has not been utilized previously. These data will guide development of future research with a larger, more diverse sample and aid in implementing effective waste-reduction strategies in university settings.

**Keywords: Food Waste, Food Systems/Sustainability, Catholic Social Teaching**

### **Introduction**

#### **1.1 Food Waste And Sustainability**

In the United States (U.S.), over 35 million tons of food is wasted each year, equating to a daily average of 0.16 to 0.67 pounds of food per person<sup>1</sup>. Food waste accounts for the largest landfill deposit, followed by plastic, with about 21% of landfills being taken up by food waste. Food in the landfills rots and produces methane gas (CH<sub>4</sub>), which is the second most prevalent greenhouse gas in the United States. Methane has 20 times greater impact on climate change than carbon dioxide over a 100-year period<sup>2</sup>. Hall et al. estimates that total food loss in the United States requires an

expenditure of over 25 percent of U.S. freshwater consumption, used in farming, and four percent of total U.S. oil consumption, required for transporting foods<sup>3</sup>.

In addition to environmental impacts, food waste has economical impacts as well. Food waste in the United States averages \$100 billion per year in losses with about \$35 billion occurring in the commercial and retail sector and \$20 billion occurring in the farming and food processing industry<sup>1</sup>. In 2010, the average cost of food loss in the United States per capita was between \$400 and \$522 per year, which equates to over \$1 each day spent on food that goes uneaten<sup>4</sup>.

Social concerns are also associated with the issue of food waste. Over 802 million Americans are food insecure which is defined as when the food intake of one or more household members is reduced and eating patterns are disrupted at times of the year because the household lacks money and other resources for food<sup>4</sup>. The government has implemented programs and laws to reduce food waste in institutions such as the “Food Recovery Challenge” and the “Good Samaritan Act”. The “Food Recovery Challenge”<sup>5</sup> is a program for businesses or organizations, which aims to reduce food waste by providing incentives such as national recognition and free resources to conduct waste assessments<sup>5</sup>. The “Good Samaritan Act”<sup>6</sup> was passed in 1996 with the goal of protecting organizations that donate foods, which would otherwise be wasted, to non-profit organizations. Yet both of these programs are highly underused, with only 889 organizations participating in the Food Recovery Challenge in 2014.

## 1.2 Theological And Philosophical Perspectives

In a conversation with Sr. Amata Miller, IHM (October 2014), Catholic Social Teaching<sup>7</sup> (CST) it was discussed as a framework that is used by, not only the Catholic tradition, but also many people to assess social issues including the issues of hunger and food waste. The tenants can be categorized differently, resulting in varying total number of CST principles. The basic CST principles include: Human Dignity, Community/Common Good, Rights and Responsibilities, Priority for the Poor and Vulnerable, Participation, Dignity of Work/Worker’s Rights, Solidarity, Stewardship, Governance/Subsidiarity, and Promotion of Peace. There are several principles that can be applied to food matters.

The fundamental principle of CST is the dignity of the human person and all of the tenants stem from this principle. This principle states that each person has a dignity, a right to life, and a right to the things that are necessary to life<sup>7</sup>. One of the most basic needs of life is food and water. With the problem of food insecurity and worldwide hunger, it is clear that this first principle of CST is not being met. Only when people recognize the dignity of each person, will they care to work for just institutions.

Another principle is that of “solidarity”, or brotherhood, which recognizes the interdependence of the human race. We are all related, from our local communities to those living across the world<sup>7</sup>. The principle of the “common good”, which states that the members of a community have a responsibility to ensure that every person’s basic needs are met, is applicable to food distribution and waste<sup>7</sup>. A society should share all resources, including wealth, land, power, and food<sup>6</sup>. The problem of world hunger is not one of production, but rather of distribution.

A fourth principle of CST that applies to hunger and food waste is that of the “universal purpose of material things” which states that everything is a gift and is meant to be shared for the good of all<sup>7</sup>. This directly relates to food and hunger because the wasted food is not being treated as a gift, but rather an indispensable object. If we took the principle of “universal purpose of material things” seriously, then food would be considered a gift and it would be shared so that no person would go hungry.

The principle of “subsidiarity”, which states that decisions should be made as much as possible by those most affected by the decision<sup>7</sup>, is applicable to food and hunger. The local food movement is a prime example of this concept because it reduces the amount of people involved in the production and purchasing of foods. Closely related to this are the principles of “transformation of social institutions” and “responsibility” for society. Injustice, as in food waste and hunger, can only be changed by a transformation of the culture and society regarding food production, processing, and distribution. This transformation can only happen through the action of responsible peoples who will work to ensure just societies and systems.

