

INVESTIGATION OF STRATEGIES TO DECREASE FOOD WASTE IN COLLEGE
AND UNIVERSITY FOODSERVICE

by

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B.S., Kansas State University, 2001
M.S., Kansas State University, 2004

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Hospitality Management and Dietetics
College of Human Ecology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

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Abstract

This study used two operational research components to explore strategies to decrease waste in university dining facilities. Component one assessed students' beliefs and behaviors toward food waste in a selected dining center. The relationships between students' food waste behavior, sustainability beliefs, and demographics were evaluated with the use of a self-administered survey and continual food waste monitoring. This study also assessed whether simple prompt-type message interventions had an impact or if the addition of more personally relevant feedback-based data elicited a greater change in consumer beliefs and behaviors

On average, more than 57 grams of edible food was left on each tray. Food waste behaviors were not influenced by demographic factors. Individuals with higher levels of food waste beliefs also disposed of less edible food items. The simple prompt-type messages stimulated a 15% reduction in food waste. The addition of more personalized feedback-based messages did not stimulate a change above that of the prompt message. These findings indicate that simply making university students aware of the topic of food waste may be useful in improving their behaviors.

Component two evaluated the operational feasibility of implementing trayfree dining at Kansas State University Dining Services. Telephone interviews with managers of university dining facilities involved in trayfree dining were conducted to identify best practices. Focus groups of students were used with a written survey to gain insight into their perceptions of trayfree dining.

Benefits included: decreased waste, reduced chemical, resource, and food costs, and improved student satisfaction. Managers identified complaints and dining room cleanliness as negative outcomes. Student involvement, education, and communication were strongly

recommended by both managers and students. This research supports the recommendation to consider the implementation of trayfree dining at Van Zile. Decreased costs, improved satisfaction, and positive public perception are likely positive outcomes.

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Approved by:

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Carol W. Shanklin, PhD

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CHAPTER 1 - INTRODUCTION

This chapter contains background information, statement of the problem, justification for the research, purpose and objectives, research questions, and limitations of the research.

Background

The Mobro 4000 incident in 1987 has been identified by many as the stimulus for the current interest in recycling and sustainability. National attention was given to the potential shortage of disposal sites when the Mobro 4000 barge was transporting tons of trash up and down the East Coast of the United States (U.S.) only to be rejected from every waste disposal site in its route to and from Belize. This incident increased government agencies' and consumers' concern that the U.S. was on the verge of an environmental crisis, in part due to a shortage of waste disposal sites, more specifically landfills (Lamar & Kane, 1987). Discussions about waste disposal alternatives, such as reduction of the amount of waste generated, reuse, and recycling were triggered by the Mobro 4000 incident and continue today.

Despite this motivation towards sustainable actions our nation continues to struggle with the amount of waste generated and the most efficient waste management strategies. Per capita waste levels have remained fairly stable for the past 20 years (American Society of Civil Engineers, 2010). The U.S. still produced 243 million tons of waste in 2009, averaging 4.43 pounds per person per day (Environmental Protection Agency [EPA], 2010). It was estimated that 55-65% of Municipal Solid Waste (MSW) was residential and 35-45% from institutions and commercial establishments. Food scraps were estimated to comprise 14.1% of all waste (EPA, 2010). Nearly 14% of the meats, grains, fruits, and vegetables in households are disposed of (Jones, Bockhorst, McGee, & Ndiaye, 2003, as cited in Jones, n.d.). This amounts to over \$43 billion in food waste from households annually (Jones, 2004, as cited in Jones, n.d.).

Commercial and retail food operations add greatly to this food loss, generating an estimated 54 billion pounds annually (Jones & MartinezNocito, 2004, as cited in Jones, n.d.). Studies by Ferris, Flores, Shanklin, and Whitworth (1995) and Shanklin and Ferris (1992) measured foodservice waste in university facilities. The researchers estimated that more than 167,000 pounds of usable by-products were being disposed of each year due to consumer plate waste. Individual tray waste studies in dining facilities have found an average of more than two ounces of food waste per tray (Aramark, 2008; Norton & Martin, 1991; Van Handel, 2004). This waste is suitable for animal feed, compost, and bioconversion, suggesting the need for alternative management strategies for food waste from foodservice operations (Ferris et al., 1995).

Solid waste and the management of this waste have been reported as important issues for foodservice managers (American Dietetic Association [ADA], 2001; National Restaurant Association [NRA], 1989). Global population growth, expected to reach 7.7 billion by 2020, will have social, environmental, and economic impacts on the food system (Rosegrant & Sombilla, 1997) and the amounts of waste produced. Continual increases in the number of individuals eating away from home (NRA, 2010) will place more responsibility on the foodservice operations to make sustainably sound decisions regarding waste management and prevention.

The problems this amount of food waste contributes create additional challenges for foodservice operators and local and state governments. Wastes from foodservice operations in the U.S. are disposed of via multiple routes (Ferris et al., 1995). Transportation of waste to landfills, processing waste into the sewer system through a garbage disposal, composting, and animal feed are the primary methods of disposal in the U.S. It is estimated that of the solid waste in the U.S. 28.5% is recycled and composted, 7.4% combusted, and 64.1% is buried in landfills

(Simmons, Goldstein, Kaufman, Themelis, & Thompson, 2006). While these methods have their merits, they also have downfalls.

These methods of waste management often have a negative impact on the environment. They require the consumption of water, fuels, chemical treatments, energy, labor, and land. Fuel is consumed in the hauling of food wastes to material recovery facilities, landfills, and processing sites (Pollan, 2006). The Energy Information Administration (2010) predicts that the consumption of liquid fuels will increase over 75% by the year 2035. Nearly 560,000 acres of U.S. land are committed to active landfills (Trzupek, 2010). Once in the landfills, food waste which is a biodegradable, will produce methane as it decomposes. This results in food waste being a major source of methane emissions from landfills (Adhikari, Barrington, & Martinez, 2006). Landfill methane accounted for 17% of the emissions in the U.S. in 2009, the third largest contributor of methane (EPA, 2011). The world population continues to increase and significant economic growth will likely impose more pressures on waste management (Adhikari et al., 2006).

The cost of waste management is of constant concern to foodservice operators. The average gate fee of landfills has increased 43% from 1993 to 2008 (Busbee, 1996; Perket, 2009). Other variables that must be considered in the disposal of waste in landfills are labor, storage locations and containers, supplies such as bags, fuel, equipment rental, and haul charges. Food waste processed by a garbage disposal requires the use of water and energy. The approximate cost of running a single garbage disposal 12 hours a day at one dining center in Kansas is approximately \$3,208 per year (Kansas State University Dining Maintenance, personal communication, May 24, 2010). The use of composting facilities require the need for vehicles, farm equipment, fuel, labor, and land (Baer, Blattner, Boss, Ostmeyer, & Wiens, 2009).

University foodservice operations are a large contributor to the waste problem, generating nearly 3.6 million tons of waste per year (Saphire, 1995). Food is estimated to comprise 10-20% of this weight (Saphire, 1995). Universities are often the largest consumers of electricity, oil, natural gas, water, and chemicals in their region (Creighton, 1998). These institutions are expected to reflect the values and demonstrate the norms of our society, while being at the forefront of many political, social, and cultural issues (Saphire, 1998). One of our most pressing issues of today is the need to decrease our society's impact on the environment, reduce our carbon footprint, and use resources more efficiently.

Universities are facing economic struggles and they are exploring methods of decreasing costs and improving their competitive stance in recruiting potential students. Many cost and resource saving actions are important to consumers (Hartman Group, 2007). Therefore, foodservice operations are developing, implementing, and evaluating methods of resource conservation to meet these demands by both the university and potential customers (Aramark, 2008; Creighton, 1998; Saphire, 1998). All alternatives must be considered carefully as to meet the triple bottom line collaborating people, profit, and planet (Rowe, 2010). The management of food waste is a sanitation concern with social, environmental, and financial implications that the institution must evaluate (Almanza, 1993).

Current strategies of resource conservation in foodservice operations include reusable to-go containers, use of waste pulpers, and installing controllable exhaust hoods (Aramark, 2008; Davis, 2008; Saphire, 1998). Other operations have implemented composting and recycling programs (Baer et al., 2009; Hobart Center for Foodservice Sustainability, 2009; McCaffree, 2009). While finding alternate methods of managing food waste is an option, considering the

entire life cycle of our products and discovering ways of preventing the waste of food may be a better approach (Kantor, Lipton, Manchester, & Oiveira, 1997).

Many university campuses are converting to trayfree dining in an effort to reduce waste. Trayfree dining is simply the practice of removing trays from the dining room. Eliminating the use of trays has decreased the amount of food wasted by individuals, and reduced the water and chemicals used in dishmachines (Aramark, 2008; Davis, 2008; Karstens & Moe, 2009; Saavedra, 2008). Aramark (2008) found that they generated 11,505 less pounds of food waste with the removal of trays. This represented a 25% reduction in per-person food waste on trayfree days (Aramark, 2008). San Diego State University removed trays from its main cafeteria and reduced food waste by more than 11 tons and saved \$14,000 on food in a single year (Saavedra, 2008). Sodexo officials estimate that removing trays from their dining centers saved nearly 200 gallons of water daily for every 1,000 meals served (Davis, 2008). The overall impact has resulted in a reduction in the environmental footprint the university may leave, as well as money saved by the university dining operators.

Despite the compelling economic and environmental arguments, many dining facilities may still be skeptical about making changes. Cost effective alternatives and strategies must serve as a baseline for making these decisions as foodservice operations are businesses relying on a positive economic status (ADA, 2001; Shanklin, 2001; Wie & Shanklin, 2001). While many food waste management options exist, their cost is a prevalent factor in management skepticism. Focus placed on preventing the amount of food disposed of may be a more economical option. Education programs can help consumers change their food discard behaviors and are known to be an effective means in preventing food loss (Kantor et al., 1997).

A comprehensive communications initiative may be a beneficial approach to food waste prevention. Persuasive communication may stimulate environmentally responsible behaviors and is relatively inexpensive to administer (Burn & Oskamp, 1986). The initiative must educate and inform all constituents on campus and create an environment that stimulates greater involvement in environmental activities (Aramark, 2008). A study focused on the role media plays in influencing recycling concluded that the role of communication is vital in leading an individual through the causal chain of effects. They begin in the stages of drawing attention to the issue and follow through to adopting and integrating behavior change (Kok & Siero, 1985). Kok and Siero's (1985) research noted the negative influence of perceived inconvenience and difficulties on individual's behavior change. The individuals were found to lack the general knowledge about how to prepare items for the recycling program, leading them to be less likely to participate. Kok and Siero (1985) noted the need for practical information and that working to educate the public on how to participate and remove perceived barriers would lead to more positive behaviors.

Burn and Oskamp (1986) used persuasive communication and public commitment to encourage a public recycling program. The three treatments used were a written persuasive message containing recycling facts, a signed contract of personal participation, or a combination of the two. Burn and Oskamp (1986) reported that the three treatment groups with various forms of persuasive communication voluntarily recycled significantly more compared to participants who were simply asked to participate in the recycling program. Langer, Blank, and Chanowitz (1978) found that making a request in combination with providing information and a reason for the request is more effective than just making the request. Other studies have found that personalizing messages with feedback allows individuals to realize the impact their own actions

can have, and have led to improved environmental actions (Abrahamse, Steg, Vlek, & Rothengatter, 2007; Arbuthnott, 2009; Darby, 2001; Petersen, Shunturov, Janda, Platt, & Weinberger, 2007).

The Elaboration Likelihood Model of Persuasion (ELM) argues that there are two routes to persuasion: central and peripheral. In general, the presence or absence of “elaboration,” or thinking about the ideas presented, is critical (Petty, Cacioppo, Strathman, & Priester, 1994). Those who receive information or a message vary in how involved they become in the message and how they evaluate the content. When the listener is willing to become involved and able to evaluate the message, the central route of persuasion is used. Because the individual is motivated and able to pay attention, they consciously think about the topic (Petty et al., 1994).

This central route creates more enduring attitudes (Petty et al., 1994). Attitude is expressed by “the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question” (Ajzen, 1991, p188). Attitude involves all aspects of a response and includes emotions, behavior, and cognitions (Eagly & Chaiken, 1998). These attitudes can lead to more in-depth evaluation of the topic and more permanent changes.

The peripheral route of persuasion can happen quite quickly without the use of logic or genuine consideration (Petty et al., 1994). It often depends on the mood and emotional state of the individual. Persuasion via the peripheral route does not require individuals to pay attention and can easily be swayed by characteristics such as whether we like the looks of an individual or the smell of the room. In the case of the peripheral route, although changes may occur, it is likely only a temporary change in our attitude toward the subject (Petty et al., 1994).

Central route based messages often have more data and are made more personal to the individuals they are delivered to. Peripheral routed messages, on the other hand, may be

somewhat vague prompt-type messages. Both routes can be beneficial and both can lead to further change via persuasion of a topic (Petty et al., 1994).

Werner, Stoll, Birch, and White (2002) integrated the ELM into a field study on a university campus investigating the persuasive impact of signage on soda can recycling. Their study compared the impact of simple “prompt” type signs to persuasive messages justifying the ease of recycling in unison with increased convenience of the bins. Any form of sign resulted in increased recycling participation over baseline. Persuasive signage did increase participation over simple improvements in recycling convenience (Werner et al., 2002). The research supported that validation may increase message scrutiny, elaboration, and sustained behavior change in line with the ELM beliefs.

Persuasive messages often contain factual data, are made personally relevant, and are easily accessible (Petty et al., 1994). This factual data may come in the form of feedback based on data collection. A study by Petersen et al. (2007) found that real-time feedback regarding energy and water use in university residence halls combined with education and incentives, motivated students to significantly reduce their resource use. Multiple studies have concluded that information in the form of feedback can lead individuals to increase their participation in sustainable activities (Brandon & Lewis, 1999; Darby, 2001; Schultz, 1998).

Statement of the Problem

Due to the accessibility of food options in the United States, our nation has placed few resources into measuring and/or decreasing the amount of food waste (Kantor et al., 1997). An immense amount of edible food is being discarded in our nation and will continue unless an effort is put forth to reduce it. University dining operations have been identified as large producers of foodservice waste, especially edible tray waste. While consumers may play a

primary role in this wastefulness, foodservice operations may have the opportunity to educate these customers on this topic. Past research has shown that messaging and feedback programs have had positive influences on consumer actions in regards to sustainability. College-aged students have also been found to respond to feedback-based messaging. However, an extensive review of literature did not reveal research focused on using messaging and feedback to stimulate behavior change to decrease edible food waste in college foodservice operations. This makes it difficult to determine the most efficient route of signage use in these facilities.

Trayfree dining has been implemented in multiple facilities. These efforts have shown a decrease in food and resource waste. However, foodservice managers may be skeptical about implementing a service style without proper guidance. Little information is available in regards to customer acceptance and facility, equipment, and service needs for the implementation of a trayfree dining system.

Justification

Messaging and feedback campaigns have been shown to influence the sustainable behaviors of individuals (Abrahamse et al., 2007; Arbuthnott, 2009; Burn & Oskamp, 1986; Darby, 2001; Kantor et al., 1997; Petersen et al., 2007). The processes of effective communication in altering voluntary consumer behaviors in reducing food waste in college dining operations has not been thoroughly examined. Dining facilities can provide various types of messages to their students, but overtime these messages can become costly in time and products. Knowing which types of messages would have the greatest impact on student food waste actions would allow for more efficient marketing and actions taken by the foodservice managers.

Past research has focused on ways to decrease resource use, save on chemicals, manage waste, and change service style to decrease the amount of food customers select (Aramark, 2008; Davis, 2008; Saavedra, 2008). Knowing the amounts of edible food waste being discarded within a facility is essential to understand the extremity of the issue. This knowledge affords management the opportunity to implement programs and procedures to aid in its reduction. One such method is trayfree dining which has shown to significantly reduce edible plate waste, requires the use of less water and energy, and decreases the use of ware washing chemicals (Aramark, 2008; Davis 2008). Foodservice managers may remain skeptical about implementing trayfree dining and other waste reduction methods because they are concerned about customer satisfaction and reduced profitability. Guidelines to evaluate the feasibility of implementing a trayfree dining system would benefit managers considering the implementation of such a system.

University foodservice appears to be the appropriate location for a study like this for multiple reasons. First, there are a large number of individuals available for observation. Second, these campuses are large producers of waste in the U.S. Finally, universities are a location where researchers and hands-on experience exist in an educational climate. College students often express concern for the environment and a desire for sustainable actions, making them more likely to make decisions beneficial to the environment (Mayer & Frantz, 2004).

This research was stimulated by two interests (1) understanding behavior and beliefs change and (2) assisting Kansas State University Housing and Dining Services in selecting the most effective way to reduce food waste and introduce trayfree dining that would result in high participation rates and consumer satisfaction.

Purpose

The purpose of this operational research study was to determine how to introduce a food waste behavior change into a university residence hall community in a way that uses a simple message-type intervention, requires little sustained administrative effort, and provides optimum impact both immediately and in the long-term. The relationship between students' food waste behavior and beliefs was evaluated. The first component of this research assessed whether simple prompt-type messages had an impact or if the addition of more feedback-based data elicited a greater change in beliefs and behaviors toward food waste in university students participating in a meal plan. The purpose of the second component of this study was to evaluate the feasibility of implementing a trayfree dining program at Kansas State University Dining Services based on foodservice professional and student input. Based on interviews and discussions, recommendations for evaluating the operational feasibility and the successful implementation of such a program were identified and are presented.

Objectives

The specific objectives of this research were to:

1. Measure the beliefs of college students participating in a meal plan towards sustainability and edible food waste.
2. Evaluate the acceptance of various sustainability-focused service style changes by college students participating in a meal plan.
3. Measure the edible food waste of college students participating in a meal plan.
4. Evaluate whether messaging impacts the beliefs of college students participating in a meal plan towards sustainability and edible food waste.

5. Evaluate whether messaging impacts the acceptance of various sustainability-focused service style changes by college students participating in a meal plan.
6. Evaluate whether messaging impacts the food waste behavior of college students participating in a meal plan.
7. Evaluate the relationship between beliefs towards sustainability and food waste reduction and actual food waste behaviors.
8. Evaluate the relationship between various demographic factors and the beliefs towards sustainability and food waste reduction.
9. Evaluate the relationship between various demographic factors and actual food waste behavior.
10. Identify the best practices for implementing trayfree dining based upon qualitative data obtained from foodservice operators.
11. Evaluate the operational feasibility of implementing a trayfree dining program at Van Zile Dining Center on the Kansas State University campus.

Hypotheses

Following are the null hypotheses guiding this research.

- Hypothesis 1: Beliefs towards sustainability will not improve significantly after exposure to the simple prompt-type message.
- Hypothesis 2: Beliefs towards sustainability will not significantly improve after exposure to the feedback-based message.
- Hypothesis 3: Beliefs towards edible food waste will not improve significantly after exposure to the simple prompt-type message.

- Hypothesis 4: Beliefs towards edible food waste will not significantly improve after exposure to the feedback-based message.
- Hypothesis 5: Students' acceptance of various service style changes directed at sustainability and food waste reduction will not significantly improve following exposure to the simple prompt-type message.
- Hypothesis 6: Students' acceptance of various service style changes directed at sustainability and food waste reduction will not significantly improve after exposure to the feedback-based message.
- Hypothesis 7: Mean edible tray waste will not significantly decrease after exposure to the simple prompt-type message.
- Hypothesis 8: Mean edible tray waste will not significantly decrease after exposure to the feedback-based message.
- Hypothesis 9: There is no significant relationship between beliefs towards sustainability and food waste behaviors in the dining center.
- Hypothesis 10: There is no significant relationship between beliefs towards food waste and food waste behaviors in the dining center.
- Hypothesis 11: There is no significant difference between beliefs towards sustainability and various demographic factors
 - a.) Sex
 - b.) College of academic major
 - c.) Year of enrollment/status
 - d.) Size of hometown
 - e.) Location of hometown

- Hypothesis 12: There is no significant difference between beliefs towards edible food waste and various demographic factors
 - a.) Sex
 - b.) College of academic major
 - c.) Year of enrollment/status
 - d.) Size of hometown
 - e.) Location of hometown

- Hypothesis 13: There will be no significant difference between food waste behaviors and various demographic factors
 - a.) Sex
 - b.) College of academic major
 - c.) Year of enrollment/status
 - d.) Size of hometown
 - e.) Location of hometown

Limitations of the Study

Many factors were considered when evaluating the outcomes of this study. Using subjects that cohabitate can increase the possibility that social impact may interfere with treatment affect. Friends, roommates, or simply acquaintances may talk and share input when living in limited space. All participants had the opportunity to receive, experience, and discuss both the prompt and feedback-based messages making it difficult to distinguish which message had the true impact. Therefore, analysis was based on evaluating whether the feedback-based message had an impact above and beyond any improvement seen following the prompt-type message.

Dining center participants were the subjects. However, in-depth discovery of personal information was limited due to the residential setting of the research and operational policies of the study site. This information is not generalizable to all university dining facilities due to the diverse nature of a university community. Students came from various financial, demographic, and educational backgrounds causing them to have been exposed to varied sustainable actions, if any. These demographic and educational backgrounds were unable to be controlled for and may have influenced student behaviors. The basic atmosphere and sustainable nature of the university may vary from campus to campus, making it difficult to generalize the data to every organization.

Definition of Terms

Attitude: A psychological inclination that is expressed by “the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question” (Ajzen, 1991, p188).

Edible Tray Waste: Any food substance, raw or cooked, that is disposed of on a dining center tray. This will not include portions of food item that cannot be consumed (i.e. apple cores, peels, bones, etc.), beverages, or paper goods.

Dining Center Participant: Any student who consumes food in the dining center.

Feedback-based Message: Providing dining center participants with data making them more aware of their edible food waste amounts and of the financial and/or environmental consequences of this waste.

Focus Group: A form of research that “collects data through group interaction on a topic determined by the researcher” (Morgan, 1996).

Message: A planned form of communication to include verbal, signage, and/or personal example (Merriam-Webster, 2010).

Trayfree Dining: The removal of trays from the dining environment, forcing plates, silverware, and glassware to be carried by hand from the service area to the dining tables.

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CHAPTER 2 - REVIEW OF LITERATURE

This chapter discusses food waste data and the environmental and economic impact of waste. Waste management and reduction tactics implemented by university foodservices are described. This chapter also summarizes previous research related to messaging, communication, and behavior change.

Municipal Solid Waste

The Environmental Protection Agency (EPA) (2010) defines municipal solid waste (MSW) as things we commonly use and then throw away, such as packaging, furniture, electronics, yard trimmings, and food. Generation of MSW increased 175% from 1960 to 2009. Population growth accounted for part of this increase, allowing per capita waste levels to remain fairly stable. The U.S. produced 243 million tons of waste in 2009, averaging 4.43 pounds per person per day (EPA, 2010). Residential waste was estimated to be 55% to 65% of total MSW generated, while commercial and institutional waste was estimated at 35% to 45% of the waste. The EPA projected that increases in waste production will continue (EPA, 2010).

Organic materials accounted for the largest portion of MSW in 2009 (EPA, 2010). Paper was the largest component (28.2%) by weight. Yard trimmings were the second largest component (13.7%), followed by food waste (14.1%), plastics (12.3%), metals (8.6%), textiles (8.3%), wood (6.5%), glass (4.8%), and other waste (3.5%). The EPA (2010) estimated that 33.8% of this waste was recycled or composted; this amount is expected to increase. Of the 243 million tons of MSW generated in 2009, 54.3% (132 million tons) was disposed of in landfills, an improvement from 93% in 1960 and 57% in 2000 (EPA, 2010). The EPA (2010) reported that while the number of U.S. landfills has decreased, the average landfill acreage has increased in size.

Food Waste

Food scraps were estimated to comprise 14.1% of all waste in 2009 (EPA, 2010). The quantity of food waste increased from 12.2 million to 34.29 million tons from 1960 to 2009, a 281% increase (EPA, 2010). In an effort to quantify food loss at the various stages of the farm to table cycle, Jones (n.d.) from the University of Arizona used archaeological techniques. In combination with interviews of industry experts and managers, site visits, and secondary data review, their findings provided an estimate of food loss and reflected current market conditions, dollar values of this loss, and the foreseen environmental impact it may have (Jones, 2004, as cited in Jones, n.d.). Jones et al. (2002, as cited in Jones, n.d.) reported that American households dispose of approximately 1.28 pounds of food daily. This poundage does not include food processed in garbage disposals, composted, or given to animals. Nearly 14% of this food was unopened, safe, pre-packaged food items. These food items were safe for consumption and could have been donated to food banks or eaten within the household. Nearly 14% of the meats, grains, fruits, and vegetables in households were disposed of as waste (Jones et al., 2003, as cited in Jones, n.d.). This amounts to over \$43 billion dollars in food waste from households annually (Jones, 2004, as cited in Jones, n.d.).

Commercial and retail food operations contributed greatly to this quantity of waste. Solid waste disposal by retail operations includes both packaging and food wastes (Shanklin & Ferris, 1992) and can vary dramatically depending on the type of business and food served (Jones, n.d.). Jones et al. (2003, as cited in Jones, n.d.) found that fast food and full-service venues disposed of 9.55% and 3.11% of purchased food, respectively based on records of purchases and disposals. Convenience store food loss was 26.33% of food purchased. Jones and MartinezNocito (2004, as cited in Jones, n.d.) reported that commercial food operations dispose of more than 54 billion

pounds of food annually. Overproduction, poor inventory management, and flux in sales all play a role in commercial food loss.

Consumers play a role in retail operations' waste as well. Larger portions, more options, and busier lifestyles may lead individuals to leave food on their plates. Due to safety regulations, unless taken home by the consumer, food left on plates or in serving containers must be disposed of by the foodservice operation. Solid waste and the management of this waste have been reported as important issues for foodservice managers (American Dietetic Association [ADA], 2001; Boss, 2009; National Restaurant Association [NRA], 1989). Continual increases in the number of individuals eating away from home will place more responsibility on the foodservice operations to make sustainably sound decisions regarding waste management and prevention (NRA, 2010).

Studies by Ferris, Flores, Shanklin, and Whitworth (1995) and Shanklin and Ferris (1992) measured waste in foodservice facilities. Shanklin and Ferris (1992) estimated that more than 167,000 pounds of usable by-products were being disposed of annually due to consumer plate waste in a single university foodservice. This weight represented nearly 4.9 tons of protein, 6.5 tons of fat, and 21 tons of carbohydrates going into the sewer system each year at this facility alone. Their research also evaluated the nutrient make-up of this waste and estimated ash, moisture, calories, fat, and carbohydrates in order to suggest alternative means of waste use. The researchers found the nutrient content of this waste was likely suitable for animal feed, compost, and bioconversion (Ferris et al., 1995; Shanklin & Ferris, 1992). Their recommendations support the need for alternative management strategies for foodservice waste.

Norton and Martin (1991) at the University of Maryland observed and weighed plate waste of selected entrees, deli items, fruits, and desserts in their dining center. They calculated

the average percent of prepared food wasted per day, mean waste per tray, and cost of waste per day. This was done by weighing all prepared food items prior to service, the amount left at close of business, and a portion of edible tray waste for these select items. Recipe pricing also aided in this analysis. They found the average percent wasted was 17% per day or an estimated 2% of their total food cost for the semester. On average, students disposed of approximately two ounces of the selected items (entrees, deli, fruits, and desserts) on their trays (Norton & Martin, 1991). In an effort to decrease waste, the authors recommended improved portion control and student education to include costs of waste. A study by Aramark (2008) found similar per person plate waste at 1.8 ounces of edible food per tray.

A study conducted at Northern Michigan University weighed edible food residuals removed from student trays (Van Handel, 2004). The goal of this study was to identify strategies to decrease costs by reducing waste. A stratified sampling procedure was utilized to determine waste in pounds per hour, and then extrapolated out to pounds per day. The dollar value of this waste was calculated using food production weights and procurement costs for a three week period. The cost per pound of food was then calculated. Researchers found nearly 2.5 tons of edible food was disposed of weekly in a facility serving approximately 17,000 meals per week. This amounted to over \$9,000 of food products wasted. When extrapolated for a semester, the researchers estimated that over \$140,000 of food would be discarded from customer plates. An estimated 9.4 ounces of food per person per day was disposed of (Van Handel, 2004).

These studies demonstrate the large amounts of food waste being generated in our nation. Two to three ounces of food are estimated to be disposed of each meal by university students participating in a meal plan (Aramark, 2008; Norton & Martin, 1991; Van Handel, 2004). This amount of food represents thousands of dollars in food products. Many people are starving, our

nation's economy is struggling, and food is not an entirely sustainable product. This data signals the need for further review and presentation of the many processes needed to manage this food waste in order to maintain a safe and sustainable environment.

Practices and Issues of Food Waste Management

Our industrial based world has used vast quantities of natural resources. This excessive consumption has had a negative effect on the environment. Land-use, appearance, pollution, and cost are issues that make proper solid waste management a concern (Tchobanoglous, 2009). Tchobanoglous (2009) defined integrated waste management as an ever-evolving “selection and application of techniques, technologies, and management programs to achieve specific waste management objectives and goals” (p. 180). Waste generated from the kitchen not only involves food products but time, energy, water, and other resources (ADA, 2001). In the U.S. we use multiple methods of solid waste disposal (Ferris et al., 1995). The EPA (2009) has identified four basic strategies for integrated waste management: source reduction, recycling and composting, combustion, and landfills. Tchobanoglous (2009) discussed how various states have chosen to take a hierarchical approach to these waste management options. Waste reduction at the source must first be evaluated before recycling can be considered. Only after maximum recycling efforts have been implemented should waste transformation be evaluated. This hierarchy varies from state to state and will likely continue to flux. Foodservice operations generally manage food waste via landfills, processing through a garbage disposal, composting, and animal feed (Ferris et al., 1995).

The use of garbage disposals requires the resources of water, energy, and labor. The outcome is that all items processed through this equipment then enter the sewage system. The approximate cost (water and electricity) of operating a single garbage disposal 12 hours a day at

one dining center in the Midwest is approximately \$3,208 annually (KSU Dining Maintenance, personal communication, May 24, 2010). The Energy Information Administration (EIA) (2010) predicts world net electricity production needs will increase by 87% by the year 2035. The domestic use of water in the world is expected to increase 40% by the year 2020, with the quantity needed to produce food increasing 17% (Schuster, 2000). The use of resources, cost, and the fact that the products entering the waste stream via these disposals are suitable for animal feed and composting stimulates the need for consideration of alternate food waste management and reduction strategies.

Transportation of waste to landfills has and will continue to increase. The average gate fee of landfills has increased from \$29.39 (Busbee, 1996) to \$42.10 (Perket, 2009) from 1993 to 2008. Northern Michigan University found that 2.5 tons of food waste was generated per week in a dining facility serving more than 17,000 meals per week, for a potential of 40 tons of food waste per semester (Van Handel, 2004). If transported to the landfill using the current national average of \$42.10 per ton, the cost to this dining facility would be \$1,684 a semester for food waste transportation. Additional expenses would be incurred for packaging and other waste hauling.

Large amounts of fossil fuels are used to fertilize, harvest, process, and transport food items. The addition of fuel needed for hauling of solid waste to the landfills only increases this. The Energy Information Administration [EIA] (2010) predicts that the consumption of liquid fuels will increase over 75% by the year 2035. Fossil fuels are projected to provide nearly 78% of our energy, however, the use of non-fossil fuel resources will increase (EIA, 2010). This increased use will stimulate the need for further research into alternative fuels and energy sources.

Using crops for fuel is one of these options. This increased use of fuels leads to an increased demand for biofuel production. The production of these fuels requires the use of crops such as corn. The demand for these crops leads farmers to dedicate more acres for this use, leaving less land available for growing other items. Fewer acres for other crops lead to a higher demand, in turn increasing the cost of food items. Alexander and Hurt (2007) estimated that food costs increased \$15 billion related to the surge in demand to use crops for fuels. While increasing research into alternative fuel use is necessary, a primary step may be discovering ways to decrease waste and the amount of fuel needed for these transportation efforts.

Since food wastes are biodegradable, they are one of the most active portions of waste found in disposal sites. This active waste decomposes to produce greenhouse gases and leachate. Leachate is the liquid that collects contaminants as it travels through waste (EPA, 2006). In a landfill rainwater gathers bacteria and chemicals which then have the potential of entering the soil and water system. Greenhouse gas emissions from landfills are one of the largest man-caused sources of methane (EPA, 2011). Food waste is also major source of this emission (Adhikari, Barrington, & Martinez, 2006). Landfill methane accounted for 17% of the emissions in the U.S. in 2009, the third largest contributor of methane (EPA, 2011), a major greenhouse gas. Research shows it traps 21 times more heat than carbon dioxide. Therefore, methane is a major factor in earth warming trends (Shipman, Bartlett, Crill, Harriss, & Blaha, 1998). The world population continues to increase and significant economic growth will likely impose more pressures on waste sites (Adhikari et al., 2006).

Many colleges and universities are taking steps towards more sustainable measures due to their increased concern about the environment (Sustainable Endowments Institute, 2010). Some universities choose to find methods of repurposing their waste rather than basic disposal.

Composting has become a popular method of food waste management. Baer, Blattner, Boss, Ostmeyer, and Wiens (2009) described a composting pilot program between Kansas State University Dining Services and the Agronomy and Horticulture Departments on campus.

The possibility and implications of a coordinated composting program on campus were evaluated by a Natural Resources and Environmental Sciences class. Both kitchen preparation waste and pre-consumer food waste from two large seven-days-a-week university dining halls were collected, evaluated, and transported to a student farm composting facility. Due to the evaluative nature of the project, the large amounts of post-consumer waste were excluded (Baer et al., 2009).

On average, the dining centers produced 270 pounds of food waste for compost weekly (Baer et al., 2009). Barriers observed to this operation were labor costs, adequate storage space for the waste, transportation of the waste, and weather prohibiting access to the compost site. Positive outcomes cited were quality food waste for compost maturation, decreased amounts of valuable solid waste landfilled, and a learning experience for the student farm. Baer et al. (2009) reported the desire to continue this program, but that a cooperative system of labor and equipment needed to be incorporated. Baer et al. (2009) estimated that an all-encompassing food waste composting program for these facilities would yield ten-fold the reported waste being composted. The expanded program would require an increased use of fuel and labor hours for collecting and hauling, and require more land for the additional windrows. This stimulates the need for dining services to identify and implement a waste reduction campaign if the program was to be successful both environmentally and economically.

Harvard University Dining Services (HUDS) launched a composting program in 2008. On average more than 26,000 pounds of compostable waste were collected weekly from nine of

their dining units. This program allowed all food waste and compostable to-go containers to be disposed of in bins that were then transferred to a near-by farm. The use of this composting option has resulted in a 90% reduction in trash, and therefore, decreased solid waste transfer expenses for Harvard University Dining Services (HUDS, 2008).

Using interviews and personal interaction with over 20 campuses, Saphire (1995) identified areas of waste and strategies used in the university foodservice setting. The three primary forms of food waste identified were preparation waste, overproduction waste, and plate waste. In the traditional all-you-care-to-eat setting, food waste was estimated to compose over 60% of the waste produced. Take-out style service packaging and food-related materials comprised over half of the waste (Saphire, 1995).

Composting and pulping were identified as methods of managing food waste produced. Saphire (1995) identified simple practices, such as purchasing condiments in bulk, relocating napkin dispensers to the tables, and placing smaller serving containers in self-service areas as ways to decrease waste. More drastic measures were identified at other facilities, such as shifting from preparing recipes from scratch to buying purchased items, implementing computer generated recipe systems, and decreasing the self-serve options. Saphire also found employee education plays a key role in waste reduction. Improving procedures for dating, rotating, and batch cooking by production employees were identified to impact waste reduction in these university dining facilities. The researcher stressed the need for a comprehensive waste reduction program that involves many aspects of the campus community (Saphire, 1995). Food, auxiliary, and professional services on campus must all play their part in educating both foodservice employees and students about methods to reduce waste (Aramark, 2008; Saphire, 1995).

Issues and Practices of Foodservice Waste Reduction

Current strategies of resource conservation in foodservice operations include use of reusable to-go containers, waste pulpers, composting, recycling, and controllable exhaust hoods (Aramark, 2008; Baer et al., 2009; Davis, 2008; Hobart Center for Foodservice Sustainability, 2009; HUDS, 2008; McCaffree, 2009; Sapphire, 1995). While finding alternate methods of managing food waste is an option, considering the entire life cycle of our products and discovering ways of preventing the waste of food may be a better approach.

The practice of removing dining hall trays, known as trayfree dining, has become a popular movement among campus dining facilities. More than 70 university foodservice operations are trayfree members of the National Association of College and University Foodservice (NACUFS, n.d.). This style of service has been found to reduce food waste and the consumption of water and chemicals used in the dishmachine.

Aramark (2008) conducted a study of 25 institutions during the academic year to measure the difference in food waste resulting from tray removal. Food waste was collected and compared between days with and without tray use for 186,000 meals served. Collectively, the institutions generated 11,505 fewer pounds of food waste per day with the removal of trays. Aramark (2008) also reported that food waste was reduced 1.2 to 1.8 ounces per person at each meal. This reduction represented 25 percent less per-person food waste in their operations (Aramark, 2008). In order to measure the customers' thoughts on this trayfree program, Aramark conducted a survey among their campuses. Of the 92,000 individuals surveyed, 79% accepted the removal of the trays. Karstens and Moe (2009) reported a Seattle campus decreased food waste by 10.8% on days when trays were not in use. The removal of trays from the main

cafeteria at San Diego State University reduced food waste by more than 11 tons and saved \$14,000 on food that semester (Saavedra, 2008).

Sodexo officials estimate that removing trays from their dining centers saved nearly 200 gallons of water daily for every 1,000 meals served (Davis, 2008). Aramark's (2008) study supported this water use reduction with a reported 288,288 gallons of water saved and \$57,000 of resource expenses eliminated.

The implementation of trayfree dining has allowed foodservice operations to decrease the environmental impact their facilities may have (Aramark, 2008; Davis, 2008; Saavedra, 2008). Financially, it reduces the cost of these resources and cost of managing food waste. Implementing programs, such as trayfree dining, allow education and awareness about environmental issues to be shared. Overall, this can be seen as a triple bottom line initiative that provides economic, social, and environmental benefits (Rowe, 2010).

Although many economic and environmental benefits may be expected, some dining managers may still question the implementation of these new systems. The knowledge of the foodservice operators about the various alternatives of waste management and the associated costs, as well as the location and amounts of food waste, can play an essential role in this decision making process (Shanklin, 2001). This provides a baseline for making these decisions, as foodservice operations are businesses that rely on a positive economic status (ADA, 2001; Shanklin, 2001; Wie & Shanklin, 2001). While many food waste management options exist, their cost is a prevalent factor in management skepticism and determining the feasibility of this option can be a taxing procedure. Focus placed on preventing the amount of food disposed of may be a more economical option. Education programs can help consumers change their food

discard behaviors and is known to be an effective means in preventing food loss (Kantor, Lipton, Manchester, & Oiveira, 1997).

Influencing Sustainable Beliefs and Behavior

Attitude is “the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question” (Ajzen, 1991, p188). University students have been shown to possess a high level of concern for the environment and sustainable actions, leading them to be more likely to make environmentally beneficial decisions (Mayer & Frantz, 2004). Public messaging campaigns that inform people about the positive impact their individual actions can potentially influence behavior (Arbuthnott, 2009). This information makes them more aware of the connection between their actions and the environmental consequences of these behaviors. Pro-environmental behavior has been shown to be influenced by beliefs about what is affected by various environmental conditions and that individual actions can assist in alleviating these threats (Joireman, Van Lange, & Van Vugt, 2004; Petersen, Shunturov, Janda, Platt, & Weinberger, 2007; Stern, 2000).

Through review of data gathered via a telephone poll regarding the level of environmental concern, Berger and Corbin (1992) investigated whether perceived consumer effectiveness acted as a moderator between environmental concerns and actual behavior. They also evaluated whether faith in others played a role in the relationship between environmental concerns and support behavior. The researchers found a more significant correlation between pro-environmental attitudes and consumer behavior in individuals who perceived themselves as being effective in their actions than those who perceived less personal efficacy. These results supported previous findings on the moderating effects of knowledge on attitude-behavior consistency, in that perceived consumer effectiveness is partly based on self-perceived

knowledge. Their analysis also found that individuals with high perceived efficacy had behavior changes that were much more responsive to environmental attitude changes than those with low personal efficacy. The results also suggested that one's faith in others' ability may influence the extent to which their environmental concerns will be acted upon. These environmental actions will be based on their support for the actions of those in which they believe in. These results indicate that believing personal actions are effective in having an impact moderate the relationship between environmental attitudes and actual consumer behaviors (Berger & Corbin, 1992). Therefore, whether attitudes predict personal behavior changes or not are significantly influenced by one's belief that their individual actions can have a positive environmental impact.

A study by Straughan and Roberts (1999) replicated and extended upon a 1996 study by Roberts. The replication study investigated the correlation between demographic and psychological aspects of ecologically conscious consumer behavior (ECCB) of university students. A questionnaire was administered to students to gather data about demographics and green purchasing behaviors. Various regression models were utilized in an effort to identify the model best suited for profiling purposes. Overall, the findings suggest that using psychographics may provide a much more accurate method of segmenting the market than demographics. Perceived consumer effectiveness was found to have the greatest predictive power into ECCB, explaining 32.8% of the variance. While many of the demographic variables were found to have a significant correlation with ECCB, they lack the ability to be manipulated and influenced. The researchers suggested that from a management perspective, focusing on coordinating psychological aspects into models of profiling should be viewed as a benefit. These aspects, such as perceived consumer effectiveness, allow for marketing campaigns to focus on beneficial

outcomes and convincing individuals that their actions can have an impact (Straughan & Roberts, 1999).

A behavioral belief refers to an individual's idea that an action or behavior will have a particular result (Ajzen & Fishbein, 1980). This indicates the control or impact they believe they will have in regards to this behavior. This perceived control of our impact is important because if individuals do not believe they can control a behavior, they will not attempt to, regardless of their attitude. We are not likely to put forth effort to change our behavior if inconvenient when we believe our actions will not make a difference. Focusing on individuals' perception of self-control in messaging campaigns will improve the connection between intentions and behavior (Arbuthnott, 2009). Specific behavior intentions are more likely to lead to behavior change than general attitudes (Arbuthnott, 2009; Joireman et al., 2004). For example, attitudes about solid waste are likely to predict food waste behavior much more than do attitudes of general environmentalism.

One form of information that addresses personal involvement and action is direct feedback targeted at the specific behavior. Personalized messaging that provides feedback has been found to increase sustainable behavior (Abrahamse, Steg, Vlek, & Rothengatter, 2007; Darby, 2001; Petersen et al., 2007; Schultz, 1998) by making individuals more aware of their direct impact on the environment. A review of 38 feedback studies by Darby (2001) provides insight into the effectiveness of three forms of feedback, and some issues that may be encountered in an effort to stimulate energy awareness and conservation. Technology-based direct feedback was reported to be the most consistent single form to elicit energy saving, with all studies reporting a 5% or greater reduction in energy use. Less expensive direct feedback implemented in cooperation with educational information also produced an energy savings of

10%. Indirect feedback was found to have much less impact on the decrease in energy usage. Inadvertent feedback elicited unexpected outcomes that aided in energy conservation although specific studies have not been implemented. A majority of the studies reviewed reported that easily accessible immediate feedback instigated much better results. Clear personally relevant information allowed individuals to feel in control and that their actions had an impact (Darby, 2001). Simple forms of feedback have been shown to have beneficial results and designs for feedback programs should take this into account.

Petersen et al. (2007) reported on the effectiveness of various formats of feedback messaging regarding water and electricity consumption in a college residence hall. The study assessed both the environmental and economic impacts of various forms of feedback. The researchers metered water and energy use and provided feedback on three levels. The first level provided once weekly manually-read resource usage amounts from an entire residence hall via a website (low-resolution). The second allowed real-time usage for an entire building to be accessed via the web (high-resolution). The final allowed real-time usage by individual floors to be accessed via the web (high-resolution). One floor was used as a control group and received no format of resource usage feedback.

A two week competition was employed to stimulate resource use reductions between buildings and as a means to advertise, educate, and provide feedback on the amounts of water and energy used in the residence halls. The researchers did not include suggestions on how to cut-back in their educational displays in order to evaluate whether students could self-teach themselves how to conserve. The timeline included a three week baseline period for measuring resource use, a two week competition period during which feedback was provided, and a two

week post-competition period when high-resolution website postings continued but no competition incentive was present (Petersen et al., 2007).

No significant change was reported in the level of water use. The researchers found that electricity use decreased significantly between baseline and competition time periods at an overall average reduction of 32%. Higher reductions were observed in the two halls with high-resolution real-time feedback. Buildings and floors that could access real-time usage levels via the web had energy use reductions of 55% compared to 31% in the building that could only view the manually read once-weekly post. Overall, this energy use reduction saved \$5,107 for the two week period, and was calculated to reduce approximately 148,000 pounds of CO₂ and 1,360 pounds of SO₂, and 520 pounds of NO_x emissions from being produced (Petersen et al., 2007).