While Catholic Social Teaching can provide one framework for looking at the problem of hunger and food waste, another perspective is that of consumerism. Miller describes a consumer culture as “a situation in which elements of culture are readily commodified.”<sup>8</sup> Food is one such commodity, where “elaborate rituals of planting, harvesting, preparation, and sharing are stripped to their elemental form, reduced to the crude consumption of purchased foodstuffs.”<sup>8</sup> Miller explains how supermarkets enforce a mentality of commodification by having shelves of products, which “compete with each other for our attention.”<sup>8</sup> The commodification of foods is not limited to supermarkets, but nearly every foodservice facility contributes to this culture as well. Miller explains that commodities hide the

conditions of production, in which the purchaser has no idea where the products came from nor has any connection to the farmer. The result is that the food has no meaning to the person. Treating food as a commodity can easily lead someone to dispose of it without any thought about the “calloused hands and stooped backs of the workers,”<sup>8</sup> which produced the items.

Commodification can take two forms: completely and incompletely commodified, as Margaret Jane Radin describes in *Contested Commodities*<sup>9</sup>. Completely commodified objects are limited to market exchange and the worth of the item is reduced to merely a price tag. Incompletely commodified objects include those that simultaneously have both a market and non-market value. For example, home ownership, could be labeled as incompletely commodified. While the “home” holds value: memories and comfort, the insurance and mortgage payments result in the object viewed as merely a “house”. Consider grocery stores, where food must be somewhat commodified for the business to be sustained. Yet, the value of food, as related to labor, processing, family, traditions, and health, must be retained for food to have any meaning. In a consumerist culture, more aspects of life (work, health care, education, ect.) are becoming completely commodified and their worth is reduced to a market price. Food is quickly becoming more commodified, for a consumer culture that does not view food waste as a problem, identifies food as merely something with a price.

### 1.3 Food Waste In University Settings And Targeting The Population

In university settings across the U.S., about 3.6 million tons of food is wasted annually<sup>10</sup>. A food waste study completed at Kansas State University sought to understand the effectiveness of two different kinds of educational messages. Baseline food waste was collected for six weeks before the messages were implemented. First, a prompt-style message was posted in the facility for two weeks followed by a feedback-based message that was posted for two weeks. The simple prompt-style messages resulted in a food waste reduction of 15 percent. The following feedback-based messages did not stimulate further waste reduction. Whitehair et al. found that an average of 32 pounds of food was wasted per person per semester<sup>11</sup>. In the conclusions of their study, Whitehair et al. suggested the use of technology as a means of disseminating educational messages to young adults.

Technology has rapidly been developing across the globe and smartphones have become a primary means of communication. In the United States, 95% of Americans have a mobile phone subscription. After the second quarter of 2013, over 432 million smartphones were shipped worldwide<sup>12</sup>. Specifically, the young adult population has increased their use of smartphones, as evidenced by an increase from 41% of young adults owning a smartphone in 2010 to 62% in 2011<sup>13</sup>. Smartphone applications, or “apps” are popular among young adults and allow users to easily and quickly access various kinds of programs, including games, books, finance, religion, and music.

Educational information can be developed using different theories or models to guide message construction. Theories, such as Reasoned Action and Theory of Planned Behavior, describe whether a person implements a recommended behavior or if they abstain from a non-recommended health behavior. Factors such as knowledge, beliefs, locus of control, and self-efficacy have been shown to impact behavior adaptation<sup>14</sup>. The Social Ecological Model and Social Cognitive Theory are two models that describe the various factors that influence a person’s decisions. Specifically, these factors include individual, relational, communal, and societal<sup>15</sup>. These models have provided the theoretical framework for understanding behaviors of individuals, such as eating and physical activity, when utilized in intervention research.

A growing body of research focused on food waste has been conducted in university settings, yet additional work is needed to understand food waste perceptions and behaviors of young adults. This study aimed to determine university student knowledge, attitudes, and behaviors about food waste and to evaluate the impact of a text message based educational intervention on individual food waste. Secondary aims of the project included to gain an understanding of the relationship between at-home food experiences and food waste behaviors and attitudes and to understand the relationship between spirituality and food waste behaviors and attitudes.