The high-resolution group was found to visit the website 4.8 visits/resident compared to 2.5 visits for the low-resolution group during the competition period. The post-competition time visits dropped to 29% of the prior levels. A post-competition survey was administered. This survey provided the researchers with insight as to the methods students used to conserve resources. The most mentioned included: turning off bathroom and dorm room lights when not in use (71% and 70%, respectively), using natural light during the day (59%), turning off computer monitors (50%), and shutting off computers entirely when not in use (39%). A majority of the respondents reported they would continue to use these energy saving practices (Petersen et al., 2007).

The students also reported their interest in the real-time data available via the web and would continue to view it even without a competition in place. This study showed that feedback, especially if real-time, may encourage individuals to decrease resource use by making them aware of the personal impact they can have. The incentive of a competition may be an efficient

way of provoking interest in a program such as this. Students also displayed that they were inspired to develop their own ways of reducing their carbon footprint and energy use (Petersen et al., 2007).

Multiple researchers have studied attitudes about waste management and their effect on sustainable behaviors (De Young, 1989; Goldenhar, 1991; McCarty & Shrum, 1994; Schwepkar & Cornwell, 1991). Individuals do not always act in ways that are consistent with their beliefs and attitude, however, changing attitudes has been shown to sometimes alter behavior (Nickerson, 2002). Goldenhar (1991) used a survey to gather thoughts, behaviors, beliefs, attitudes, and knowledge about recycling of 3,700 residence hall students. This survey was administered pre and post-intervention. Four forms of informational interventions were applied for a period of five months. The first provided recycling behavior feedback via posters. The second posted educational messages on the importance and advantages of recycling. The third a combination of both message formats, and the final was a control group having no poster messages (Goldenhar, 1991).

They were able to assess the change in knowledge by providing educational facts in the intervention based on knowledge questions asked in the initial survey. The feedback posters displayed bar graphs of student recycling rates in the residence halls and a ranking system between the various buildings. Post-test data were analyzed to determine if there were any significant differences across experimental groups. No significant change in attitudes, beliefs, intentions, importance ratings, or recycling knowledge was observed from time one to time two. However, there was a significant difference in the reported recycling behavior levels between the two groups receiving feedback messages compared to the control and educational message only group (Goldenhar, 1991). These findings were in agreement with research on recycling behavior

suggesting that providing a person with feedback on their behavior will increase their desired behavior (Kazdin, 1980).

Schultz (1998) examined the effects of normative feedback on a community curbside recycling program. The researcher predicted that messages in the form of feedback, rather than raw data or a plea to participate, would have a greater influence on increasing recycling behaviors. Schultz (1998) postulated that feedback would activate personal and social norms, leading to an increase in household recycling efforts. Observational data from a previous study was used to provide baseline participation rates, recyclable amounts and quality, and to compare self-reported versus observed recycling behaviors of 605 single-family households (Schultz, 1998)

The households were randomly assigned to one of five treatment conditions: plea alone, plea plus individual written feedback, pleas plus group written feedback, plea plus general information, and control group. All treatment groups, except the control, received a basic plea-based door hanger informing them of a recycling research program beginning in their area and encouraged them to recycle. Households in the personal feedback treatment group received door hangers containing the information about the amounts of recyclables collected at their own residence during the previous week, the amount of each recyclable collected during the current week, and the total amounts collected so far throughout the study. The group feedback condition received similar door hangers supplying them with information about the amounts of recyclables collected in their neighborhood, rather than at their own personal residence. The information group received door hangers with general recycling and contaminant information and the control group received no door hangers (Schultz, 1998).

Recycling behaviors were observed through weekly assessment of all households' recycling materials. The amounts of each type of recyclable materials and any bin contamination was observed and recorded. Each of the treatments lasted four weeks and was then followed by four weeks of continued observations. The observations indicated that both the individual and group feedback interventions significantly increased both the amounts recycled and the frequency of participation. The plea and informational groups did not show significant improvements in their recycling. The discrepancy between recycling behavior and feedback was analyzed to indicate that participants used the feedback to regulate their behavior (Schultz, 1998). These results indicate that feedback interventions may be an effective way to improve recycling behaviors and are consistent with findings by other researchers (Cialdini, Reno, & Kallgren, 1990; Reno, Cialdini, & Kallgren, 1993; Schultz, 1998).

Educating people that their individual actions can have an impact on the outcome of a sustainable movement is relative to making a difference (Arbuthnott, 2009; Straughan & Roberts, 1999). Providing feedback, whether in an individual or group format, is one method of demonstrating the impact actions can have (Kazdin, 1980; Schultz, 1998). Improving the perceived effectiveness one can have via a messaging campaign is an area worthy of further research in the field of sustainability.

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CHAPTER 3 - METHODOLOGY

Introduction

The purpose of this exploratory research was to investigate various methods of decreasing edible food waste in a university dining facility. The first component of this study compared the effects two forms of posted messages had on beliefs regarding food waste and sustainability, and food waste behaviors of university students dining in a selected university facility. Students were exposed to prompt-type and feedback-based messages in an effort to improve their beliefs about sustainability and edible food waste, improve acceptance of various service style changes directed at improving sustainability and decreasing food waste, and to decrease edible tray waste. A flow chart of the research procedures for the first component is presented in Figure 3.1. The second component of the study evaluated the operational feasibility of implementing a trayfree dining program at Kansas State University Dining Services, specifically Van Zile Dining Center.

The following sections discuss the research design and data analysis that were used to address the objectives of this operational research study. The sections include a description of the population and sampling frame, the instrument and measures, the interventions applied, and description of the statistical analysis.

Component One

Setting and Participants

The population for component one of this operational study was approximately 540 Kansas State University students who resided in Putnam, Van Zile, and Boyd residence halls and purchased meal plans. The sample included students who ate meals in-house at Van Zile Dining



Figure 3.1. Component One Research Design

Center during the data collection period. Students choosing to take their lunch and dinner meals to-go were not evaluated.

Van Zile Dining Center was identified as the facility where this operational study would be conducted. The facility was chosen for ease of accessibility and because the foodservice management staff was interested in participating in the study. The facility also has a strict entrance policy in that only residents from Boyd, Putnam, and Van Zile residence halls were allowed to dine in the facility, with the exception of 10 staff members and approximately 15 student guests per meal. Staff member data was not included in this study. This setting allowed student behavior to be easily monitored.

Van Zile Dining Center is an “all-you-care-to-eat” cafeteria-style dining facility that has four serving lines, each with a different menu concept. This operation served, on average, 412 people at lunch and 381 at dinner during the 2011 spring semester. Entrees and sides are available at four serving lines; these menu items are served by the employees to the customers. Salads, soups, fruits, cereals, and desserts are available for self-service. Breakfast, lunch, and dinner are served Monday through Friday. This facility does not operate on weekends or holidays.

Instrument Development

A primary requirement of the first component of this study was to develop an instrument to explore constructs of this study. A self-administered questionnaire was developed following a review of pertinent literature of variables of interest. This questionnaire was developed with multiple purposes in mind (Appendix A).

The first section assessed students' beliefs concerning food waste and sustainability. The second section evaluated the students' acceptance of recommended service style changes focused

on improving sustainability and decreasing food waste. The third gathered basic demographic data such as sex, college of study, and hometown details.

Pilot Study

The initial questionnaire, developed based on the review of literature, was reviewed by Hospitality Management and Dietetics faculty for flow and clarity. The faculty were asked for suggestions on questionnaire wording, flow, and length. The instrument was modified as appropriate. A pilot study with university dining center student customers was used to validate the initial questionnaire and establish reliability of the instrument.

Permission was obtained from Derby Dining Center management to survey their student customers. Students were approached while dining, informed of the pilot study, and asked to participate. Students were entered in a gift certificate drawing in appreciation for their participation. Those involved in the pilot test received a cover letter (Appendix B) that described the purpose and importance of the research, and provided contact information for future questions. The pilot test also requested that participants complete the questionnaire (Appendix A) and make additional comments regarding the flow, clarity, and ease of completion (Appendix C). Those who participated in the pilot study were not involved in the actual study.

The pilot study yielded 65 usable questionnaires. Cronbach's alpha was used to determine the internal consistency of the items. A threshold of 0.70 was used to demonstrate consistency. The reliability coefficients for beliefs towards sustainability and food waste ($\alpha = 0.85$) and acceptance of sustainability-based service style changes ($\alpha = 0.83$) were strong. Comments provided by pilot test participants showed acceptance and understanding of the written instrument, thus no additional changes were made in the questionnaire.

Questionnaire

The final version of this instrument was used to evaluate student beliefs about sustainability and food waste, evaluate their acceptance of service style changes directed at sustainability, and obtain demographic data on the respondents (Appendix D). Principal axis factor analysis with varimax rotation was conducted on part one of the survey, which measured beliefs, to minimize the effects of multicollinearity. Based on a minimum eigenvalue of 1.0 this factor analysis yielded two constructs: sustainability beliefs (Questions 1 and 2) and food waste beliefs (Questions 3 through 8).

Part two of the questionnaire contained five statements evaluating the participants' acceptance at various service style changes. These service style changes involved dining center processes that could be changed to possibly improve the foodservice's sustainable practices and decrease food waste.

Five questions obtained general demographics of the students including sex, class standing, academic college enrolled, location of their home town, and urban versus rural status of their home town. Urban areas were classified as locations with populations of 50,000 or more, suburb places as 2,500 to 50,000, and rural as less than 2,500 people (United States Census Bureau, n.d.).

This questionnaire was distributed prior to and following the administration of various message interventions. The only difference between the pre-intervention and post-intervention questionnaires was that the post-intervention survey contained three questions directed at whether the respondent had seen the intervention posters and had been influenced by the presence of the research project. Cronbach's alpha was used to evaluate the internal consistency

of the final instrument yielding reliability coefficients for beliefs ($\alpha = 0.82$) and acceptance of suggested changes ($\alpha = 0.76$) that were strong.

Food Waste Data Collection

Edible food waste data was collected by monitoring each dining hall tray for lunch and dinner service during a six week period of the spring semester. Students were asked to participate in tray tracking. Those volunteering to participate were entered into a drawing for gift certificates. Dining hall trays of students willing to participate were coded with a number as they were returned to the dishroom carousel accumulator. This same code was used to match participant survey responses with individual tray waste data. As the coded trays entered the dishroom area, all edible food items were scraped into a container on a digital scale. The weight of this individual waste was recorded in grams. All edible food on un-coded trays was scraped into a separate container to allow for the total weight of edible waste for each meal to be calculated. Average per person tray waste was calculated by dividing the weight of all edible items disposed by the total number of students who dined in-house for each meal. Beverages left in glasses and non-edible items such as fruit peels, bones, and paper items were not weighed. Other factors such as weather, menu, holidays, and campus and social events were documented.

Experimental Design

Baseline and Intervention Conditions

Data collection for component one of this operational research study was conducted during the spring semester of 2011 (Figure 3.1). There had been no waste audit or food waste education in place for years in this facility. The experimental design began with a two week baseline period. During this baseline period, food waste was documented and the baseline pre-message questionnaire was administered. The researcher and trained assistants collected and

weighed all edible food waste from trays returned to the dishroom during lunch and dinner meals. Coded trays were documented individually. The total amount of edible waste for all trays was also documented. This allowed the researcher to identify the actual amount of edible food wasted per student tray and determine the average per tray food waste weight. Due to the limited hot food service times, low counts, and high variability in breakfasts at this facility, only lunch and dinner data were collected. This facility does not serve weekend or holiday meals. At no point were the customers able to see the waste weighing process.

During the fourth week of the semester a prompt-type intervention was introduced and food waste data continued to be documented. The second intervention occurred during week six and employed feedback-based messages and food waste data collection. During week seven all intervention messages were removed but weighing of the waste continued.

Message Intervention Materials

The experimental interventions in this study were of two types. The first was a basic prompt-type message providing nothing but a suggestion to not waste food. The second provided feedback-based information on food waste weights in the facility. The intervention periods each lasted two weeks.

The intervention signs were large with font easily read from across the room with designs that attracted attention. These signs were 11” by 17” and were placed at eye-level on both sides of the tray return window, near the tray dispersal units at the entrance, and on various bulletin boards throughout the facility. Small paper tents were also placed on dining room tables providing the same information as the larger posters.

Prompt-type Intervention

The prompt-type message was a simple, somewhat vague poster and table tent that could be read without the use of logic or genuine consideration, and required only a quick glance to comprehend. This likely stimulated the peripheral route of persuasion (Petty, Cacioppo, Strathman, & Priester, 1994). For ease of comprehension and basic stimulus, the message was in two short segments. The first a graphic stated “All Taste...No Waste” and a second line below the first reading “Eat what you take – Don’t waste food” (Appendix E). These messages were displayed during the third and fourth week of the research.

Feedback-based Intervention

The feedback intervention, also poster and tent-based, provided information to the students in two ways (Appendix F). First, the average per person tray waste weight was related to a social impact statement: “On average, each Strong Complex Resident wastes 2.15 oz. of food each meal. This amounts to more than 32 pounds per person per semester”. Second, the total amount of edible food disposed of at Van Zile was provided. This number was also related to a social impact statement. This more personalized data allowed students the chance to evaluate the information and think about it if desired. This approach was designed to stimulate the central route of persuasion (Petty et al., 1994).

Questionnaire Consent and Administration

The questionnaire was administered by the researcher and trained assistants at Van Zile Dining Center. The questionnaire contained a cover letter (Appendix G) informing the respondents of their rights as study participants and the purpose of the study. These surveys were distributed on two days during the “baseline period,” the second week of the prompt-type message intervention, and again during the second week of the feedback-based message

intervention. All students dining in the facility during the lunch and dinner meals on these days were asked to voluntarily complete the instrument and return them as they left the dining rooms. Students who completed surveys were entered into a drawing for gift certificates in appreciation of their participation.

Data Analysis

A coding system was developed to allow the researchers to match participant tray waste with their survey responses. After data was recorded all individual identifiers were destroyed to protect the anonymity of the respondents. A data file of all survey responses and food waste weights was created and analyzed using the Statistical Package for the Social Sciences (SPSS) (version 13.0, 2004, SPSS, Inc., Chicago: IL). Significance levels were set at $p \leq 0.05$ for all data unless otherwise noted.

Descriptive statistics were calculated for the demographics, beliefs, and acceptance of service style changes data presented as frequencies, means, and standard deviations. To assess relationships and established hypotheses, inferential statistics such as ANOVA and correlation analysis were used. Table 3.1 depicts all variables analyzed.

Component Two

Overview

Component two of the study used qualitative methods to explore the operational feasibility of implementing a trayfree dining system at Kansas State University Dining Services. This portion of the study included a best-practice review from other dining facilities involved in trayfree dining. This qualitative review employed telephone interviews with foodservice professionals of college and university dining facilities. A case study investigating the feasibility of implementing this system at Van Zile Dining Center used the information gathered from the

Table 3.1. Component One Variables and Analysis

Objectives	Hypotheses	Independent Variable	Dependent Variable	Measure Used	Statistical Analysis
1. Measure the beliefs of college students participating in a meal plan towards sustainability and edible food waste.				Survey: Q1-8	Descriptive statistics
2. Evaluate acceptance of various sustainability-focused service style changes by college students participating in a meal plan.				Survey: Q9-13	Descriptive statistics
3. Measure the edible food waste of college students participating in a meal plan.				Scale weight	Descriptive statistics
4. Evaluate whether messaging impacts the beliefs of college students participating in a meal plan towards sustainability and edible food waste.	Hypothesis 1: Beliefs towards sustainability will not improve significantly after exposure to the simple prompt-type message.	Prompt-type poster	Beliefs	Survey: Q1,2	ANOVA
	Hypothesis 2: Beliefs towards sustainability will not significantly improve after exposure to the feedback-based message.	Feedback-based poster	Beliefs	Survey: Q1,2	ANOVA
	Hypothesis 3: Beliefs towards edible food waste will not improve significantly after exposure to the simple prompt-type message.	Prompt-type Poster	Beliefs	Survey: Q3-8	ANOVA
	Hypothesis 4: Beliefs towards edible food waste will not significantly improve after exposure to the feedback-based message.	Feedback-based poster	Beliefs	Survey: Q3-8	ANOVA

Table 3.1. Component One Variables and Analysis (cont.)

Objectives	Hypotheses	Independent Variable	Dependent Variable	Measure Used	Statistical Analysis
5. Evaluate whether messaging impacts the acceptance of various sustainability-focused service style changes by college students participating in a meal plan.	Hypothesis 5: Students' acceptance of various service style changes directed at sustainability and food waste reduction will not significantly improve following exposure to the simple prompt-type message.	Prompt-type poster	Acceptance of suggested changes	Survey: Q9-13	ANOVA
	Hypothesis 6: Students' acceptance of various service style changes directed at sustainability and food waste reduction will not significantly improve after exposure to the feedback-based message.	Feedback-based poster	Acceptance of suggested changes	Survey: Q9-13	ANOVA
6. Evaluate whether messaging impacts the food waste behavior of college students participating in a meal plan.	Hypothesis 7: Mean edible tray waste will not significantly decrease after exposure to the simple prompt-type message.	Prompt-type poster	Edible food waste weights	Scale weight	ANOVA
	Hypothesis 8: Mean edible tray waste will not significantly decrease after exposure to the feedback-based message.	Feedback-based poster	Edible food waste weights	Scale weight	ANOVA
7. Evaluate the relationship between beliefs towards sustainability and food waste reduction and actual food waste behaviors.	Hypothesis 9: There will be no significant relationship between beliefs towards sustainability and food waste behaviors in the dining center.	Survey: Q1,2	Edible food waste weights	Scale weight	Correlation
	Hypothesis 10: There will be no significant relationship between beliefs towards food waste and food waste behaviors in the dining center.	Survey: Q3-8	Edible food waste weights	Scale weight	Correlation

Table 3.1. Component One Variables and Analysis (cont.)

Objectives	Hypotheses	Independent Variable	Dependent Variable	Measure Used	Statistical Analysis
8. Evaluate the relationship between various demographic factors and the beliefs towards sustainability and food waste reduction.	Hypothesis 11: There will be no significant difference between beliefs towards sustainability and various demographic factors			Survey: Q1,2	ANOVA
	a.) Sex	Survey: Q14	Beliefs		
	b.) College of academic major	Survey: Q15	Beliefs		
	c.) Year of enrollment/status	Survey: Q16	Beliefs		
	d.) Size of hometown	Survey: Q17	Beliefs		
	e.) Location of hometown	Survey: Q18	Beliefs		
	Hypothesis 12: There will be no significant difference between beliefs towards edible food waste and various demographic factors			Survey: Q3-8	ANOVA
	a.) Sex	Survey: Q14	Beliefs		
	b.) College of academic major	Survey: Q15	Beliefs		
	c.) Year of enrollment/status	Survey: Q16	Beliefs		
d.) Size of hometown	Survey: Q17	Beliefs			
e.) Location of hometown	Survey: Q18	Beliefs			
9. Evaluate the relationship between various demographic factors and food waste behavior.	Hypothesis 13: There will be no significant difference between food waste behaviors and various demographic factors:		Edible food waste weights	Scale weight	ANOVA
	a.) Sex	Survey: Q14			
	b.) College of academic major	Survey: Q15			
	c.) Year of enrollment/status	Survey: Q16			
	d.) Size of hometown	Survey: Q17			
	e.) Location of hometown	Survey: Q18			

Note: Abbreviation: Q = Survey Question.

foodservice professionals and focus groups of university dining center students to gain insight into student perceptions of implementing such a system.

Best Practices Review

Population and Sample

Component two began with telephone interviews of college and university dining professionals who have been previously involved or are currently implementing or using the trayfree dining service style. The population for this portion of the study was university foodservice professionals who are members of The National Association of College and University Foodservices (NACUFS) and regional universities identified as being trayfree.

NACUFS is a trade association for foodservice professionals at institutions of higher learning in the U.S., Canada, and Mexico. There are over 625 educational institutions and 500 industry members in this organization. For the purpose of this study, 70 institutions identified on a list of “Trayless Members in NACUFS” and 13 regional universities were identified for sample selection of foodservice professionals involved in the trayfree service style. The final convenience sample of foodservice professionals was determined by those who indicated their willingness to participate in our telephone survey.

Telephone Interview

The seven questions in the telephone survey were developed based on a review of the trayfree dining system and previous research in the field. The questions were primarily open-ended and were designed to gather input on challenges, benefits, and suggestions these professionals may have on implementing or evaluating the feasibility of a trayfree system. Discussion was encouraged and additional questions often arose during the telephone

conversation. These questions were administered verbally over the telephone with the guidance of a script (Appendix H) to facilitate that information was gathered uniformly. When feasible the discussions were audio taped for clarity of responses.

Administration

An introductory e-mail (Appendix I) was sent to all 83 of the academic institutions identified as being trayfree. This e-mail provided them with basic details of the study, subject's rights, methods for contacting the researchers, and requested their participation. The subjects were informed that their responses would be kept confidential and that they could decline to participate at any time. If willing to participate in the telephone survey, they were asked to reply with the name and telephone number of the individual they prefer the researcher contact. The introductory e-mail was sent a second and third time to all non-responding institutions one and two weeks after the initial contact.

The information from all responding institutions was gathered and organized for calling purposes. Following Dillman's (1978) recommendations, a call tracking form was developed to document the details of each facility and log calls made.

Student Focus Groups

Participant Recruitment

Student interest group representatives focused on environmentalism within the residence halls were contacted by the researcher to discuss the purpose of the study and request their help recruiting students to participate. The researcher was instructed to post promotional materials on the group's bulletin board. Posters were also displayed throughout the dining center. Focus group sessions were held in Van Zile Dining Center following dinner service on two weeknights.

Individuals who consumed at least one meal a day at Van Zile, lived in the residence halls, and were at least 18 years of age were eligible to participate in the focus group.

As the participants arrived and were seated, introductions were made, and tent cards with a number were placed in front of each respondent. The students' comments were identified by number only. Prior to the focus group, the participants were verbally informed of the purpose, confidentiality of information, and contact information for the study. They were informed that they could leave at any time if they felt they were unable to continue the discussion. Each participant was asked to sign an informed consent form (Appendix J) and received a copy of this information in written form. Each student received a gift certificate in appreciation of their participation.

Focus Group Discussion

Two focus groups were held in Van Zile Dining Center. Three students participated the first night and eight the second. The purpose of this discussion was to identify student familiarity with trayfree dining, perceived barriers and benefits of this service style, and suggestions for the future. The researcher used a focus group guide that was developed to facilitate and organize the session (Appendix K). The discussion points were based on facility interest and data gathered during the foodservice professionals best practice review portion of this study. Permission was sought to record the audio of the focus group discussion process. The focus groups were semi-structured with open-ended questions.

The students were asked to dine at Van Zile the following week without using a tray. The students then followed-up with the researcher on an individual basis. This allowed for further probing of student perceptions of trayfree dining after their exposure to the trayfree service style. During both the pre and post-trayfree experience, focus group students were asked

to complete a short survey (Appendix L). This survey allowed for quantitative analysis of the students' support for and concern with the implementation of trayfree dining, and to identify suggested changes. The changes included glass size, plate and bowl size, and silverware locations. Students were asked to rate their agreement with five statements ranging from Strongly Disagree (1) to Strongly Agree (5). All responses were coded using a number to identify each respondent, therefore ensuring anonymity. Following the focus groups the researcher transcribed the audiotapes and reviewed the notes from each session. The discussion responses were then categorized into themes and survey data analyzed for descriptive statistics.

Data Analysis

Interview and focus group discussion data were compiled and sorted by categories per the interview question. Data were also sorted by themes; problems, benefits, best practices, and recommendations. NVivo software (version 9, 2010, QSR International, Australia) was used to identify themes within the qualitative discussion data. Survey data was analyzed for frequency and descriptive purposes using SPSS (version 13.0, 2004, SPSS, Inc., Chicago: IL). This information was formatted into a set of guidelines to assist in the case study to determine the feasibility of implementing a trayfree dining program at Van Zile.

Project Approval

Approval from Kansas State University Institutional Review Board (IRB) was obtained before initiating the study. The IRB approval letter is located in Appendix M. Approval was also obtained from the management team of Kansas State University Housing and Dining Services. All participants were informed of their rights, the study topics, and the use of data by a cover letter or e-mail.

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CHAPTER 4 - THE INFLUENCE OF STUDENT BELIEFS AND DEMOGRAPHICS ON FOOD WASTE BEHAVIORS IN A UNIVERSITY DINING FACILITY

Abstract

Sustainability and going green have become popular trends among foodservice organizations. Despite this interest, these operations still produce large amounts of edible food waste and contribute significantly to the waste management problems. This study aimed to evaluate factors influencing student waste behaviors.

A self-administered questionnaire was used to measure beliefs regarding sustainability and food waste and to obtain demographic information from 133 students living in a residence hall complex at a Midwestern university. Trays of students volunteering to participate were coded so their edible waste weights could be measured. Individual food waste behaviors were evaluated by monitoring 3,097 coded trays for lunch and dinner service during a two week period. An aggregate measure of all edible food waste was monitored for an additional 3,692 uncoded trays. Average weight per tray was calculated for both coded and uncoded trays. General descriptive statistics, correlation analysis, and ANOVA were used to evaluate the habits and the relationships among the factors.

The amounts of edible food disposed of on trays ranged from 0 to 998 grams, with an average of 61.55 grams. Approximately 33% of the students disposed of no edible food items. No significant differences in food waste discarded and meal periods, menu types, events, or weather were found. Females disposed of significantly more edible items and had stronger beliefs towards food waste than males. General sustainability beliefs had no relationship to food

disposal behaviors. However, beliefs regarding food waste were negatively correlated with waste behavior, indicating individuals with higher levels of food waste beliefs disposed of less edible food items.

This study indicates that large amounts of edible food items are being disposed of by university students. These findings support the role consumers have relative to waste disposal. This knowledge identifies an area of focus for management's attention when striving to decrease the carbon footprint of their dining operation.

Introduction

Sustainability and going green have become popular trends among individuals and organizations globally. Despite this recent motivation towards sustainable actions, the United States (U.S.) continues to struggle with the amount of waste generated and the most efficient strategies to manage this waste. In 2009 the U.S. generated 243 million tons of municipal solid waste (MSW), nearly 4.43 pounds per person (Environmental Protection Agency [EPA], 2010). MSW contains items such as grass clippings, packaging, furniture, newspapers, food scraps, and electronics. Households generate an estimated 55-65% of this waste, and commercial organizations and institutional establishments produce the remaining 35-45% (EPA, 2010).

Food scraps were estimated to comprise 14.1% of all waste (EPA, 2010). The quantity of food waste increased from 12.20 million to 34.29 million tons from 1960 to 2009 (EPA, 2010). Commercial and retail food operations contribute greatly to this food loss. An estimated 54 billion pounds of food waste are disposed of annually by these operations (Jones & MartinezNocito, 2004, as cited in Jones, n.d.).

University foodservice operations are a large contributor to the waste problem. These operations generate nearly 3.6 million tons of waste per year, 10-20% of which is estimated to be food (Saphire, 1995). Studies by Ferris, Flores, Shanklin, and Whitworth (1995) and Shanklin and Ferris (1992) measured foodservice waste in university dining. They estimated that more than 167,000 pounds of food scraps were being disposed of annually in a single facility due to consumer plate waste. Consumer tray waste studies in university dining services have found an average of more than two ounces of food waste per student tray (Aramark, 2008; Norton & Martin, 1991; Van Handel, 2004).

Academic institutions are expected to represent the social norms and demonstrate the implementation of change (Saphire, 1998). Many cost and resource saving actions are important to consumers. Universities are beginning to explore methods of decreasing cost, improve their sustainable initiatives, and communicate their green efforts when recruiting potential students. Foodservice operations on these campuses are developing and implementing methods to meet these demands by both the university and potential customers (Aramark, 2008; Creighton, 1998; Penton Media Inc., 2011).

Current strategies of resource conservation and savings in campus foodservice operations include the use of waste pulpers, implementation of recycling and compost programs, and introduction of reusable to-go containers and trayfree dining. While finding alternate methods of managing waste is a commendable option, discovering ways of preventing the waste of food may be a better approach. The consumers in university dining operations play a primary role in this wastefulness and should be the focus of our attention.

This research was a component of a broader operational study. This chapter presents data obtained about student sustainability beliefs and food waste behaviors in a university dining operation. The quantity of waste generated is analyzed based on the following variables: demographic characteristics of the sample, menu options, and beliefs regarding food waste and sustainability. Sustainability efforts in the university setting can then be developed more efficiently to focus on areas of greater impact.

Methodology

Setting and Participants

The setting of this operational study was Van Zile Dining Center at Kansas State University. Only residents from three specific residence halls are allowed to dine in the facility

and up to 15 student guests per meal. Staff member data was not included in this study. This setting allowed student behavior to be easily monitored.

Van Zile Dining Center is an “all-you-care-to-eat” cafeteria-style dining facility. Entrees and sides are available at four serving lines, each with a different menu concept. Menu items are served by the employees to the customers. Salads, soups, fruits, cereals, and desserts are available for self-service. Breakfast, lunch, and dinner are served Monday through Friday. This facility does not operate on weekends or holidays.

The population for this operational study was 540 students who lived in Putnam, Van Zile, and Boyd residence halls and purchased meal plans during the spring semester of 2011. The sample included students who ate meals in-house at Van Zile Dining Center during the data collection period.

Instrument Development and Administration

A self-administered questionnaire was developed to explore the constructs of this study. Questions were based on a review of the pertinent literature. The instrument was reviewed by Hospitality Management and Dietetics faculty at Kansas State University. The faculty provided suggestions on questionnaire wording, flow, and length. The instrument was modified using input obtained (Appendix A).

A pilot study was conducted with a random sample of university students at the end of the fall semester of 2010 who were participating in an on-campus meal plan. The pilot survey instrument included feedback questions regarding the flow, clarity, and ease of completion (Appendix C). The pilot survey was administered to students dining at Derby Dining Center at Kansas State University.

The pilot study yielded 65 usable questionnaires. Cronbach's alpha was used to determine the internal consistency of the items. A threshold of 0.70 was used to demonstrate consistency. The reliability coefficient ($\alpha = .85$) for beliefs towards sustainability and food waste was strong. Comments provided by pilot test participants showed acceptance and understanding of the written instrument, thus no additional changes were made. Students who participated in the pilot study were excluded when the instrument was administered during the spring semester of 2011.

The final version of the written instrument included three sections, two of which were used for the current study. Part one was constructed of eight questions. Two questions focused on evaluating the participants' beliefs towards sustainability and self. Six questions were directed at measuring beliefs towards food waste. Students were asked to rate their opinion on each of these items from Strongly Disagree (1) to Strongly Agree (5) (Appendix D). Cronbach's alpha was again used to evaluate the internal consistency of the final instrument yielding a strong reliability coefficient for beliefs ($\alpha = 0.82$).

Five questions gathered general demographic information about the students including sex, class standing, academic college enrolled, location of their home town, and urban versus rural status of their home town. Urban areas were classified as locations with populations of 50,000 or more, suburb places as 2,500 to 50,000, and rural as less than 2,500 people (United States Census Bureau, n.d.).

This questionnaire was administered a total of three times during a broader six week study while students dined in the facility. For the current study, discussions regarding student beliefs towards sustainability and food waste will focus on the initial questionnaire administration (Time 1) survey responses. However, demographic data gathered from any of the

three survey times was used for evaluation of food waste behavior of those dining during the two weeks of the current study. All students who participated were entered into various drawings for gift certificates.

Food Waste Data Collection

Edible food waste data was collected by monitoring each tray for lunch and dinner service during a two week period of the spring semester. Trays of students willing to participate were coded with a number as they were returned to the dishroom carousel accumulator. This code was used to match participant survey responses with individual tray waste data. As the coded trays entered the dishroom area, all edible food items were scraped into a container on a digital scale. The weight of this individual waste was recorded in grams. All edible food on uncoded trays was scraped into a separate container to allow for the total weight of edible waste for each meal to be calculated. Average per person tray waste was calculated by dividing the weight of all edible items disposed by the total number of students who dined in-house for each meal. Beverages left in glasses and non-edible items such as fruit peels, bones, and paper items were not weighed. Other factors such as weather, menu, holidays, and campus and social events were documented.

Data Analysis

A coding system was used to allow the researchers to match participant tray waste with their survey responses. After data were recorded, all individual identifiers were destroyed to protect the anonymity of the respondents. A data file of all survey responses and food waste weights was created using the Statistical Package for the Social Sciences (SPSS) (version 13.0, 2004, SPSS, Inc., Chicago: IL). Statistical procedures included general descriptive, ANOVA,

and correlation analysis. Significance levels were set at $p \leq .05$ for all data unless otherwise noted.

Results

The average number of students dining for each lunch was 417 and the average dinner census was 391 during the two weeks of data collection. Of the 540 students residing in the Van Zile Complex, 133 completed the initial questionnaire, yielding a 24.6% response rate for beliefs data. Fifty-two percent of the students ($n=285$) completed a questionnaire during at least one of the three collection periods and allowed their trays to be coded during the two weeks of this study, yielding demographic data for 52.78% of the students.

Profile of Respondents

Demographic characteristics of those who participated in individual food waste analysis during the two week collection period are presented in Table 4.1. Females comprised a majority (70.88%) of the subjects. A majority were freshman (51.58%); 25.96% were sophomores. Limited residential diversity was found among the participants. The majority were residents of Kansas (87.72%). This sample was similar in demographics to that of the entire complex of students researched. Van Zile Dining Center is located in a complex of three resident halls. This complex was 68% female, and approximately 86% of the students were from the state of Kansas. Less than one percent of the complex were international students.

The size of the respondents' hometowns was fairly evenly distributed with 20.35% being from rural (<2,500 people), 30.53% suburb (2,500-49,999 people), 27.02% medium urban (50,000-250,000 people), and 21.75% from large urban areas (>250,000 people). The participants were primarily enrolled in majors within the College of Arts and Sciences (35.44%) and Agriculture (12.98%).

----Insert Table 4.1----

Edible Food Waste

During the two week study a total of 8,077 student meals were served during lunch and dinner. On average, 84.05% of the student dined in-house. Of the 6,789 lunch and dinner meals consumed in Van Zile during these two weeks, approximately 46% of these students allowed their trays to be coded. This allowed the specific food waste to be measured on 3,097 trays. Food waste was collected as an aggregate measure for the remaining 3,692 trays and an average food waste per tray was computed.

Individual food waste ranged from 0 to 998 grams of waste. On average, 61.55 grams (2.12 ounces) of edible food waste was left on each student dining tray. This is slightly higher than the average food waste per customer (1.8 ounces) reported by Aramark (2008). More than half of the students (60%) left less than 50 grams of edible items on their trays. Approximately 33% of the students returned their trays with no edible food items remaining. Few students left edible waste in excess of 150 grams. The distribution of waste remaining on coded student trays is shown in Figure 4.1.

----Insert Figure 4.1----

Mean tray waste is presented by day of the week and meal period in Table 4.2. Data for coded trays (individually monitored) is presented separately from that of uncoded trays (aggregate measure). The average waste for each meal and day of service is also shown as an average of the aggregate data gathered from all trays. Individual data was able to be analyzed for students who allowed their trays to be coded, however, only an aggregate measure was available for uncoded trays. This prevents the statistical comparison of this data.

Observational comparison of the data shows that students who allowed their dining hall trays to be coded had a lower average tray waste in comparison to average waste calculated for un-coded trays. Coded trays had an average of 58.99 grams or 2.08 ounces of waste. The average waste left on un-coded trays was 64.84 grams or 2.29 ounces.

While the average amount of food left on student trays at dinner was higher than that at lunch, when evaluated by individual days of service results were not consistent. Evaluation of the two week period indicated that the amount of food disposed of on student trays varied by day of the week and from lunch to dinner.

---Insert Table 4.2---

General observance indicated that bread items, such as deli and hoagie buns, and fresh fruit were disposed of most frequently. Disposal of large portions of entrée items was rarely observed. Self-serve condiments, such as ketchup and ranch dressing, increased the total amount of waste disposed. However, no distinct patterns in the amount of waste were observed between menu options. When food waste amounts were evaluated for the meals when local sporting or campus events were scheduled only a few changes in the average amount of waste were observed.

Demographic Influences on Food Waste

Edible food waste amounts for the individuals who allowed their trays to be coded were evaluated based on demographic factors (Table 4.1). Females were found to discard significantly ($p = 0.01$) higher amounts of edible waste than males. The average weight of edible items disposed of by females and males was 65.59 grams ($SD = 57.62$) and 46.08 grams ($SD = 37.43$) grams, respectively.

Students enrolled in the College of Business disposed of the highest average amounts of waste (77.86 g), while those in Architecture disposed of the least (51.33 g). While the difference is apparent, it was not statistically significant. The small number of respondents in some of the college enrollment categories may have contributed to the results.

Class standing was found to have no significant relationship with food waste behavior. Sophomores had the highest average waste (64.99 g) and juniors the least (41.06 g). Again, the low number of respondents in some of the class standing categories may have contributed to the non-significant results. Kansas and Missouri natives, although not significant, had an overall average waste less than that of other out-of-state students.

Beliefs Regarding Food Waste and Sustainability

Sustainability Beliefs

Beliefs towards sustainability were measured using two survey questions regarding personal understanding and importance of sustainability. When asked to rate their understanding of sustainability, the responses averaged higher than neutral (3.00) ($M = 3.49$, $SD = 0.96$) (Table 4.3). Students rated the importance of sustainability higher than neutral ($M = 3.75$, $SD = 0.96$). Aggregated ratings for these two opinion items indicated a higher than neutral (3.00) level of belief towards sustainability ($M = 3.62$, $SD = 0.81$). While higher than neutral, these ratings do not indicate a strong belief towards environmental sustainability. The means are displayed in Table 4.3.

Food Waste Beliefs

Students' beliefs regarding food waste and their personal role were analyzed with six questions. Students' belief that disposing of edible food on their trays has a negative environmental impact was stronger than neutral (3.00) ($M = 3.74$, $SD = 1.09$) (Table 4.3).

Students agreed (4.00) that the dining center had a large amount of food being disposed of on trays ($M = 4.00, SD = 0.93$). Students agreed (4.00) that it is wrong to waste food with a high number of people going hungry in our world ($M = 4.05, SD = 1.10$).

The belief of students regarding the impact of one person, whether it be in a negative manner with food waste or a positive effort towards improving world hunger were both stronger than neutral (3.00). Students rated their belief that the dining center should implement more sustainability programs as higher than neutral ($M = 3.60, SD = 1.00$). Aggregated ratings for these six opinion items associated with food waste beliefs indicated a stronger than neutral (3.00) level of belief ($M = 3.76, SD = 0.81$).

-----Insert Table 4.3-----

Demographic Influence on Beliefs

One-hundred and thirty-three students completed the questionnaire allowing their beliefs regarding sustainability and food waste to be evaluated in relation to demographics also gathered using the written survey instrument.

The level of beliefs regarding sustainability and food waste based on demographic profile are displayed in Table 4.4. Females had significantly ($p = 0.02$) stronger average food waste belief ratings than did males. The aggregate rating of females based on the six opinion items regarding food waste was stronger than a neutral (3.0) level of belief ($M = 3.87, SD = 0.77$). Males, having beliefs slightly lower than females, were also stronger than a neutral standing ($M = 3.51, SD = 0.87$). While significantly different, both fell just above neutral demonstrating no strong personal beliefs regarding food waste. Males ($M = 3.67, SD = 0.71$) and females ($M = 3.61, SD = 0.85$) did not significantly differ in their beliefs in regards to sustainability.

The ratings of beliefs in regards to sustainability and food waste did not significantly differ based on college of enrollment or size and location of hometown. Sophomores had significantly ($p = 0.01$) stronger beliefs related to food waste and personal impact of behavior than freshman and seniors. Aggregated ratings of six opinion items indicated sophomores agreed (4.00) with the impact of food waste and their role in it ($M = 4.09, SD = 0.65$). Freshman ($M = 3.64, SD = 0.71$) and seniors ($M = 3.44, SD = 0.97$) rated their role lower than sophomores and juniors.

Relationship Between Beliefs and Food Waste Behaviors

Sustainability Beliefs

The relationship between the food waste behavior and the sustainability beliefs of 120 students was evaluated. These students completed the beliefs survey and allowed their trays to be evaluated for food waste amounts during the two week study period. The mean edible food waste of these 120 students during the baseline period was calculated as 61.05 grams. The aggregate rating of the opinion items focused on sustainability for these students was stronger than a neutral (3.00) level of belief ($M = 3.63, SD = 0.79$). These beliefs were found to have no significant correlation with food waste behaviors of the subjects.

Food Waste Beliefs

The aggregated rating of the six food waste belief opinion items indicated a baseline rating stronger than neutral (3.00) in regards to food waste ($M = 3.78, SD = 0.80$) for these 120 students. Average food waste at baseline was found to be negatively correlated ($r(118) = -0.25$) at $p = 0.01$ with food waste beliefs. Students who had higher food waste beliefs also disposed of less edible food items.

Conclusions

Although today's society expresses significant interest in sustainability and decreasing our carbon footprint, data about the amount of waste discarded show that we still struggle with the amount of waste we generate (EPA, 2010; Jones & MartinezNocito, 2004, as cited in Jones, n.d.). University foodservice operations represent a segment of the industry that often is expected to be at the forefront of trends and societal demands. A basic knowledge of the amounts of food waste in these facilities may motivate managers to develop methods of decreasing this waste. Knowledge of what factors influence college students participating in a meal plan to waste edible items is essential to the development of effective messaging and marketing campaigns aimed at sustainable dining in these on-campus facilities.

This research evaluated the quantities of edible items disposed of in a university dining hall and assessed whether the amount of waste was influenced by selected demographic variables and student beliefs. This study demonstrated that large amounts of edible food items were disposed of during lunch and dinner service during a two week period in a single on-campus facility. Lunch and dinner waste weights were evaluated. The amounts of edible food disposed of varied by meal period as well as day of the week. No distinct pattern was observed. Campus events and menu offerings did not appear to impact the waste behaviors of these students.

Students who volunteered to have their trays coded were observed to discard of less edible food than the aggregate average of students who did not participate. This observed difference may indicate that those willing to participate had a better perception of sustainability and stronger beliefs than those who did not participate. This may also signal that the study itself may have played a role in the food waste behavior of these students.

Beliefs in regards to sustainability in this study were determined by two measurement items on a written questionnaire. Responses for these two opinion items were averaged together to provide an overall aggregate rating of sustainability beliefs. This study found that student beliefs were only mildly supportive in regards to sustainability.

Beliefs focusing on food waste and one's personal impact on this topic were evaluated by six measurement items on the questionnaire. An aggregate rating of these opinion items was used to demonstrate an overall rating of food waste beliefs. Students were only mildly positive in regards to their beliefs of food waste and their personal role.

The literature suggests that beliefs about various conditions and personal impact influence behavior (Arbuthnott, 2009; Straughan & Roberts, 1999). The current study found somewhat mild support in the beliefs of university dining center students in regards to sustainability and food waste. Beliefs focused on sustainability had no correlation with the food waste behaviors of these students.

Specific behavior intentions are more likely to lead to behavior change than general attitudes (Arbuthnott, 2009; Joireman, Van Lange, & Van Vugt, 2004). The current study supports this as when the topic was more focused in relation to the behavior evaluated a relationship was discovered. As personal beliefs regarding food waste improved, the food waste behavior of these students also improved. While not a causal relationship, the correlation does indicate that an improvement in one does mirror an improvement in the other. The stronger the personal beliefs regarding the negative impact of food waste and the individual impact one can have, the less edible food items disposed of.

While females disposed of greater amounts of food items than males, it is difficult to determine the cause. This study did not include analysis of the initial food portions taken. It

cannot be determined if one gender disposed of a greater portion of their servings than the other. Future research should include analysis of food taken versus consumed in relation to edible waste behaviors.

While some variance did exist, demographic factors were not found to play a profound role in the sustainable beliefs or behaviors of these students. The students' field of study and class standing were not shown to influence their food waste behaviors. It does not appear that social versus science-based fields of study significantly impact the waste behaviors of students in this dining facility. The small sample size of some of the college of study categories may have prevented a true significance from being observed. This observation may also be due to the fact that sustainability based curriculum is in the early phases of development on this campus. Other campus environments may vary in their presence and impact on this topic.

Location and size of the students' hometown did not appear to influence food waste behaviors. Rural, urban, and metropolitan residents disposed of similar amounts of food items. Habits gained while growing up in these various environments do not appear to impact the food disposal behaviors of these students. Again, the small sample in each category may have limited the evaluative nature of the data, preventing a significance from being observed.

While we hope that sustainable habits can and will be gained during our easily impactable adolescence this may not be reality. The university environment may be the initial introduction students have with this topic. All areas of study could benefit from the inclusion of sustainable topics into their curriculum. Campus dining facilities can reinforce learning through various strategies they implement to reduce their carbon footprint.