## 2. Methodology

### 2.1 Study Design And Protocol

This study was approved by the Saint Catherine University Institutional Review Board and participants provided informed consent before beginning the study. The study included the following steps: development of the survey instrument, recruitment of participants, baseline data collection (survey and food waste), development and

implementation of a text message intervention, post-intervention data collection (survey and food waste), and post-intervention individual interviews. Data collection took place from September-December 2014.

## 2.1 Development Of The Survey Instrument

The Social Ecological Model and Social Cognitive Theory provided the theoretical framework for construction of the survey instrument used in this study. The survey was developed in Qualtrics<sup>16</sup> and contained validated survey questions identified from the literature including those used by Whitehair et al.<sup>11</sup> and Quested et al.<sup>17</sup>, as well as newly created study specific questions. The baseline survey contained a total of 25 questions and participants completed the survey in about 10 minutes. Questions targeted the following categories: environmental sustainability, dining habits, at home food experiences, cell phone usage, and the relationship between food and spirituality. Demographic questions were also included at the end of the survey.

## 2.2 Study Sample

A convenience sample of undergraduate university students at a mid-west college for women (n=55) were recruited during fall 2014. Inclusion criteria for participation in the study required that students lived on campus and had a meal plan. Recruitment methods included posting flyers around campus buildings and in the dining facility, tabling outside of the dining facility, and sending email messages to eligible participants, through contacts with Residence Life staff on campus. Informed consent was obtained from participants during the tabling event in the cafeteria in September 2014. No incentives were provided to participants for their involvement in the study.

## 2.3 Baseline Data Collection

A baseline survey was disseminated using Qualtrics in October 2014. Participants were allotted one week to complete the online survey. Email reminders were sent to participants who had not completed the survey within the first five days of survey dissemination. The survey was closed after two weeks of distribution.

Baseline food waste was collected on two consecutive days over the lunch and dinner service hours in October 2014. Arrangements were made with the campus foodservice director prior to data collection. Participants were notified of the specified waste collection days through an email message and anonymous text message. Trained research assistants were located at the point of sale and participants were directed to meet the assistant to receive instructions on the food waste protocol. The research assistant provided the participant with a study ID card, which the participant was to leave on their tray. The research assistant also noted the foods and liquids that were on the tray of each participant. When the participant was finished eating, they were asked to bring their tray with the ID card to the tray drop-off carousel where the food waste would be weighed. After the participant was finished eating, they brought their tray to the weigh station where a calibrated scale was used to measure the amount of edible food waste. All edible food waste and beverages other than water were weighed and recorded. Items not weighed include peels, cores, and bones. If there was negligible waste (such as remaining sauces and condiments) or if there was no waste, the participant received a waste amount of zero. The waste was removed and the scale was tared after each measurement was obtained.

## 2.4 Intervention Development And Implementation

Four educational text messages were disseminated to participants using cell phone technology over a 4-week period. The messages focused on four food waste themes identified from the baseline survey results: “environmental effects”, “use-by-dates on food”<sup>18</sup>, “impact of one person”, and “make a change”. The content of the messages were as follows: (1) “US food waste occupies the most landfill space (21%). Consider that 3.6 million tons of food are wasted each year in university settings.” (2) “Use-by” dates refer to best quality and aren’t required by law. If you store food properly, it will likely be safe after the “use-by” date.” (3) “802 million Americans are food insecure with reduced food quality and variety. Make small changes: compost food scraps, eat leftover food.” and (4) “Campus dining facilities are a large source of food waste. Advocate for sustainable practices on campus: go trayless, donate leftover food.” The four text messages were disseminated using “Remind”<sup>19</sup>, an online program that anonymously sends text messages to registered participants. The educational messages were disseminated each Monday throughout the month of November 2014; one message distributed per week.

## 2.5 Post-Intervention Data Collection

The post-intervention survey included the same questions from the baseline survey with the addition of eleven questions that addressed spirituality in relation to food waste, behaviors while dining with others, and effectiveness of the text message intervention. The survey was disseminated in December 2014 to participants using Qualtrics and participants had one week to complete the survey. Email reminders were sent to participants who had not completed the survey within the first five days of survey dissemination. The survey was closed after two weeks of distribution.

Post-intervention food waste collection followed the same procedure as at baseline. All edible food waste and liquids other than water were weighed using a calibrated scale and recorded. If no waste was observed, the participant's waste was recorded as zero.