These observations, in conjunction with the fact that no correlations between menu types, events, or weather were found, indicate that consumers play a primary role in the edible food

waste struggle. General consumer education may help. Simply informing students of the large amount of foods being disposed of on their trays may be a starting point. The fact that demographic differences played a very small role in the food waste behaviors of this population simplifies the process.

Development of educational or marketing programs and campaigns often involves various target audiences. However, in this situation many of the factors often evaluated, such as sex, areas of interest, and location of childhood, did not have a significant impact. This allows more general, less focused programs to be developed and implemented. Further research into the impact various forms of messages have on students' waste behaviors will be discussed in Chapter 5.

This study indicates that a problem does exist. Large amounts of edible food items are being disposed of by university students. These findings implicate these consumers have a responsibility to decrease the amount of food waste discarded. However, this also identifies an area of focus for management attention when striving to decrease the carbon footprint of their dining operation. Knowing that students play a part and that similarities in their practices do exist will provide management with a feasible option. Customer education can be simple.

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Table 4.1. Influence of Student Demographics on Average Food Waste

		Time 1 (N = 285)			
		% ^a	Mean ± Standard Deviation Food Waste (grams)	F	Sig.
Gender	Female	70.88	65.59±57.62 ^x	8.099	0.005
	Male	29.12	46.08±37.43 ^y		
College	Arts & Science	35.44	53.85±47.39 ^x	0.795	0.574
	Agriculture	12.98	62.30±57.98 ^x		
	Engineering	12.63	58.23±63.84 ^x		
	Education	12.28	65.44±52.37 ^x		
	Human Ecology	11.93	60.86±40.82 ^x		
	Business	9.12	77.86±73.59 ^x		
	Architecture	2.11	51.33±45.65 ^x		
Class	Freshman (including ESL) ^b	51.58	62.85±55.60 ^x	2.075	0.104
	Sophomore	25.96	64.99±56.57 ^x		
	Junior	14.04	41.06±41.52 ^x		
	Senior	7.02	56.54±41.03 ^x		
Hometown	Kansas	87.72	57.88±49.07 ^x	1.276	0.281
	Missouri	3.51	46.78±36.82 ^x		
	Other State	8.07	73.45±71.08 ^x		
Hometown Size	Rural	20.35	51.54±48.17 ^x	1.050	0.371
	Suburb or Rural	30.53	64.07±49.09 ^x		
	Medium Urban	27.02	65.42±62.72 ^x		
	Large Urban	21.75	55.87±50.24 ^x		

Note: Means with different superscripts (x,y,z) differ significantly within a category based on Tukey's Post-Hoc test, ($p \leq 0.05$).

^aResponses may not equal 100% due to non-response to a question.

^bESL = English as a Second Language Program

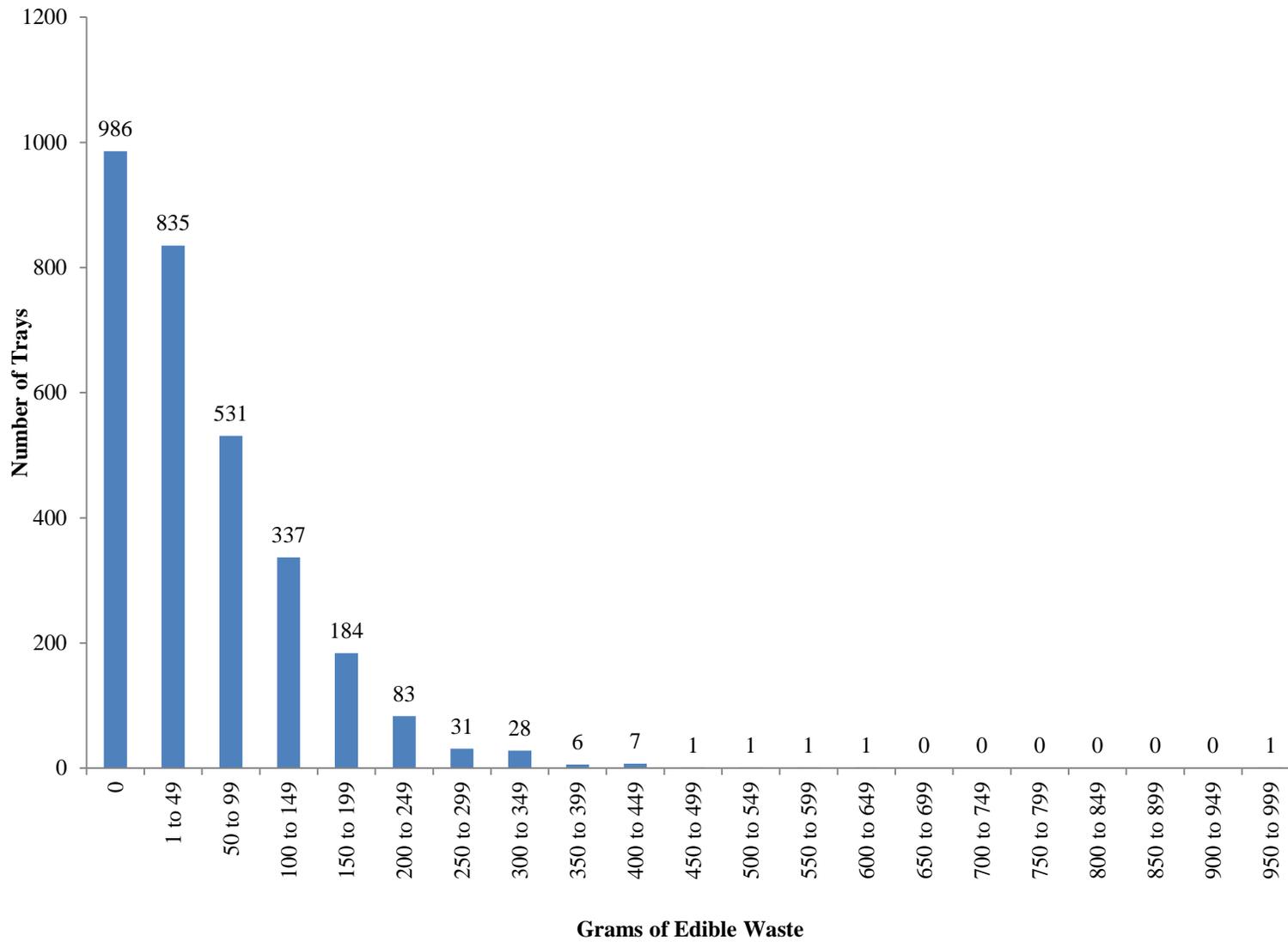


Figure 4.1. Grams of Edible Food Waste Disposed of on Coded Student Trays (N=3033)

Table 4.2. Average Edible Tray Waste by Day and Meal

	Lunch (grams)			Dinner (grams)		
	Coded Trays ^a	Uncoded Trays ^b	All Trays ^c	Coded Trays ^a	Uncoded Trays ^b	All Trays ^c
Average Waste	55.41	60.96	57.56	62.94	67.70	65.18
<i>Day of Service:</i>						
Monday	66.63	79.89	71.63	63.66	69.18	66.17
Tuesday	54.05	33.97	42.26	52.74	60.23	56.70
Wednesday	58.24	64.92	61.08	61.52	62.82	61.64
Thursday	47.12	64.28	55.23	88.07	77.86	80.40
Friday	47.60	48.98	47.80	43.05	64.01	54.82

^aAverage Waste of Coded Trays = sum of edible waste from coded trays ÷ total number of coded trays

^bAverage Waste of Uncoded Trays = (total edible waste – sum of edible waste from coded trays) ÷ (total dine-in customer count – total number of coded trays)

^cAverage Waste of All Trays = total weight of edible waste ÷ total dine-in customer count

Table 4.3. Students' Beliefs Towards Sustainability and Food Waste (N=133)

	Mean ± Standard Deviation
Sustainability Belief Statements	
My understanding of environmental sustainability is excellent.	3.49±0.96
Environmental sustainability is very important to me.	3.75±.096
<i>Overall Sustainability Belief</i>	3.62±.081
Food Waste Belief Statements	
Leaving uneaten food on my dining tray has a negative effect on the environment.	3.74±1.09
I feel the dining center has a large amount of food thrown out on student trays.	4.00±0.93
I believe it is wrong to waste food when there are so many hungry people in the world.	4.05±1.10
I feel one person's food waste can have a negative impact on the environment.	3.64±1.04
I feel one person's efforts to decrease food waste can assist in improving world hunger.	3.56±1.15
I believe the dining center should implement more programs on environmental sustainability	3.60±1.00
<i>Overall Food Waste Belief</i>	3.76±0.81

Scale values: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1)

Table 4.4. Profile of Students Completing Beliefs Survey (N=133)

		Sustainability Beliefs ^b				Food Waste Beliefs ^b		
		% ^a	Mean ± Standard Deviation	F	Sig.	Mean ± Standard Deviation	F	Sig.
Gender	Female	69.92	3.61±0.85 ^x	0.147	0.702	3.87±0.77 ^x	5.653	0.019
	Male	29.36	3.67±0.71 ^x			3.51±0.87 ^y		
College	Arts & Science	28.57	3.57±0.70 ^x	1.682	0.131	3.80±0.81 ^x	1.389	0.225
	Agriculture	16.54	3.95±0.79 ^x			3.77±0.89 ^x		
	Human Ecology	15.79	3.81±0.84 ^x			4.19±0.85 ^x		
	Education	13.53	3.25±0.62 ^x			3.57±0.82 ^x		
	Engineering	10.53	3.57±0.81 ^x			3.77±0.58 ^x		
	Business	9.02	3.41±1.20 ^x			3.55±0.65 ^x		
	Architecture	2.26	3.83±0.76			3.50±0.44 ^x		
Class	Freshman (including ESL)	39.85	3.62±0.87 ^x	0.190	0.903	3.64±0.71 ^x	3.871	0.011
	Sophomore	29.32	3.59±0.81 ^x			4.09±0.65 ^y		
	Junior	16.54	3.66±0.66 ^x			3.80±0.85 ^{xy}		
	Senior	11.28	3.47±0.80 ^x			3.44±0.97 ^x		
Hometown	Kansas	86.47	3.60±0.81 ^x	0.498	0.684	3.72±0.83 ^x	0.692	0.558
	Missouri	3.01	3.61±1.11 ^x			4.04±0.67 ^x		
	Other State	9.77	3.73±0.67 ^x			4.00±0.68 ^x		
	International	0.70	4.50±0.00 ^x			4.17±0.00 ^x		
Hometown Size	Rural	21.80	3.48±0.85 ^x	1.034	0.380	3.69±1.04 ^x	0.916	0.403
	Suburb or Rural	29.32	3.78±0.77 ^x			3.78±0.70 ^x		
	Medium Urban	27.07	3.51±0.72 ^x			3.73±0.79 ^x		
	Large Urban	21.05	3.66±0.91 ^x			3.83±0.78 ^x		

^aResponses may not equal 100% due to non-response to a question.

^bScale values: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1)

Note: Means with different superscripts (x,y) differ significantly within a category ($p \leq 0.05$).

CHAPTER 5 - THE IMPACT OF WRITTEN MESSAGES ON BELIEFS AND EDIBLE FOOD WASTE BEHAVIORS IN A UNIVERSITY DINING FACILITY

Abstract

The purpose of this operational study was to determine how to introduce a food waste behavior change into dining facility using a simple message-type intervention that requires little sustained administrative support and can provide optimum impact.

The population for this study was 540 Kansas State University students living in the residence halls and participating in a meal plan. This study assessed whether simple prompt-type message interventions had an impact or if the addition of more personally relevant feedback-based data elicited a greater change in student beliefs and food waste behaviors. A written questionnaire and individual student tray waste tracking were used to gather data. Simple print-format messages were evaluated, allowing the effect of an affordable message campaign to be determined.

Students had a higher than neutral level of belief, but did not indicate a strong conviction towards environmental sustainability or food waste. The edible food items disposed of on 19,046 trays in this “all-you-care-to-eat” university dining operation were evaluated. On average more than 57 grams of edible food was disposed of, accumulating to more than 1.5 tons of food waste during the six week study. The simple to-the-point prompt-type message stimulated a 15% reduction in food waste. The addition of a more personalized feedback-based message did not stimulate an additional change beyond that of the prompt message. These findings indicate

that simply making university students aware of the topic of food waste may be useful in improving their behaviors and the sustainability of the foodservice facility.

Introduction

Today one of our most pressing issues is to decrease our impact on the environment, including reducing our carbon footprint and using our resources more efficiently. Food is one of these resources. Despite this fact, nearly 14% of the meats, grains, fruits, and vegetables in households are disposed of (Jones, Bockhorst, McGee, & Ndiaye, 2003, as cited in Jones, n.d.) Commercial and retail food operations are major contributors to the vast amounts of food waste being generated in our nation each year. Nearly 54 billion pounds are disposed of annually by these operations (Jones & MartinezNocito, 2004, as cited in Jones, n.d.). University dining operations are contributors to this problem. On-campus dining facilities were estimated to generate nearly 3.6 million tons of waste each year, 540,000 tons of which is estimated to be food (Saphire, 1995). Overproduction, poor inventory management, and flux in sales all contribute to commercial food loss. Consumers play a role in retail operations' waste as well. Larger portions, more options, and busier lifestyles may lead individuals to leave more food on their plates.

While these amounts of food waste may be staggering to comprehend, the problems this amount of food waste contributes create additional challenges for foodservice operators and local and state governments. Transportation of waste to landfills, processing waste into the sewer system through garbage disposals, composting, and animal feed are the primary methods of food waste disposal in the United States (U.S.). While these methods have their merits, they also have limitations (Adhikari, Barrington, & Martinez, 2006; Busbee, 1996; Perket, 2009; Pollan, 2006).

These methods of waste management often have a negative impact on the environment. Water, fuels, chemical treatments, energy, labor, and land are required. Fuel is consumed in the hauling of food waste materials to landfills, processing sites, and recovery facilities (Pollan,

2006). Nearly 560,000 acres of U.S. land are consumed with active landfills (Trzupek, 2010). Once in the landfills, food waste begins to decompose and biodegrade, producing methane. This results in food waste being a major source of the emissions from landfills (Adhikari et al., 2006). Landfill methane accounted for 17% of the emissions in the U.S. in 2009, the third largest contributor of methane (EPA, 2011). The world population continues to grow and will likely impose more pressures on waste management (Adhikari et al., 2006).

The cost of managing this waste is of constant concern to foodservice operators. The average gate fee at landfills has increased 43% from 1993 to 2008 (Busbee, 1996; Perket, 2009). Other variables that must be considered in the disposal of waste are labor, storage locations and containers, supplies such as bags, equipment rental, and haul charges (Wie & Shanklin, 2001). Food waste processed by a garbage disposal requires the use of water and energy. The approximate cost of running a single garbage disposal 12 hours a day at one dining center in the Midwest is approximately \$3,208 per year (KSU Dining Maintenance, personal communication, May 24, 2010). The use of composting facilities requires the use of vehicles, farm equipment, land, and labor (Baer, Blattner, Boss, Ostmeier, and Wiens, 2009; Harvard University Dining Services, 2008).

Despite the compelling environmental and economic arguments, dining facilities may still be skeptical to make changes. Foodservice operations are businesses relying on a positive economic status, therefore, cost effective alternatives and strategies must serve as a baseline for alternatives considered (American Dietetic Association, 2001; Shanklin, 2001; Wie & Shanklin, 2001). Despite efforts to improve waste management practices, the truth is that they require the use of further resources. While many food waste management options exist, their cost is a

prevalent factor. Focus placed on preventing the amount of food disposed of may be a more economical option.

Education programs can help consumers change their food discard behaviors and are known to be an effective means in preventing food loss (Kantor, Lipton, Manchester, & Oiveira, 1997). Messaging campaigns that educate individuals about the positive impact their own actions can have may potentially improve their behavior. Providing this information allows consumers to be aware of the connection between their actions and the environmental consequences of these behaviors. Pro-environmental behavior has been shown to be influenced by beliefs about what is affected by various environmental conditions and that individual actions can assist in alleviating these problems (Joireman, Van Lange, & Van Vugt, 2004; Stern, 2000). Messaging and feedback campaigns have shown to positively influence the sustainable behaviors of individuals (Petersen, Shunturov, Janda, Platt, & Weinberger, 2007).

The goal of this study was to assess whether printed message materials influence food waste beliefs and behaviors in college students participating in an on-campus meal plan. The first objective was to analyze the food waste behaviors of university dining students. The second objective was to evaluate the beliefs of students towards sustainability and food waste. The third objective was to evaluate the acceptance of suggested service style changes focused on improving sustainability. The final objective was to explore whether simple prompt-type poster messages led to a reduction in edible waste, improved beliefs, and increased the acceptance of the service style changes or if more feedback-based postings were necessary.

This Elaboration Likelihood Model of Persuasion provided the theoretical framework for this study. The Elaboration Likelihood Model supports that there are two routes to persuasion. These routes are based on the presence or absence of “elaboration” or thinking about the ideas

presented (Petty, Cacioppo, Strathman, & Priester, 1994). The peripheral route can happen quite quickly without the need for logic or genuine thought, such as a glancing at a simple prompt-type poster. The central route involves more thought and consideration of personal impact, such as evaluation of feedback data. Both routes can be beneficial and both can lead to change (Petty et al., 1994). Knowing the type of information needed to simply make an individual aware of food waste in an effort to decrease edible waste can benefit managers aiming to improve sustainability in their operations.

Methodology

Setting and Participants

The setting of this operational study was Van Zile Dining Center at Kansas State University. Only residents from three specific residence halls are allowed to dine in the facility and up to 15 student guests per meal. Staff member data was not included in this study. This setting allowed student behavior to be easily monitored.

Van Zile Dining Center is an “all-you-care-to-eat” cafeteria-style dining facility. Entrees and salads are available at four serving lines, each with a different menu concept. Menu items are served by the employees to the customers. Salads, soups, fruits, cereals, and desserts are self-serve items available in other areas of the facility. Breakfast, lunch, and dinner are served Monday through Friday. This facility does not operate on weekends or holidays.

The population for this operational study was approximately 540 students who lived in Putnam, Van Zile, and Boyd residence halls and purchased meal plans during the spring semester of 2011. The sample included students who ate meals in-house at Van Zile Dining Center during the data collection period and approximately 15 student guests per meal.

Instrument Development

A self-administered questionnaire was developed to explore the constructs of this study and was based on a review of the pertinent literature. This questionnaire was developed with multiple purposes in mind. The first section assessed students' beliefs concerning food waste and sustainability. The second section evaluated the students' acceptance of various service style changes focused on improving sustainability and decreasing food waste. The third gathered basic demographic data. The instrument was reviewed by Kansas State University Hospitality Management and Dietetics faculty. The faculty provided suggestions on questionnaire wording, flow, and length. The instrument was modified using input obtained (Appendix A).

A pilot study was conducted with a random sample of university students who were participating in a meal plan at the end of the fall semester of 2010. The pilot survey instrument included feedback questions regarding the flow, clarity, and ease of completion (Appendix C). The pilot survey was administered to students dining at Derby Dining Center at Kansas State University.

The pilot study yielded 65 usable questionnaires. Cronbach's alpha was used to determine the internal consistency of the items. A threshold of 0.70 was used to demonstrate consistency. The reliability coefficient ($\alpha = .85$) for beliefs towards sustainability and food waste was strong. Acceptance of sustainability-based service style changes was also strong at $\alpha = .83$. Comments provided by pilot test participants showed acceptance and understanding of the written instrument, thus no additional changes were made in the instrument. Students who participated in the pilot study were excluded when the instrument was administered during spring semester, 2011. Cronbach's alpha was again used to evaluate the internal consistency of

the final instrument after data collection yielding reliability coefficients for beliefs ($\alpha = 0.82$) and acceptance of suggested changes ($\alpha = 0.76$) that were strong.

Questionnaire

The final version of the written instrument included three sections that measured students' beliefs about sustainability and food waste, evaluated their acceptance of service style changes directed at sustainability, and obtained demographic data. Part one was constructed of eight questions. Two questions focused on evaluating the participants' beliefs towards sustainability and self. Six questions were directed at measuring beliefs towards food waste. Students were asked to rate their opinion on each of these items from Strongly Disagree (1) to Strongly Agree (5) (Appendix D).

The participants' acceptance of various service style changes was measured with five questions in the second part of the survey. These service style changes involved dining center processes that could be altered to decrease food waste and improve sustainability. Each service style statement was rated from Strongly Disagree (1) to Strongly Agree (5). The final section contained five questions to obtain demographics data about the students including sex, class standing, academic college enrolled, location of their home town, and urban versus rural status of their home town.

The survey was administered at three times during the six week research period. Students were approached while in the dining facility and asked to complete the survey. All students who participated were entered into various drawings for gift certificates.

Food Waste Data Collection

Edible food waste data was collected by monitoring every tray for lunch and dinner service during the six week period of spring semester. These six weeks were divided into three

time periods that corresponded to various printed message interventions and survey administrations. The trays of students willing to participate were coded with a number as they were returned to the dishroom carousel accumulator. This code was used to match participant survey responses with individual tray waste data. As the coded trays entered the dishroom, all edible food items were scraped into a container on a digital scale. The weight of this individual waste was recorded in grams. All edible food on uncoded trays was scraped into a separate container to allow for the total weight of edible waste for that meal to be calculated. Beverages in glasses and non-edible items such as fruit peels, bones, and paper items were not weighed. Other factors such as weather, menu, holidays, campus, and social events were documented.

Experimental Design

The experimental design began with a two week baseline period. During this baseline period, food waste was documented and the baseline pre-message questionnaire was administered. During the third week of the study, a prompt-type intervention was initiated and food waste data continued to be documented. The second intervention occurred during week five and employed a feedback-based message and food waste data collection. During the final week all intervention messages were removed but weighing of the waste continued.

Message Intervention Materials

The experimental interventions in this study were of two types. The first was a basic prompt-type message providing only a suggestion to not waste food (Appendix E). The second message provided feedback-based information on food waste weights in the facility (Appendix F). Each intervention period lasted two weeks. Each message was presented as 11" x 17" posters and table tents throughout the facility. These locations included the menu posting board, tray dispensing area, serving lines, and dish return carousel.

The prompt-type message was simple and fairly vague, allowing students to quickly read the message and did not require the use of logic or genuine consideration. This message was designed to stimulate the peripheral route of persuasion. For ease of comprehension and basic stimulus, the message was divided into two short segments. The first a graphic stating “All Taste...No Waste” and the second line below the first reading “Eat what you take. Don’t Waste Food”. These posters and table tents were displayed during the third week of the study.

The feedback intervention phase provided information to the students in two ways. First, the average per person tray waste weight was related to a social impact statement: “On average, each Strong Complex Resident wastes 2.15 oz. of food each meal. This amounts to more than 32 pounds per person per semester”. Second, the total amount of edible food disposed of at each meal was provided. This more personalized data allowed students the opportunity to evaluate the information and internally evaluate it if desired. This approach aimed to stimulate the central route of persuasion.

Questionnaire Administration

The questionnaire was administered by the researcher and trained assistants at Van Zile Dining Center. The questionnaire contained a cover letter informing the respondents of their rights as study participants and the purpose of the study. These surveys were distributed on two days during the “baseline period,” the second week of the prompt-type intervention, and again during the second week of the feedback-based message intervention. All students dining in the facility during the lunch and dinner meals on these days were asked to voluntarily complete the survey. Each student who completed a questionnaire was entered into a drawing for gift certificate prizes.

Data Analysis

A coding system was used to allow the researchers to match individual participant tray waste with their survey responses. After data was recorded all individual identifiers were destroyed to protect the anonymity of the respondents. A data file of all survey responses and food waste weights was created using the Statistical Package for the Social Sciences (SPSS) (version 13.0, 2004, SPSS, Inc., Chicago: IL).

Statistics were calculated for demographics, beliefs, and acceptance of service style changes. Principal axis factor analysis with varimax rotation was conducted on part one of the survey, which measured beliefs, to minimize the effects of multicollinearity. Based on a minimum eigenvalue of 1.0 this factor analysis yielded two constructs: sustainability beliefs (Questions 1 and 2) and food waste beliefs (Questions 3 through 8). Statistical procedures included general descriptives, ANOVA, and correlation analysis. Significance levels were set at $p \leq .05$ for all data unless otherwise noted.

Results

The average number of students dining for each lunch was 412 and the average dinner census was 381. Of the 540 students residing in the Van Zile Complex, 327 completed a questionnaire during at least one of the three collection periods (Time 1, Time 2, or Time 3). Twenty-one students completed all three surveys allowing the researchers a small group in which to assess trends over the three time periods. Data for this study is presented for those who completed all three surveys (matched sample surveys) and as an overall average of all respondents (all surveys) for each time period. Any comparisons made between these two groups are based on observational trend analysis and not statistical analysis.

Profile of Respondents

Demographic characteristics of students who participated in individual edible waste tray tracking during the six week study are presented in Table 5.1. Of the sample, 71% were female. Freshman and sophomores composed 51.33% and 25.67%, respectively. Limited residential diversity was found among the participants. The majority were residents of Kansas (87%). Only two of the respondents were international students. This sample was similar in demographics to that of the entire complex of students researched. Van Zile Dining Center is located in a complex of three resident halls. This complex was 68% female, and nearly 86% of the students were from the state of Kansas. Less than one percent of the complex were international students.

The size of the respondents' hometown was fairly evenly distributed with 21% being from rural (<2,500 people), 29.67% suburb (2,500-49,999 people), 26.67% medium urban (50,000-250,000 people), and 22.33% from large urban areas (>250,000 people). The participants were primarily enrolled in majors within the College of Arts and Sciences (35.67%) and Education (13.33%).

----Insert Table 5.1----

Beliefs Regarding Food Waste and Sustainability

Sustainability Beliefs

Beliefs towards sustainability were measured using two survey questions regarding personal understanding and importance of sustainability. The level of belief is discussed in terms of all survey respondents at baseline, prior to any printed message exposure.

When asked to rate their understanding of sustainability, the responses averaged higher than neutral (3.00) for all respondents at baseline ($M = 3.49$, $SD = 0.96$) (Table 5.2). Students rated the importance of sustainability higher than neutral ($M = 3.75$, $SD = 0.96$). Aggregated

ratings during the baseline period for these two opinion items indicated a higher than neutral (3.00) level of belief towards sustainability ($M = 3.62, SD = 0.81$). While higher than neutral, these levels of ratings do not indicate a strong belief towards environmental sustainability. The means are displayed by time period and comparison group in Table 5.2.

Food Waste Beliefs

Students' beliefs regarding food waste and their personal role were analyzed with six questions. Students' belief that disposing of edible food on their trays has a negative environmental impact was stronger than neutral (3.00) at baseline ($M = 3.74, SD = 1.09$) (Table 5.2). Students agreed (4.00) that the dining center had a large amount of food being disposed of on trays ($M = 4.00, SD = 0.93$). At baseline, students agreed (4.00) that it is wrong to waste food with a high number of people going hungry in our world ($M = 4.05, SD = 1.10$).

The belief of students regarding the impact of one person, whether it be in a negative manner with food waste or a positive effort towards improving world hunger were both stronger than neutral (3.00). Students rated their belief that the dining center should implement more sustainability programs as higher than neutral at baseline ($M = 3.60, SD = 1.00$).

Aggregated ratings for these six opinion items associated with food waste beliefs indicated a stronger than neutral (3.00) level of belief at baseline ($M = 3.76, SD = 0.81$). Individuals who completed all surveys (matched sample) had higher mean beliefs than the average of all individual surveys, although not statistically comparable.

-----Insert Table 5.2-----

Messaging Impact on Beliefs

The beliefs of students towards food waste and sustainability were evaluated in comparison to time period. The matched sample was evaluated using repeated measures

analysis. This allowed the impact of the prompt-type and feedback-based messages to be determined. The beliefs of the students remained fairly stable throughout the six weeks of the study. Beliefs did not significantly improve from baseline after exposure of the prompt-type message (Time 1 to Time 2) as shown in Table 5.2. No significant improvement in the beliefs after feedback-based messages were introduced (Time 2 to Time 3) was observed. The posted written messages did not have significant impact on the beliefs of these dining center participants.

Food Waste

During the six week study period 19,046 meals were served to students dining in-house at Van Zile. Approximately 40% of these students volunteered to have their trays coded. This allowed the specific food waste to be measured on 7,574 trays. Food waste was collected as an aggregate measure for the remaining 11,472 trays and an average food waste per tray was computed.

A broad range of edible waste weights was observed. Individual food waste ranged from 0 to 998 grams. An average of more than 57 grams or 2.00 ounces of edible food items was discarded. This 2.00 ounces is slightly higher than the 1.8 ounces of average waste found by Aramark (2008).

Impact of Printed Messages on Food Waste Behavior

The evaluation of edible tray waste was identified for the three time periods to assess the impact of the printed message interventions. The food waste behaviors of 296 students were able to be evaluated over the three time periods. These 296 students consistently allowed their trays to be coded and evaluated during the six week study. Table 5.3 presents the mean food waste weights during the three time periods.

When using an ANOVA with repeated measures with a Greenhouse-Geisser correction, the mean food waste weights of these 296 students during the three time periods were statistically significantly different ($F(1.83, 590) = 3.89, p = 0.02$). The mean edible food waste weight at Time 2 ($M = 53.08, SD = 67.08$) was significantly lower than that of Time 1 ($M = 62.76, SD = 56.10$) ($F(1.0, 295) = 5.41, p = 0.02$). A 15% decrease in mean food waste was observed after posting the prompt-type message. This indicates that exposure to the simple prompt-type message triggered an increased awareness of food waste that influenced the students' food waste behavior. While the amount of edible tray waste did remain lower, the addition of the feedback-based message did not stimulate a further significant decrease in the amount of food waste.

-----Insert Table 5.3-----

Acceptance of Various Service Style Changes

In an effort to decrease food waste amounts in dining centers often times various service-style changes are implemented. The students' level of agreement of implementing five practices to decrease food waste was evaluated. Table 5.4 presents the mean level of agreement to adopt the food waste reduction practices for the three time periods. The average acceptance is also presented. This mean included the acceptance ratings of all students who completed a survey at some point during the six week study. This average acceptance rating represents the opinions of nearly 74% of the students having a Van Zile meal plan.

Students rated below neutral (3.00) acceptance of limiting entrée ($M = 2.56, SD = 1.18$) and side dishes ($M = 2.43, SD = 1.19$) per trip through the serving line. The respondents were even less favorable towards the removal of self-serve areas from the dining center ($M = 1.76, SD = 0.82$). Students disagreed with the suggestion that removal of trays would be an acceptable

option in an effort to decrease food waste ($M = 1.75, SD = 0.88$). A la carte pricing had the lowest level of acceptance ($M = 1.54, SD = 0.89$).

-----Insert Table 5.4-----

The students' level of agreement with the suggested service style changes was evaluated during the three time periods to assess the impact of the printed message interventions. Analysis of this data could only be conducted for those students who completed all three surveys. Twenty-one students completed the survey at all three survey time periods. Table 5.5 presents the mean acceptance of the suggested practices during the three time periods for these 21 students.

When using an ANOVA with repeated measures with a Greenhouse-Geisser correction, the acceptance ratings of these 21 students for each of the five opinion items at the three time points were not significantly different (Table 5.5). General observation of mean acceptance of all students completing the surveys (Table 5.4) indicate a similar trend in that acceptance ratings did not improve throughout the messaging interventions. This indicates that neither exposure to simple prompt-type messages or feedback-based postings triggered an increased acceptance of the five suggested practices to decrease food waste.

-----Insert Table 5.5-----

Discussion and Implications

The purpose of this study was to assess whether two forms of printed message materials influenced food waste beliefs and behaviors in college students participating in an on-campus meal plan. This investigation was designed to identify methods to assist foodservice managers in developing ways of improving the sustainability of their operations. Knowing whether simple prompt-type messages can impact the food waste beliefs and behaviors of college students or if

more detailed feedback-based marketing is needed can assist operational managers in sustainable program decisions

The messages were not found to have a significant effect on the beliefs of students towards sustainability or food waste. Student acceptance of suggested service style changes directed at improving the sustainability of the operation did not improve after exposure to the prompt or feedback-based messages.

The printed messaging campaigns had a significant positive impact on food waste behaviors of these college students. Simple to-the-point prompt-type postings stimulated a 15% reduction in the food waste in this facility. Detailed data gathered during the waste weighing process allowed feedback-based message postings to be developed for this facility. Personalized data in the format of feedback has been found by many studies to improve sustainable behavior (Abrahamse, Steg, Vlek, & Rothengatter, 2007; Darby 2001; Petersen et al, 2007; Schultz, 1998). While the addition of the feedback-based information in the current study did maintain the reduction in edible food items being disposed, it did not stimulate an additional improvement above and beyond that of the simple prompt messaging.

The feedback provided in this study was low-tech, print-based information directed at the residence hall complex as a whole. Previous studies have discussed the use of digitally delivered individually focused information (Darby, 2001; Petersen et al., 2007). These studies identified real-time feedback as stimulators to a greater change. The message delivered by the feedback posting referred to food waste in ounces of food. This terminology may not prove relevant to college-aged individuals. Formatting this message into statements focused more on social issues such as hungry children or family meals may have provided concepts more easily evaluated by this population and may have stimulated a greater impact.

While real-time feedback was discussed by others to improve the impact and behavior change, the current study found that simple postings elicited an improvement in waste behaviors of these college students. In other words, message postings simply making students aware of the topic had an impact without the need for more detailed data and information. Reminding students of their beliefs with a simple poster, so that they could act on them, was enough to stimulate a change.

Conclusions

Food waste is a topic of focus for foodservice operations. University dining facilities must address this. While these operations may desire to improve their sustainable stance, the options can be daunting. Occasionally small changes must be implemented while larger projects are evaluated for feasibility and impact.

Research on sustainability in foodservice operations is vast. University foodservice is often involved in studies concerning program implementation and evaluation of food waste components and amounts. However, there is a lack of research on the food waste behaviors of individuals and methods of changing these behaviors.

This study indicates that simply making university students aware of the topic of food waste may be useful in improving the sustainability of a foodservice facility. Simple postings aimed at increasing the awareness of food waste triggered a significant decrease in waste behaviors. Reminding students of their beliefs that food waste creates environmental problems was enough to trigger a positive behavior. This fact warrants the suggestion for increased education and sustainable influence for individuals.

While these findings are not applicable to all dining operations or even to all university settings, it is a starting point. Consumers play a role in our food waste difficulties and getting

them to evaluate their role may require a marketing campaign. Messaging campaigns may not need to be in-depth and research based. Simple messages drawing attention to the topic of sustainability may have the impact needed to stimulate a behavior change. This provides foodservice operators a feasible option. Printed messaging can be a step towards creating a more sustainable facility and student community.

Research focused on the format of messaging, such as digital versus print, would prove useful. Determining the terminology best understood by college students regarding sustainability in their residence and dining facilities should be considered in creating messages. Knowing the areas of sustainability (social, economic, environment) that matter most to this population would allow educational marketing campaigns to narrow their focus and have the greatest impact.

Future studies and operational programs are suggested to focus on improved education of university students on the topic of sustainability in the foodservice operations they patronize. It would be interesting to determine whether implementation of sustainability topics in more student life situations can improve the sustainable practices of the university student population.

Research in this segment of the industry should also investigate the food waste practices of the kitchen personnel. Evaluation of this segment of the foodservice team may indicate other areas of focus for sustainability training and procedural improvement.

This study concludes with the observation that education and communication is key. Making one aware of the impact their actions can have, especially regarding food waste and sustainability, may allow us to improve the actions and decrease the carbon footprint of our society.

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Table 5.1. Profile of Students Participating in Individual Tray Waste Tracking (N=300)

Characteristic	n	%^a
<i>Gender</i>		
Female	213	71.00
Male	87	29.00
<i>College</i>		
Arts & Science	107	35.67
Education	40	13.33
Human Ecology	37	12.33
Agriculture	37	12.33
Engineering	37	12.33
Business	26	8.67
Architecture	6	2.00
<i>Class</i>		
Freshman (including ESL)	154	51.33
Sophomore	77	25.67
Junior	43	14.33
Senior	20	6.67
<i>Hometown</i>		
Kansas	261	87.00
Missouri	12	4.00
Other State	25	8.33
International	2	0.67
<i>Hometown Size</i>		
Rural	63	21.00
Suburb or Rural	89	29.67
Medium Urban	80	26.67
Large Urban	67	22.33

^aResponses may not equal 100% due to non-response to a question.

Table 5.2. College Students’ Beliefs Toward Environmental Sustainability and Food Waste

	All Surveys			Matched Sample Surveys		
	<u>Time 1 (Baseline)</u> (n=133) Mean ± Standard Deviation	<u>Time 2 (Prompt)</u> (n=194) Mean ± Standard Deviation	<u>Time 3 (Feedback)</u> (n=150) Mean ± Standard Deviation	<u>Time 1 (Baseline)</u> (n=21) Mean ± Standard Deviation	<u>Time 2 (Prompt)</u> (n=21) Mean ± Standard Deviation	<u>Time 3 (Feedback)</u> (n=21) Mean ± Standard Deviation
Sustainability Belief Statements						
My understanding of environmental sustainability is excellent.	3.49±0.96	3.49±0.82	3.58±0.84	3.90±1.00	3.90±1.00	3.71±0.90
Environmental sustainability is very important to me.	3.75±.096	3.78±0.76	3.79±0.77	3.90±0.94	4.19±0.87	4.10±0.77
Overall Sustainability Belief	3.62±.081	3.64±0.70	3.68±0.68	3.90±0.72	4.05±0.85	3.90±0.77
Food Waste Belief Statements						
Leaving uneaten food on my dining tray has a negative effect on the environment.	3.74±1.09	3.62±0.92	3.56±1.03	3.71±1.15	3.76±1.04	3.67±1.06
I feel the dining center has a large amount of food thrown out on student trays.	4.00±0.93	4.09±0.83	3.81±0.95	4.33±0.73	4.52±0.51	4.10±0.89

Scale values: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1)

Note: No significant differences were found when using ANOVA with Repeated Measures to compare the means of the matched sample surveys at Time 1, Time 2, or Time 3 ($p \leq 0.05$).

Table 5.2. College Students' Beliefs Toward Environmental Sustainability and Food Waste (Cont.)

	All Surveys			Matched Sample Surveys		
	<u>Time 1 (Baseline)</u> (n=133) Mean ± Standard Deviation	<u>Time 2 (Prompt)</u> (n=194) Mean ± Standard Deviation	<u>Time 3 (Feedback)</u> (n=150) Mean ± Standard Deviation	<u>Time 1 (Baseline)</u> (n=21) Mean ± Standard Deviation	<u>Time 2 (Prompt)</u> (n=21) Mean ± Standard Deviation	<u>Time 3 (Feedback)</u> (n=21) Mean ± Standard Deviation
Food Waste Belief Statements						
I believe it is wrong to waste food when there are so many hungry people in the world.	4.05±1.10	4.02±0.92	3.76±1.08	4.19±1.08	4.24±0.89	3.81±1.08
I feel one person's food waste can have a negative impact on the environment.	3.64±1.04	3.45±1.00	3.30±1.05	3.91±1.00	4.00±0.84	3.52±1.17
I feel one person's efforts to decrease food waste can assist in improving world hunger.	3.56±1.15	3.40±1.09	3.35±1.14	3.95±0.92	3.62±1.12	3.43±1.33
I believe the dining center should implement more programs on environmental sustainability	3.60±1.00	3.46±1.02	3.43±1.02	3.67±0.97	3.76±1.04	3.86±0.96
Overall Food Waste Belief	3.76±0.81	3.67±0.74	3.54±0.80	3.96±0.78	3.98±0.74	3.73±0.95

Scale values: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1)

Note: No significant differences were found when using ANOVA with Repeated Measures to compare the means of the matched sample surveys at Time 1, Time 2, or Time 3 ($p \leq 0.05$).

Table 5.3. Influence of Message Type and Average Food Waste

	Mean Edible Food Waste Per Tray (N=296)
	Mean ± Standard Deviation (grams)
Time 1 (Baseline)	62.76±56.10 ^x
Time 2 (Prompt)	53.08±67.08 ^y
Time 3 (Feedback)	54.23±56.75 ^y

Note: Means with different superscripts (x,y) differ significantly when using an ANOVA with a Greenhouse-Geisser correction, ($p \leq 0.05$).

Table 5.4. Acceptance of Various Service Style Changes for All Students Completing Surveys

	Time 1 (Baseline)		Time 2 (Prompt)		Time 3 (Feedback)		Average Acceptance	
	n	Mean ± Standard Deviation	n	Mean ± Standard Deviation	n	Mean ± Standard Deviation	n	Mean ± Standard Deviation
Allowing only one <u>entrée</u> per trip through the serving line would be acceptable to me.	133	2.53±1.22	194	2.61±1.28	150	2.51±1.26	330	2.56±1.18
Limiting the number of <u>side dishes</u> to two per visit through the serving line would be acceptable to me.	133	2.55±1.26	193	2.49±1.31	150	2.33±1.17	329	2.43±1.19
Eliminating self-serve areas would be acceptable to me.	133	1.94±0.93	194	1.71±0.89	150	1.59±0.71	330	1.76±0.82
No longer providing trays to carry my food items on would be acceptable to me.	133	1.80±0.98	193	1.69±0.90	148	1.73±0.98	327	1.75±0.88
Paying for food items individually (a la carte) would be acceptable to me.	131	1.72±1.05	193	1.51±0.90	149	1.40±0.78	327	1.54±0.89

Scale values: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1)

Note: Due to the variability in subjects for this portion of the survey between time periods, statistical analysis could not be conducted.

Table 5.5. Influence of Message Type and Acceptance of Various Service Style Changes for Students Completing All Three Surveys

	Average Acceptance (N=21)		
	Time 1 (Baseline)	Time 2 (Prompt)	Time 3 (Feedback)
	Mean ± Standard Deviation	Mean ± Standard Deviation	Mean ± Standard Deviation
Allowing only one <u>entrée</u> per trip through the serving line would be acceptable to me.	2.81±1.40	3.00±1.48	2.62±1.50
Limiting the number of <u>side dishes</u> to two per visit through the serving line would be acceptable to me.	2.86±1.39	3.05±1.47	2.71±1.38
Eliminating self-serve areas would be acceptable to me.	1.95±0.86	1.62±0.80	1.43±0.60
No longer providing trays to carry my food items on would be acceptable to me.	2.19±1.29	1.95±1.12	1.81±1.29
Paying for food items individually (a la carte) would be acceptable to me.	1.81±1.12	1.62±1.16	1.52±0.98

Scale values: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1).

Note: No significant differences were found when using ANOVA with Repeated Measures to compare the means at Time 1, Time 2, or Time 3 ($p \leq 0.05$).

CHAPTER 6 - IMPLEMENTING TRAYFREE DINING IN A UNIVERSITY DINING FACILITY – A CASE ANALYSIS

Abstract

Trayfree dining has become a popular method of improving the sustainability of university dining facilities. This case analysis evaluated the operational feasibility of implementing trayfree dining at Van Zile Dining Center at Kansas State University. Telephone interviews with 24 foodservice professionals involved in the implementation of trayfree dining were utilized to complete a best practices review. The interview participants provided their opinions on the benefits, complications, recommendations, and best practices for the success of trayfree dining. Student focus groups were used to gain insight into student perceptions of trayfree dining at Van Zile. Based on the interviews and focus groups, recommendations for evaluating the operational feasibility and the successful implementation of such a program were identified and are presented.

Benefits included: decreased waste, reduced chemical, food, and resource costs, and improved student satisfaction. Managers identified complaints and dining room cleanliness as negative outcomes. Student involvement, education, and communication were strongly recommended and waste audits were a suggested practice. Managers reported little to no renovation or equipment changes and were positive about this change. Increased availability of service ware and silverware were recommended. Students provided suggestions similar to those of the managers and had a positive level of support for trayfree dining. This research supports the recommendation to consider the implementation of trayfree dining at Van Zile. Decreased costs, improved satisfaction, and positive public perception are likely positive outcomes.

Introduction

University dining operations struggle with the management of the considerable waste they generate. Saphire (1995) reported that university dining operations generate nearly 3.6 million tons of waste per year; 10-20% is estimated to be food. Other studies also have demonstrated the large amounts of food waste being disposed of by students in these on-campus facilities. Shanklin and Ferris (1992) determined that more than 167,000 pounds of edible food items were being disposed of annually on student trays in a single facility. Others have reported an average of more than two ounces per meal of edible food waste being generated by students (Norton & Martin, 1991; Van Handel, 2004). This amount of food represents thousands of dollars in food products and tons of solid waste.

The generation of this food waste involves products, time, energy, water, and other resources (American Dietetic Association, 2001). Foodservice operations often manage this waste via garbage disposals and transporting waste to landfills (Ferris, Flores, Shanklin, & Whitworth, 1995). Garbage disposals require energy, water, and labor; all of which cost money. Transportation of waste to landfills involves storage, fuel, and gate fees. Once in the landfills, this food is active biodegradable waste that decomposes slowly to produce methane. Methane is a greenhouse gas and a major factor in earth warming trends (Environmental Protection Agency, 2011; Shipman, Bartlett, Crill, Harriss, & Blaha, 1998). While convenient, these methods of waste management contribute their own problems to the cycle of sustainability.