## 2.6 Individual Interviews

Individual interviews (n=7) with a subset of interested participants were conducted after the post-intervention waste collection and survey administration was completed. A private time and meeting space was arranged for the interviews, which lasted between 20-45 minutes. Interview questions addressed sustainability knowledge and attitudes, home influence on food waste behaviors, effectiveness of the intervention text messages, and modification of eating behaviors that may have occurred during data collection. Each interview was recorded and transcribed verbatim and analyzed to generate themes.

## 2.7 Analytical Procedures

Data were analyzed using SPSS (version 22.0, SPSS Inc, Chicago, IL, 2014). Statistical significance was set at  $p < 0.05$ . Individual interviews were analyzed using qualitative analytical procedures to determine themes.

# 3. Results

## 3.1 Demographic Characteristics Of The Sample

A convenience sample of female students (n=44) enrolled at a private college for women in the Midwest participated in the study. The majority of the participants were White (63%) with a mean age of 19 years. Slightly more than half (56%) reported being a first-year student living on campus and had the largest or second largest meal plan offered (87.5%). Participants reported eating in the campus dining facility three or more times per day on Tuesdays, Wednesdays, and Thursdays during fall semester 2014. All students reported owning a cell phone of which 88% of were smartphones. Cell phone services most often used by participants (over 10 times per day) included sending text messages, checking social media sites, and checking email versus making phone calls and taking pictures (1-4 times per day).

## 3.2 Knowledge, Attitudes And Behaviors Regarding Food Waste

A majority of the surveyed students (70.7%) reported that environmental sustainability is important to them, but only 51.2% rated their knowledge of environmental sustainability as excellent. Table 1. shows responses from selected survey questions at baseline and post-intervention. The only significant survey change from baseline-post intervention was the use of a grocery list, with fewer participants reporting the use of a grocery list at post-intervention. Additionally, there were more participants at post-intervention who agreed that a person's efforts to decrease food waste can improve world hunger, though the difference was not significant. In general, participant knowledge and sustainability attitudes improved from baseline to post-intervention.

Table 1. Changes in university students' knowledge, attitudes and behaviors pertaining to food waste and environmental sustainability issues

Survey question	Range	n	Mean Baseline	SD	Mean Post-Intervention	SD	Change from baseline <sup>3</sup>	SD	P value for differences
My understanding of environmental sustainability is excellent.	0-5 <sup>1</sup>	27	3.52	.75	3.66	.88	.15	.60	0.21
Environmental sustainability is very important to me.	0-5 <sup>1</sup>	27	4.22	.75	4.33	.68	.11	.51	0.26
I feel one person's food waste can have a negative effect on the environment.	0-5 <sup>1</sup>	27	3.85	.66	3.96	.71	.11	.80	0.48
I feel one person's efforts to decrease food waste can assist in improving world hunger.	0-5 <sup>1</sup>	27	3.77	1.01	4.14	.86	.37	1.11	0.10
I believe the dining facility should implement more programs on environmental sustainability.	0-5 <sup>1</sup>	27	4.37	.69	4.40	.69	.04	.71	0.78
I use a grocery list when shopping.	0-5 <sup>2</sup>	26	3.57	1.06	3.30	1.40	-.27	.67	0.05*
I follow the use-by-dates on purchased food products.	0-5 <sup>2</sup>	26	3.92	.744	3.92	.890	.00	.632	1.0

SD, standard deviation

\*Significant baseline/post intervention difference:  $p < 0.05$

<sup>1</sup> Response options: Strongly disagree, disagree, neutral, agree, strongly agree

<sup>2</sup> Response options: Never, rarely, sometimes, often, all of the time

<sup>3</sup> Difference=Post intervention - Baseline

Of the participants who completed the post-intervention survey, 92% (n=24) responded that they received the text messages from the study, and 63% (n= 15) stated that they read all four messages. Yet, only 8% (n=2) said that they shared the information from the messages with another person.

Baseline to post-intervention food waste difference was 8.34 grams (n=32, p=0.42). The majority of participants at baseline and post-intervention had less than 50 grams of waste. Table 2. shows the percent of participants with the designated amount of plate waste at baseline and post-intervention.

Table 2. Grams plate waste at baseline and post-intervention

Grams plate waste	Baseline (n=39)	Post-intervention (n=32)
0g	49%	50%
1-50g	33%	22%
> 51g	18%	28%

### 3.3 Post-Intervention Individual Interviews

Five themes emerged from the post-intervention individual interviews: (1) “we only have one earth”, (2) “family influences food habits”, (3) “eating with other people takes time, but builds community”, (4) “mindful of food selection on weigh days”, and (5) “mixed reviews of text messages”. Selected quotes from participants representative of each theme are depicted in Table 3.