Colleges and universities are initiating more sustainable practices due to their increased concern about the environment (Sustainable Endowments Institute, 2010). Some universities have implemented methods to repurposing their waste rather than dispose of it. Colorado State has implemented the use of residence hall graywater (water from sinks and showers) for surface

irrigation (Colorado State Department of Public Relations, 2011). George Washington University initiated their “Green Office Program” to encourage their offices and departments to reduce printer and copier paper use and increase recycling (International Perspectives on Green Business, 2011). A student-run farm is fertilized by compost created from campus waste at Kansas State University (Baer, Blattner, Boss, Ostmeyer, & Wiens, 2009). Programs, such as these, are initiated in an effort to educate university students and employees while improving the sustainability of the campus environment.

Recycling, composting, bioconversion, and animal feed are options suitable for foodservice waste (Ferris et al., 1995; Shanklin & Ferris, 1992). While evaluating methods of managing waste is a step in the right direction, evaluating the entire cycle of the food production process and implementing strategies to prevent food waste initially may be a better approach (Kantor, Lipton, Manchester, & Oiveira, 1997).

Many campus dining facilities are implementing a trayfree style of service in an effort to reduce waste. Simply removing the option of using a dining hall tray has been found to decrease the amount of food waste and reduce the water and chemicals used in dishmachines (Aramark, 2008; Davis, 2008; Karstens & Moe, 2009; Saavedra, 2008). Aramark (2008) observed a 25% reduction in per-person food waste when trays were removed. Sodexo estimated saving nearly 200 gallons of water daily for every 1,000 meals served (Davis, 2008). A reduction of more than 11 tons of food waste and \$14,000 in food cost resulted from the removal of dining hall trays at San Diego State (Saavedra, 2008). Trayfree dining has allowed these facilities to reduce their environmental footprint and save money.

Statement of the Problem

While foodservice operators may strive to implement changes that direct them towards a more sustainable facility, the options may seem daunting. Trayfree dining has been implemented in many facilities and has been shown to decrease the amount of edible food disposed of while also reducing the water, energy, and chemical use. This can be a source of both environmental and economic improvement in a foodservice facility. However, foodservice managers may still be skeptical about implementing a service style change due to concern about customer satisfaction and reduced profitability. Having access to guidance and suggestions to evaluate the operational feasibility of implementing trayfree dining may be an asset to managers considering the implementation of such a system.

Currently little information is available in regards to customer acceptance and facility, equipment, and service needs for the removal of dining hall trays. Past research has focused on the environmental and economic benefits of trayfree service (Aramark, 2008; Karstens & Moe, 2009; Saavedra, 2008). No research was found that explored foodservice managers' experiences in implementing trayfree dining. Results of research of this nature could be useful to identify best practices for the successful implementation of this style of service.

Purpose of Study

The purpose of the study was to explore the feasibility of the implementation of a trayfree dining program by Kansas State University Dining Service. This operational research used qualitative methods to conduct a best practices review with managers of university dining facilities involved in the implementation or management of a trayfree style of service. Telephone interviews with foodservice professionals were used to obtain data about their experiences implementing trayfree dining. Focus groups with students were conducted to

investigate perceptions of tray removal. Based on the interviews and focus groups, recommendations for evaluating the operational feasibility and the successful implementation of such a program were identified and are presented.

Methodology

Best Practices Review

Population and Sample

The population for this study was university foodservice professionals who were members of The National Association of College and University Foodservice (NACUFS) and regional universities identified as having trayfree dining facilities. The NACUFS publication of “Trayless Members in NACUFS” was used to identify 70 foodservice professionals involved in trayfree dining. Thirteen regional universities were identified as being trayfree by website research and personal contact. These 83 professionals from across the United States were contacted and asked to participate. Twenty-four of the NACUFS professionals contacted agreed to participate in the telephone interviews and thus composed the final convenience sample. No regional organizations responded with their willingness to participate.

Development of Instrument

Seven open-ended interview questions were developed after reviewing trade and peer publications about the trayfree dining system. The interviews were used to explore university foodservice professionals’ perceptions regarding the implementation of trayfree dining in their facilities. The open-ended interview questions asked managers to provide input on the challenges, benefits, and recommendations about implementing or evaluating the feasibility of a trayfree system. During the interviews, the directors were prompted to elaborate on their responses. The telephone interview guide is presented in Appendix H.

Data Collection

An introductory e-mail was sent to all 70 foodservice managers on the “Trayless Members of NACUFS” list and the 13 regional universities identified as having trayfree facilities (Appendix I). This e-mail provided information about the study and their rights as human subjects and requested their participation. Individuals willing to participate in the telephone survey were asked to reply to the e-mail with the name of the desired person to contact and a telephone number. The introductory e-mail was sent two additional times to all non-responding institutions at one-week intervals following the initial contact.

Foodservice managers willing to participate were contacted via e-mail to schedule a time for the telephone interview. At the time of the scheduled interview, the researcher followed a written script to facilitate that information was gathered uniformly (Appendix H). Phone interviews were audio recorded, when land-line connections were used to facilitate capturing all responses. A call-tracking form was used to document call times, respondent information, and to record responses.

Student Focus Groups

Participant Recruitment

Promotional materials inviting students to participate in a focus group regarding trayfree dining were posted on various bulletin boards and throughout the dining center. Individuals who consumed at least one meal a day at Van Zile, lived in a residence hall within the complex, and were at least 18 years of age were asked to sign-up to participate in the focus group. Three focus groups of residence hall students who dine in Van Zile Dining Center were scheduled to be conducted, however, only two sessions were conducted due to insufficient response to the invitation. A total of eleven students signed-up to participate in the focus groups.

Focus Group Discussion

Two focus groups were held in Van Zile Dining Center after dinner service. The purpose of these focus group discussions was to identify student familiarity with trayfree dining, perceived barriers and benefits they may foresee, and any recommendations they may have for the future. The researchers followed a focus group guide to facilitate the discussion (Appendix K). Permission was granted to audio record the discussions to aid in documentation. The focus groups were semi-structured and allowed for student discussion to occur naturally. The main points of discussion were based on the interests of Van Zile Dining Center and data gathered during the best practice review portion of this study.

The students were asked to dine at Van Zile the following week without using a tray. The individuals then followed up with the researcher on an individual basis to revisit the discussion. This allowed for further probing of student perceptions of trayfree dining after their exposure to the trayfree service style. Students completed both a pre and post-trayfree experience survey (Appendix L). This survey allowed for quantitative analysis of the students' support for and concern with the implementation of trayfree dining and the changes the students perceived would be needed. The changes included glass size, plate and bowl size, and silverware locations. Students were asked to rate their agreement with five statements ranging from Strongly Disagree (1) to Strongly Agree (5).

Data Analysis

Interview and focus group data were compiled and sorted by categories per the interview question. Data were also sorted by themes for the following categories: problems, benefits, best practices, and recommendations. NVivo software (version 9, 2010, QSR International, Australia) was used to organize themes within the qualitative discussion data. Survey data was

analyzed for frequency and descriptive statistics using SPSS (version 13.0, 2004, SPSS, Inc., Chicago: IL). This information was summarized into a set of guidelines provided to the management team of Van Zile Dining Center to assist in their decision making.

Results

Interviews

All managers were asked general questions about their operations. The managers indicated the number of years their trayfree-style of service had been in operation ranged from one to four years. The number of meals served daily by these facilities ranged from 500 on a campus with a single trayfree facility to over 20,000 at a university with five on-campus dining facilities. Twenty-three operations were self-operated; only one was managed by a contract foodservice company. A majority of the operations were all-you-care-to-eat operations with both self-serve and employee-served formats of food delivery. Five were all-you-care-to-eat facilities comprised of entirely self-serve food delivery stations.

The managers were asked to identify any changes that were made to their facility to accommodate the trayfree style of service. Two managers indicated no changes were made to their facilities to accommodate the new format. Fifteen managers described physical dishroom changes that had to be made to better suit the trayfree operation. These physical changes were simple modifications, such as adding trays or solid surface material to their carousel/accumulator style dish return areas (n=12) and reformatting belt returns to have sides to prevent spillage (n=2). No managers indicated remodeling or equipment changes necessary for their dishroom and sanitation areas to accommodate the trayfree operation.

Thirteen managers discussed the need to relocate silverware stations in their facilities. Silverware was made available throughout their service areas rather than at a single entry-area

dispenser. Locations included serving lines, self-serve stations, beverage areas, and dining rooms. Similarly, three operations relocated their service ware (plates, bowls) to the serving line and self-serve areas.

Overall, very general changes were identified as necessary modifications to any of these facilities. Renovations and large purchases were not needed to make the removal of the dining hall trays a success.

Themes Identified in Interviews

The telephone discussion allowed specific topics to be covered but the open-ended format allowed managers to speak freely and provide personal experiences and opinions to be shared. Figure 6.1 demonstrates the primary topics of discussion. Specific response patterns became evident and the hierarchy of each theme discussed are supported by NVivo software (version 9, 2010, QSR International, Australia) treemaps in Appendix N-Q.

-----Insert Figure 6.1-----

Benefits

Foodservice managers' input was valuable in identifying themes regarding the benefits of implementing a trayfree dining operation (Table 6.1). Managers were directly questioned as to the benefits they encountered. Decreased food waste was identified as the primary benefit of tray removal by twenty managers. Two facilities reported a 30% reduction in waste, one had a reduction of 40%, and one decreased their food waste disposal in half. This reduction in waste was described as decreasing "chaos" in the dishroom, lowering the sanitation labor needs, and decreasing waste removal expenses.

Decreased utility (water and energy) use was mentioned by sixteen managers. The utilities discussed included water and energy and supported findings of previous studies

(Aramark, 2008; Davis, 2008). Fourteen facilities reported a reduction in water use. The water savings reported ranged from 20% to 50%. One facility reported washing 220,000 fewer trays per year. Another saved approximately one million gallons of water in the first year of tray removal. Energy savings was identified by five managers as a positive outcome. Many managers mentioned the difficulty in reducing energy use in their dishroom areas as the machines are often left to idle between loads. This practice allows water usage to be reduced, but energy is still required for maintenance of the machine temperatures.

Other savings identified as benefits of tray removal included reduced chemical use, decreased beverage and food costs, and reduced food production needs. Reduction in chemical use in the dishroom area was identified as a benefit by 10 managers. Ten facilities saw a food and beverage cost reduction, similar to reports by Saavedra (2008). Two of these facilities identified the need to prepare less food as the primary reason for this reduction in cost. One manager mentioned a 30% savings in beverage expenses, while another observed a 23% reduction in milk purchases alone.

Three managers identified positive public relations as a benefit of the tray removal. Their trayfree programs had received coverage by campus groups and newspapers based on their positive sustainable action. Five facilities reported an unexpected increase in customer satisfaction directly related to their trayfree program. One manager mentioned positive student perceptions of the improved sustainability of the facility, while four indicated shorter lines and customer waits improved student perceptions. These shorter lines were explained to be a result of less “wondering around” and “grazing” by the students. Managers reported that student made more focused choices rather than taking a little of something from each serving area. This decreased wandering by students was considered by four managers to provide a health benefit to

their student population. These managers reported that the lack of trays forced students to make better choices by preventing tray loading. Improved portion control and decreased calorie consumptions were identified as positive outcomes of their trayfree program.

-----Insert Table 6.1-----

Problems Encountered

Problems identified by the foodservice managers are show in Table 6.2. Seventeen managers indicated that their facilities received complaints regarding the removal of these trays. However, all of these managers stated that the complaints were minimal and subsided within the first two weeks after the removal of the trays. Three of the managers indicated that the complaints were received from faculty and staff, and not students dining in their facilities.

Sixteen managers stated that dining room cleanliness became a problem. Tables were messier due to crumbs and spills. These managers indicated that adding an employee to clean tables throughout the meal period was a necessity. When asked if additional labor was needed for this, five of these managers indicated that dishroom labor was reallocated from pulling trays in the dishroom to wiping tables in the dining areas. Two facilities organized a self-serve sanitation area in which students could retrieve the materials needed to clean their own spills; both indicated positive student participation.

-----Insert Table 6.2-----

Recommendations

Recommendations for successful implementation of trayfree dining are show in Table 6.3. When asked for recommendations for a successful transition to trayfree dining, nineteen managers indicated some form of marketing prior to and during the transition process was necessary. Sixteen managers stressed the importance of involving students in the transition.

Focus groups, student interest group interaction, and peer groups to introduce the new process were all methods shared. Fifteen managers indicated the importance of using a marketing campaign to educate students on the reasons behind the change and the benefits of a trayfree facility. Ten managers encouraged using waste audits for gathering data to reinforce the educational efforts.

Five managers suggested implementing the new trayfree program at the beginning of the fall semester. The managers stressed that preventing incoming students from being exposed to a dining hall tray would benefit the operation greatly. Five managers indicated that removing the trays entirely from the facility was the best method of implementation. These managers recommended avoiding occasional trayfree events and days of service. They felt it was confusing to the students and often allowed more comparison between the methods of service. Other recommendations from these managers included involving upper administration, planning ahead, and being consistent in implementing the plan when students, faculty, or staff complained.

-----Insert Table 6.3-----

Best Practices

The telephone discussions with these managers allowed best practices for the implementation of trayfree dining to be identified (Table 6.4). Two overall best practices were identified by a majority of the managers interviewed.

Ten managers stressed the importance of having data to quantify the impact of the tray removal. Waste and expense audits were said to provide quality information to evaluate the success of such a change. Using the waste itself and the data collected as demonstrations of the change were identified as successful methods of student education and increased awareness.

Communication and student involvement were identified by twelve of the managers as the best practice when implementing a service-style change such as tray removal. Managers discussed the positive outcome of allowing students to feel involved and to have input on the change. Postings, face-to-face interactions, and events were all methods used to engage students in the topic of trayfree dining. One facility encouraged having a manager available during meal service to answer questions about the trayfree program and gain insight into students' perceptions of the change.

-----Insert Table 6.4-----

Focus Groups

Eleven students participated in focus group discussions regarding trayfree dining at Van Zile Dining Center. The students reported having very little exposure to dining facilities without the option of trays. The primary type of trayfree dining exposure was restaurant buffets.

When asked to identify obstacles to trayfree dining, many students discussed the congestion in serving areas. They felt that spills and dish breakage would happen more often due to the crowds and lack of space to move around. However, their concerns focused on others around them and not their own ability to handle a trayfree experience. Only one suggestion was made about increasing the size of beverage glasses, however, a student suggestion regarding the use of divided tray-type plates became quite heated. Many students felt a divided tray would allow for multiple food options without items having to touch and overlap on their plates. This would decrease tray washing while still allowing the students flexibility on their choices. When probed as to why this idea of a divided tray had so much support, it was obvious that freedom of choice and the ability to separate food items was important to the group.

Students were asked to discuss changes they saw as necessary for trayfree dining to work in Van Zile. Many felt it would be important to move silverware throughout the facility. One student suggested placing silverware on dining tables, while others indicated having it available near serving lines and in dining rooms would be sufficient. The carousel-type dish return was discussed to be appropriate for such a change although solid surfaces were suggested to prevent items from falling through. Some students felt others may stack items high and cause spills in this area. One student suggested having students sort their own trash and silverware at the dish return area. However, a majority of the students enjoyed the current relaxed, carefree atmosphere of Van Zile and indicated that having students sort more would take away from the current atmosphere. It was evident that if trayfree dining were implemented that avoiding unnecessary changes in students' routine was vital.

The timing and manner in which trayfree dining should be implemented was discussed. Few students indicated that easing into a change such as this would be successful. They indicated that if a trayfree day was implemented that students who were against the change would simply eat elsewhere on those days. A majority indicated that removing trays at the beginning of a semester when many students would be new to the facility would be the best option. The students agreed with the foodservice managers that it would be best not to present the tray option to new students to avoid the comparison of systems. At this point, it was also recommended to advertise the removal of the trays the prior semester. Students noted this would give students returning the following semester the opportunity to move elsewhere if they did not support the change and felt they could not adapt. Overall, the focus group participants stated that students may be upset at first but would learn to adapt.

The students showed very little concern about the implementation of trayfree dining at Van Zile in the discussion portion of focus groups. However, the survey administered during the initial focus groups indicated only slightly higher than neutral (3.00) level of support in implementing trayfree dining at Van Zile ($M = 3.18, SD = 0.60$). The survey completed after the students voluntarily dined trayfree showed an improvement in acceptance indicating they more than agreed (4.00) that they would support the implementation of trayfree dining at Van Zile ($M = 4.29, SD = 0.76$). Students' rated their level of agreement that trayfree dining can aid in decreasing food waste higher than neutral (3.00) both prior to ($M = 4.27, SD = 0.66$) and following their trial experience with trayfree dining ($M = 4.71, SD = 0.49$).

The level of agreement with suggested service ware changes increased from the pre to post-experience survey. Following their trial experience with trayfree dining the students more than agreed (4.00) that larger glasses ($M = 4.79, SD = 0.39$), larger plates and/or bowls ($M = 4.00, SD = 1.00$), and relocating silverware to the dining room ($M = 4.29, SD = 0.95$) would assist in making trayfree successful at Van Zile.

Overall, the focus group participants showed positive support for the implementation of trayfree dining at Van Zile. Their recommendations for minor changes mirrored those discussed by the foodservice managers in the best practice review.

Suggestions for Implementing Trayfree Dining in University Dining

All 24 managers reported immediate benefits from the removal of dining hall trays. No managers indicated the need for major purchases or renovations for the success of their trayfree program. Furthermore, multiple facilities reported an increase in student satisfaction. Student focus group participants also indicated their support while providing suggestions for only minor changes to the operation for success. Given the overall positive outcomes from the discussions

with these individuals and the ease of transition other foodservice facilities have experienced, it is recommended to implement trayfree dining at Van Zile Dining Center at the start of a fall semester.

The removal of dining trays from this facility would likely stimulate a decrease in the amount of edible food items being disposed of. As indicated by multiple managers interviewed, students make more informed choices and take less food from the serving areas since they do not have a tray to place extra menu items. The decrease in the amount of food each student takes, and therefore consumes, has multiple benefits for Van Zile. Several managers stated that the amount of food items prepared in their facilities decreased. Therefore, it is likely that food costs would decrease in response to the need for less production. This savings would benefit Van Zile financially as less food would need to be purchased.

A second benefit of this decrease in food taken is the health-benefits gained by the students. Improved awareness of serving sizes and more informed food choices were indicated by multiple managers as positive outcomes of trayfree dining. Since students have limited space on the plates they must select items that fit, thus they may review the menu board in advance and determine food choices. Rather than taking larger servings of their favorite items, they may choose to take smaller amounts as to allow more items to fit on the plate they will be carrying. Overall, these eating behavior changes will influence their lifestyle and may improve their current and future health status.

Fifteen managers indicated the need to educate students on the transition and student focus groups reinforced this thought. While the financial benefits may seem appealing to the facility, the educational marketing campaign should focus elsewhere. Multiple managers suggested waste and expense audits be conducted before, during, and after the implementation.

Sustainability is important to many students and focusing on the positive outcomes of this change may be alluring. Demonstrating the amounts of waste produced by students prior-to and following the implementation of trayfree dining is recommended for maximum impact. Printed numbers indicating the weights of waste may have an impact, but being exposed to the physical greatness of the amounts of edible food being disposed of may leave an overwhelming impression on these students.

It is also recommended to educate the students on the health benefits trayfree dining may provide them. Intertwine the aspect of not using a dining tray with portion sizes, calories consumed, and that this style of service may unexpectedly assist students with making healthier choices. The impact of a nutrition education campaign such as this may enhance student lifestyle choices and personal growth, which coincides with the Kansas State University Dining Services mission.

Finally, it is recommended that waste and expense audits be performed prior to and throughout the implementation of trayfree dining. This will provide financial data for continued support of such a change. This data will also allow educational campaigns to be developed for students. The physical waste can be used to demonstrate improvements based on the removal of trays. Having information that supports the progress of sustainability in such a facility can be utilized to recruit students, promote the operation, and advance this university foodservice within their national association.

Conclusions and Future Research Directions

This study evaluated the operational feasibility of implementing trayfree dining at Van Zile Dining Center. Recommendations for the facility management team were identified and were based on results of foodservice manager interviews and student focus groups. Previous

research has examined the outcomes of trayfree dining in university facilities (Aramark, 2008; Davis, 2008; Karstens & Moe, 2009; Saavedra, 2008). The current study identified similar outcomes, such as decreased food cost, reduced waste, and fewer resources needed. This research also supplemented these findings with recommendations for implementation and success of trayfree dining

Generally, student involvement, communication, and timing were indicated to be primary methods of successful trayfree implementation. While savings of resources and products were identified as benefits of trayfree dining, unexpected outcomes surfaced as well. Improved student satisfaction and lifestyle choice impact were discovered to be additional benefits of this style of service. Future research in this area is recommended. Determining the impact of tray removal on student weight gain and lifestyle influence may contribute to the factors supporting such a change. Sustainability focuses on future generations and evolving the healthy habits of university students plays a part in this equation.

The research found that focus groups involving students can provide useful information. However, the impact of multiple participants can cause the discussion to divert to unrelated topics. The researcher recommends conducting individual interviews with students to obtain individual student perspectives. This format may prevent the impact of peer influence and random topic introductions. The individual foodservice manager interviews provided useful information on specific topics while allowing additional questions to obtain more in-depth understanding of the topic.

Future work should focus on evaluating methods of communication and student education that can best benefit the implementation and continued success of trayfree dining. While past research, as well as the current study, demonstrate the environmental and financial

benefits of trayfree dining, evaluating the continued impact and success of such a change is recommended. It is equally important to evaluate the student perceptions of trayfree dining and their thoughts on the environmental impact of such a change. Determining whether introducing this form of environmentally friendly service impacts students selection and evaluation of academic institutions would be interesting. Because student recruitment and retention are vital to the success of colleges and universities, the next logical step would be to evaluate what other methods of sustainable improvement entice student choices.