Table 3. Themes identified and corresponding quotations from individual interviews (n=7)

Theme	Participant Quotes
We only have one earth	<p>“We should take care of the environment cause it’s the only one we have.”</p> <p>“We need to protect our earth because we only have one earth.”</p>
Family influences food habits	<p>“I think family has an influence because if you’re living at home you eat what your family eats...and if your family doesn’t save leftovers, well then you don’t save leftovers, and you like learn from your family.”</p> <p>“Me and my family, we really, really try to not waste food and I do the same here. Like, I’ll usually eat all my plate...even if I don’t like it from the cafeteria, because that was like what I’ve always done.”</p>
Eating with others takes more time, sense of community	<p>“I like eating with other people, it’s a lot more pleasant experience. It’s like a sense of community.”</p> <p>“[Eating together with people] gives me a sense of belonging.”</p> <p>“I love the social aspect of food...it takes a long time...cause you’re sitting with somebody and then after you’re done eating, you want to talk for longer.”</p>
Mindful of food selection on weigh days	<p>“[I was] aware of what I choose too, cause... I don’t</p>

	<p>want to choose something that I don't like to eat cause if I eat that, I know for sure that I'm not going to finish it.”</p> <p>“I was kind of more mindful of what I picked to make sure that I would like it, just in case.”</p>
Mixed reviews of the text messages	<p>“I was already in the habit of like not wasting food and not throwing stuff away, so it was ineffective to me.”</p> <p>“I liked the information presented...it was really quick, you had it as like a reference if you wanted to go back and read it.”</p> <p>“I don't really know if they were effective...I feel like [the texting] kinda just makes it like background.”</p>

#### 4. Discussion

This study examined the knowledge, attitudes, and behaviors about food waste of women college students and the impact of a text message educational intervention on individual food waste. Results from this study showed that no significant changes were observed in food waste knowledge, attitudes, and behaviors of participants. Responses from individual interviews showed that participants are concerned about the environment, their family and home-environment affects their food waste habits, and there were mixed reviews regarding the effectiveness of the text message intervention. Because the baseline responses regarding concern for environmental and sustainability issues were high, there was little room for attitudes to increase further. Survey results showed that the majority of participants frequently use text messaging, making the use of text messaging a viable means of communication and message dissemination. Yet, the messages from this study were not engaging enough for participants to share the information with others. The use of text messaging as a way to convey educational information to young adults is very appropriate, but the messages must be relevant and memorable to resonate with this target population.

This study had several limitations. One such limitation is that menu items differed at baseline and post-intervention, despite efforts to maintain the same menus on each data collection day. The nature of the meal plans is such that students' meal points cannot roll-over to the next semester, thus food purchases may have been higher at post-intervention than at baseline. The first-year participants are required to have the largest meal plan and therefore may have had many points remaining at post-intervention, which was conducted two weeks before the end of the fall semester. Having meal points to use up may have resulted in more waste since the participants bought more food items but did not want to consume all the purchased foods. Another limitation is that the dining facility is an a-la-carte style, where each item must be paid for. If a student doesn't like the item that they have purchased, they must pay for another item if they want to replace the unfavorable food. If a participant did not like the menu item of the day, they may have purchased a new item and discarded the old, tossed the item, or eaten the item regardless of their preference. Furthermore, individual interviews concluded that participants were more selective of food choices on data collection days, which may have decreased the total plate waste collected than would normally be seen in the dining facility on a regular basis. These variables would affect the food waste collected.

This study utilized a small sample of college-aged women and had low participant follow-through during the entirety of the project. This could be due to the commitment required of participants, in that they were asked to come to the dining facility on specified days and times. Scheduling, dining preferences, and available meal points may have contributed to the low participation and participant follow-through.

#### 5. Conclusions And Implications

Results from this study provide evidence that additional research is needed to determine the overall effectiveness of a text-message based educational intervention targeting young adults. There is some evidence indicating that families



and at-home food experiences influence food waste behaviors of university students in the campus dining facility. The relationship between spirituality and food waste behaviors is likely complex and requires further investigation. Future research should include a larger more diverse sample and contain additional waste collection days to provide a more comprehensive view of student food waste behaviors. Also, of interest would be to measure the food waste at a dining facility where the meal plan consists of meal points that can be used to purchase a-la-carte items versus a facility with a meal plan that limits the student to a specific number of meals purchased in an all-you-can eat facility. Future studies could also include the use of newer technology, such as the use of social media sites.

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