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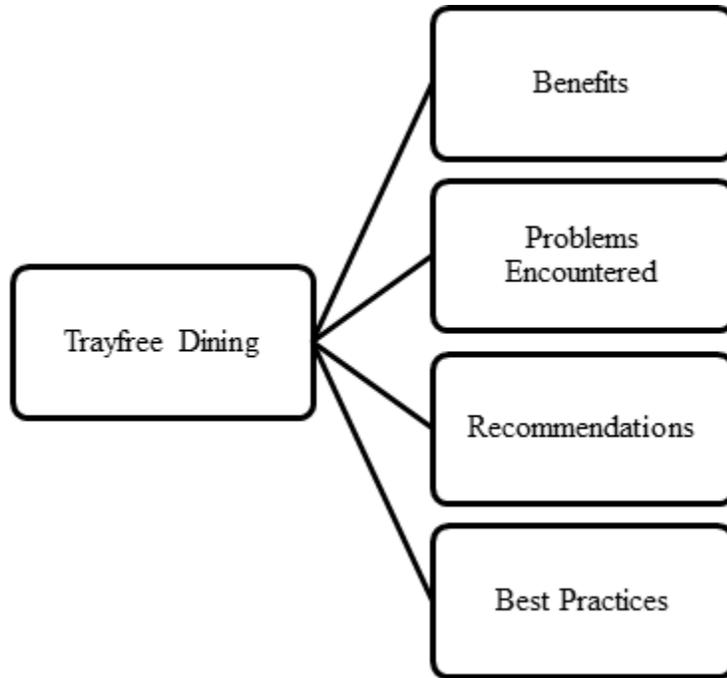


Figure 6.1. Trayfree Phone Discussion Theme Diagram

Table 6.1. Benefits of Trayfree Dining Identified by Foodservice Managers (N=24)

	n	% ^a
Decreased Waste	20	83.33
Decreased Water Use	13	54.17
Decreased Chemical Use	10	41.67
Decreased Food Cost	10	41.67
Improved Dishroom Efficiency	9	37.50
Improved Service and Satisfaction	7	29.17
Good Public Relations	6	25.00
Student Health Benefits	5	20.83
Decreased Energy Use	4	16.67
Decreased Beverage Cost	4	16.67
Less Napkin Use	2	8.33
Student Lifestyle Changes	1	4.17

^aEquals percentage of all respondents who identified this as a benefit.

Table 6.2. Problems of Trayfree Dining Identified by Foodservice Managers (N=24)

	n	% ^a
Complaints	17	70.83
Messing Dining Room Tables	16	66.67
Dishroom Problems	5	20.83
Increased Dish Breakage	4	16.67
More Spills	4	16.67
Did Not Monitor Data of Change	3	12.50
Student Issues with Change	3	12.50
Dirtier Floors	2	8.33

^aEquals percentage of all respondents who identified this as a problem.

Table 6.3. Recommendations for Trayfree Dining Identified by Foodservice Managers (N=24)

	n	% ^a
Involve Students	16	66.67
Market and Educate	15	62.50
Conduct Waste Analysis	10	41.67
Communicate	9	37.50
Remove All Trays at One Time	5	20.83
Implement at Beginning of Fall Semester	5	20.83
Evaluate the Change	4	16.67
Ease into the Change	2	8.33
Consider Individuals with Disabilities	1	4.17
Involve Upper Administration	1	4.17
Purchase Larger Plates	1	4.17
Plan Ahead	1	4.17
Stand Your Ground	1	4.17

^aEquals percentage of all respondents who identified this as a recommendation.

Table 6.4. Best Practices for Trayfree Dining Identified by Foodservice Managers (N=24)

	n	% ^a
Quantify the Change	7	29.17
Market and Educate	5	20.83
Involve Students	4	16.67
Communicate	3	12.50
Demonstrate the Waste	3	12.50
Focus on Environment Not Savings	3	12.50
Start At the Beginning of the Semester	3	12.50
Involve Upper Administration	2	8.33
Stand Your Ground	2	8.33
Using the Savings on Students	2	8.33
Conduct Waste Trials	2	8.33
Ease Into the Change	1	4.17

^aEquals percentage of all respondents who identified this as a best practice.

CHAPTER 7 - SUMMARY AND CONCLUSIONS

The researcher's desire to identify strategies to decrease the amount of edible food being disposed of in university dining facilities stimulated this two-component study. The major findings of this research are summarized in this chapter. Several implications for professionals and researchers are discussed. In addition, limitations and future research suggestions are presented.

Summary of Component One: Food Waste

This initial component of this study was both exploratory and descriptive in nature. The primary objective was to evaluate factors that may influence edible food waste behaviors of college students in a campus dining hall environment. The investigation involved obtaining descriptive data regarding food waste amounts, beliefs towards sustainability and food waste, and general demographic variables. Food waste behavior was assessed both on an individual basis and as an aggregate for all students dining in the facility. These waste behaviors were evaluated based on various demographic factors and belief states of the individuals.

Messaging and feedback campaigns have been shown to positively influence the sustainable behaviors of individuals (Petersen, Shunturov, Janda, Platt, & Weinberger, 2007). A secondary objective of this study was to assess whether printed message materials influence food waste beliefs and behaviors in college students participating in an on-campus meal plan. Descriptive data was used to explore whether simple prompt-type poster messages resulted in a reduction in edible waste or if feedback-based postings were necessary to stimulate a decrease in food waste.

This Elaboration Likelihood Model of Persuasion, which holds that there are two routes to persuasion was evaluated. These routes are based on the presence or absence of “elaboration” or thinking about the ideas presented (Petty, Cacioppo, Strathman, & Priester, 1994). The peripheral route can happen quite quickly without the need for logic or genuine thought, such as a glancing at a simple prompt-type poster. The central route involves more thought and consideration of personal impact, such as evaluation of feedback data. Both routes can be beneficial and both can lead to change (Petty et al., 1994). Knowing the type of information needed to make an individual aware of food waste with the goal of decreasing edible waste can benefit managers aiming to improve the sustainable practices in their operation.

The research objectives and hypotheses were developed to describe the level of beliefs college students hold towards sustainability and food waste, and their food waste behaviors. Student acceptance of various service style changes aimed at sustainability was evaluated. A messaging campaign was implemented and variables were monitored by time period. The remaining research objectives were designed to describe the relationships among all of the variables.

A primary requirement of this component of the study was the development and pilot testing of a self-administered questionnaire that would accurately explore the constructs of interest. The questionnaire was developed based on a review of pertinent literature, foodservice management interest, and a pilot test. The questionnaire included two opinion items aimed at evaluating students’ beliefs towards sustainability, followed by six questions focused on food waste belief and personal impact. The second section of the survey evaluated the acceptance of five sustainability-based service style changes. The final section obtained demographic data: sex, college of enrollment, class standing, and size and location of hometown.

The population for component one included 540 students residing in Van Zile, Boyd, and Putnam halls. The sample included students who ate meals in-house at Van Zile during the data collection period. One hundred and thirty-three (33.5%), 194 (48.9%), and 150 (37.8%) students completed the written questionnaires at Time 1, Time 2, and Time 3, respectively. On average, 128 (32.2%) trays were coded and the edible waste individually weighed at each meal.

Major Findings of Component One: Food Waste

Objective 1: Measure the beliefs of college students participating in a meal plan towards sustainability and edible food waste.

Students rated their understanding of sustainability higher than neutral (3.00) at baseline ($M = 3.49$, $SD = 0.96$). The importance of sustainability was also rated above neutral ($M = 3.75$, $SD = 0.96$). Aggregated ratings for these two opinion items indicated a higher than neutral level of beliefs towards sustainability ($M = 3.62$, $SD = 0.81$). While higher than neutral, these levels of ratings do not indicate a strong level of beliefs towards environmental sustainability.

Students' beliefs that disposing of edible food items on their trays has a negative impact on the environment was rated as stronger than neutral ($M = 3.74$, $SD = 1.09$). Students agreed (4.00) that the dining center had large amounts of food being disposed of on trays ($M = 4.00$, $SD = 0.93$) and that it is wrong to waste food ($M = 4.05$, $SD = 1.10$).

Students' beliefs regarding the negative impact of one person's food waste behavior was higher than neutral ($M = 3.64$, $SD = 1.04$). The belief that an individual's efforts can improve world hunger also rated higher than neutral ($M = 3.56$, $SD = 1.15$). Students rated their belief that the dining center should implement more programs based on sustainability as higher than neutral ($M = 3.60$, $SD = 1.00$). Aggregated ratings for these six items associated with food waste beliefs indicated a stronger than neutral (3.00) level of belief at baseline ($M = 3.76$, $SD = 0.81$).

Overall, students' mean level of beliefs regarding sustainability and food waste were 3.62 ± 0.81 and 3.76 ± 0.81 , respectively. Given the five-point scale anchored (1) Strongly Disagree to (5) Strongly Agree used, these results do not represent a strong standard of beliefs for these students.

Objective 2: Evaluate the acceptance of various sustainability-focused service style changes by college students participating in a meal plan.

The students' level of agreement with implementing five practices aimed at decreasing food waste was evaluated. The mean for each opinion item includes the acceptance ratings of all students who completed a survey at some time point during the six-week study. This average acceptance rating represents the opinions of nearly 74% of the students having a Van Zile meal plan.

Mean acceptance of limiting entrees ($M = 2.56$, $SD = 1.18$) and side dishes ($M = 2.43$, $SD = 1.19$) per trip through the serving line was below neutral (3.00). The students were even less favorable towards the removal of self-serve areas from the dining center ($M = 1.76$, $SD = 0.82$). Student acceptance of the removal of trays from the dining center was below neutral ($M = 1.75$, $SD = 0.88$), as was a la carte pricing ($M = 1.54$, $SD = 0.89$). Overall, the students were not supportive in the implementation of any of the five suggested changes to assist in the decrease of edible food waste.

Objective 3: Measure the edible food waste of college students participating in a meal plan.

Approximately 40% of the students who dined in-house during the six-week study period volunteered to have their trays coded. Therefore, the individual food waste of 7,574 student

trays was measured and documented. Food waste was collected as an aggregate measure for the remaining 11,472 trays and an average food waste per tray was calculated.

A broad range of edible waste weights was observed (0 to 998 grams). On average, more than 57 grams, or 2.00 ounces, of edible food was being discarded on trays. This 2.00 ounces is slightly higher than the 1.80 ounces of average tray waste reported by Aramark (2008). The average weight of edible items disposed of at lunch and dinner was 56.33 grams and 57.59 grams, respectively. These averages varied by day of the week. The mealtime differences in average tray waste were not significant by day of the week or meal period. The edible food waste accumulated and weighed during this six-week study equated to more than 1.5 tons of waste.

Objective 4: Evaluate whether messaging impacts the beliefs of college students participating in a meal plan towards sustainability and edible food waste.

The students' beliefs towards sustainability and food waste were evaluated in comparison to the three time-periods of the study. These included baseline (Time 1), post-prompt message (Time 2), and post-feedback message (Time 3). The matched sample of 21 students who completed the survey at all three time periods was used to evaluate the impact of each form of message. An ANOVA with repeated measures with a Greenhouse-Geisser correction was used to evaluate the mean beliefs of the three time points.

Hypothesis 1: Beliefs towards sustainability will not improve significantly after exposure to the simple prompt-type message.

Hypothesis 2: Beliefs towards sustainability will not significantly improve after exposure to the feedback-based message.

Hypothesis one and hypothesis two were supported because the results did not indicate that the prompt-type or feedback-based messages had a significant impact on the beliefs of the students. Sustainability beliefs increased from a mean of 3.90 ($SD = 0.72$) at Time 1 to 4.05 ($SD = 0.85$) at Time 2. This increase was not a significant improvement in sustainability beliefs from baseline after exposure to the prompt-type message (Time 1 to Time 2). No significant improvement in the beliefs after feedback-based messages were introduced (Time 2 to Time 3) was observed. The mean level of belief in sustainability decreased to a mean of 3.90 ($SD = 0.77$) at Time 3. The posted written messages did not have a significant impact on the sustainability beliefs of these dining center students.

Hypothesis 3: Beliefs towards edible food waste will not improve significantly after exposure to the simple prompt-type message.

Hypothesis 4: Beliefs towards edible food waste will not significantly improve after exposure to the feedback-based message.

Hypothesis 3 and hypothesis 4 were supported. A significant improvement in food waste beliefs after exposure to the prompt-type or feedback-based messages was not observed. Food waste beliefs increased slightly from a mean of 3.96 ($SD = 0.78$) to 3.98 ($SD = 0.74$) from Time 1 to Time 2. This was not a significant improvement from baseline after exposure to the prompt-type message (Time 1 to Time 2). No significant improvement in the food waste beliefs after feedback-based messages were introduced (Time 2 to Time 3) was observed. The mean level of food waste beliefs decreased to a mean of 3.73 ($SD = 0.95$) at Time 3. The posted written messages did not have a significant impact on the food waste beliefs at this dining center.

Objective 5: Evaluate whether messaging impacts the acceptance of various sustainability-focused service style changes by college students participating in a meal plan.

The students' level of agreement with five suggested service style changes was evaluated during the three time points to assess the impact of the printed message interventions. The mean acceptance of each of the five opinion items was evaluated using an ANOVA with repeated measures with a Greenhouse-Geisser correction.

Hypothesis 5: Students' acceptance of various service style changes directed at sustainability and food waste reduction will not significantly improve following exposure to the simple prompt-type message.

Hypothesis 6: Students' acceptance of various service style changes directed at sustainability and food waste reduction will not significantly improve after exposure to the feedback-based message.

Hypothesis 5 and hypothesis 6 were supported. The acceptance rating of each of these service style changes at the three time points were not significantly different. The students' level of support for the suggested changes remained low throughout the entire six-week study. This indicates that exposure to either the simple prompt-type message or the feedback-based message triggered an increased acceptance of the five suggested practices to decrease food waste.

Objective 6: Evaluate whether messaging impacts the food waste behavior of college students participating in a meal plan.

The food waste behaviors of 296 students were evaluated over the three time periods. These 296 students consistently allowed their trays to be coded and evaluated during the six-week study. When using an ANOVA with repeated measures with a Greenhouse-Geisser

correction, the mean food waste weights of these 296 students at the three time points were statistically significantly different ($F(1.83, 590) = 3.89, p = 0.02$).

Hypothesis 7: Mean edible tray waste will not significantly decrease after exposure to the simple prompt-type message.

Hypothesis 7 was not supported. Results indicate that exposure to the simple prompt-type messages triggered a reduction in the mean weight of edible items being disposed of on trays. The mean edible food waste weight at Time 2 ($M = 53.08, SD = 67.08$) was significantly lower than that of Time 1 ($M = 62.76, SD = 56.10$) ($F(1.0, 295) = 5.41, p = 0.02$). A 15% decrease in mean edible food waste was observed after the introduction of the simple prompt-type message intervention.

Hypothesis 8: Mean edible tray waste will not significantly decrease after exposure to the feedback-based message.

Hypothesis 8 was supported. The addition of the feedback-based messages did not stimulate a significant decrease in the amount of edible food items being disposed of.

Objective 7: Evaluate the relationship between beliefs towards sustainability and food waste reduction and actual food waste behaviors.

The relationship between food waste behaviors and beliefs towards sustainability and food waste were evaluated for 120 students. These students completed the baseline survey and allowed their trays to be evaluated for food waste amounts. Beliefs and food waste data for Time 1 (baseline) were used as this allowed the uninfluenced beliefs of the students to be evaluated in relationship to their behaviors prior to any messaging interventions being introduced.

Hypothesis 9: There will be no significant relationship between beliefs towards sustainability and food waste behaviors in the dining center.

Hypothesis 9 was supported in that beliefs towards sustainability were found to have no significant correlation with food waste behaviors.

Hypothesis 10: There will be no significant relationship between beliefs towards food waste and food waste behaviors in the dining center.

Hypothesis 10 was not supported in that the average food waste at baseline was found to be negatively correlated ($r(118) = -0.25$) at $p = 0.01$ with food waste beliefs. Students who had higher food waste beliefs also disposed of less edible food items.

Objective 8: Evaluate the relationship between various demographic factors and the beliefs towards sustainability and food waste reduction.

The baseline (Time 1) was used to evaluate the relationship between student beliefs and demographic factors. This allowed the impact of the demographics to be evaluated before the influence of message materials had been introduced.

Hypothesis 11: There will be no significant difference between beliefs towards sustainability and various demographic factors.

a.) Sex

Hypothesis 11a was supported. No significant differences in beliefs regarding sustainability were found between male and female students. .

b.) College of Academic Major

Hypothesis 11b was supported. Beliefs regarding sustainability were not significantly associated with the students' college of academic major.

c.) Year of Enrollment / Class Standing

Hypothesis 11c was supported. No significant differences in beliefs regarding sustainability were found based on the class standing of the students.

d.) Size of Hometown

Hypothesis 11d was supported. The students' beliefs regarding sustainability were not significantly associated with the size of the hometown of the students.

e.) Location of Hometown

Hypothesis 11e was supported. The students' beliefs regarding sustainability were not significantly associated with the location of the students' hometown.

Hypothesis 12: There will be no significant difference between beliefs towards edible food waste and various demographic factors.

a.) Sex

Hypothesis 12a was not supported as females had significantly ($p = 0.02$) stronger average food waste belief ratings than did males. The aggregated rating of females based on the six opinion items regarding food waste was stronger than a neutral (3.00) level of belief ($M = 3.87, SD = 0.77$). The food waste beliefs of males were also stronger than a neutral standing ($M = 3.51, SD = 0.87$).

b.) College of Academic Major

Hypothesis 12b was supported. Beliefs regarding food waste were not significantly associated with the students' college of academic major.

c.) Year of Enrollment / Class Standing

Hypothesis 12c was not supported as sophomores were found to have significantly ($p = 0.01$) stronger beliefs related to food waste and personal impact of behavior than freshman and seniors. Aggregated ratings of six opinion items indicated sophomores agreed (4.00) with the impact of food waste and their role in it ($M = 4.09, SD = 0.65$). Freshman ($M = 3.64, SD = 0.71$) and seniors ($M = 3.44, SD = 0.97$) rated their beliefs lower than sophomores and juniors.

d.) Size of Hometown

Hypothesis 12d was supported. Beliefs regarding food waste were not significantly associated with the size of the students' hometown.

e.) Location of Hometown

Hypothesis 12e was supported. Beliefs regarding food waste were not significantly associated with the location of the students' hometown.

Objective 9: Evaluate the relationship between various demographic factors and actual food waste behavior.

Hypothesis 13: There will be no significant difference between actual food waste behaviors and various demographic factors.

a.) Sex

Hypothesis 13a was not supported as females were found to discard of significantly ($p = 0.01$) higher amounts of edible waste. The average weight of edible food items disposed of by females and males at baseline was 65.59 grams ($SD = 57.62$) and 46.08 grams ($SD = 37.43$), respectively.

b.) College of Academic Major

Hypothesis 13b was supported. Food waste behaviors were not significantly associated with students' college of academic major.

c.) Year of Enrollment / Class Standing

Hypothesis 13c was supported. Food waste behaviors were not significantly associated with the students' college of academic major.

d.) Size of Hometown

Hypothesis 13d was supported. Food waste behaviors were not significantly associated with the size of students' hometowns.

e.) Location of Hometown

Hypothesis 13e was supported. Food waste behaviors were significantly associated with the location of students' hometowns.

Implications of Component One: Food Waste

This study suggests that a problem does exist. Large amounts of edible food items are being disposed of by students dining in university facilities. These results indicate that students contribute to the negative environmental impact of excess food waste. This also identifies consumer education as an area of focus for management attention when striving to decrease the carbon footprint of their dining operation.

Student beliefs specific to the topic of food waste were found to be correlated to their food waste behaviors. These findings indicate that students with a higher level of belief towards food waste and their role in it also dispose of less edible food items. Demographic factors were found to have very little association with the food waste behaviors of these students. While we hope that sustainable habits can and will be gained during our impactable adolescent years, this may not be a reality. The university setting may very well be the initial point of contact students have with the topic of sustainability. This indicates that general consumer education may help these dining facilities inform their students of the large amounts of waste being disposed of and the role that they play in this problem.

Messaging is a form of education that can easily be implemented by these facilities. This study indicates that while printed messaging may not change the beliefs of these students it can

play a role in improving their behavior. Simple prompt-type messages were found to stimulate a significant improvement in the food waste behaviors of these students. These prompt-type messages simply triggered student awareness. This awareness of food waste in the dining facility was enough to stimulate improved food waste behavior.

Summary of Component Two: Case Study

The second component of this study explored the feasibility of implementing trayfree dining in Van Zile Dining Center at Kansas State University Dining Services. This operational research-based case study used qualitative methods to conduct a best practices review with managers of university dining facilities involved in trayfree dining. Focus groups of students dining in the facility were used in conjunction with a written survey to gain insight into student perceptions of the proposed change. Recommendations for the management team at Van Zile are based upon the results of the data collection.

Best Practices Review

Seven open-ended interview questions were developed to explore the foodservice managers' perceptions regarding the implementation of trayfree dining in their facilities. These questions were based on a review of the trayfree dining system and previous research in the field. The discussion questions asked for their input on the challenges, benefits, and suggestions they may have on implementing or evaluating the feasibility of a trayfree system. Discussion was encouraged.

The population for best practices review was 70 university foodservice professionals who were members of The National Association of College and University Foodservice (NACUFS) and listed in the publication "Trayless Members in NACUFS", as well as 13 regional universities identified as having trayfree facilities. These 83 professionals from across the United States

were contacted and asked to participate. Twenty-four (34%) of those contacted comprised the final convenience sample and were selected based on their willingness to participate in the telephone interviews. No regional managers replied to participate.

Student Focus Groups

Two focus groups were held following dinner meals at Van Zile. A total of eleven students signed-up to participate and were included in the discussion and survey data collection. The focus group discussions aimed to identify student familiarity with trayfree dining, perceived barriers and benefits they may foresee, and any recommendations they may have for the future. The main points of discussion were based on the interests of Van Zile Dining Center and data gathered during the best practice review portion of this study. The students were asked to dine at Van Zile the following week without using a tray. The individuals then followed up with the researcher to revisit the discussion.

Students completed both a pre and post-trayfree experience survey. This survey allowed for quantitative analysis of the students' support for and concern with the implementation of trayfree dining as well as the need for various changes. The changes included glass size, plate and bowl size, and silverware locations.

Major Findings of Component Two: Case Study

Interview and focus group data were sorted by themes: problems, benefits, best practices, and recommendations. NVivo software (version 9, 2010, QSR International, Australia) was used to identify themes within the qualitative discussion data. Survey data was analyzed for frequency and descriptive purposes using SPSS (version 13.0, 2004, SPSS, Inc., Chicago: IL). This information was formatted into a set of guidelines to assist in the case study to determine

the feasibility of implementing a trayfree dining program at Van Zile. The objectives for this component of the study were as follows:

Objective 13: Identify the best practices for implementing trayfree dining based upon qualitative data obtained from foodservice operators.

A general summary of themes derived from the foodservice managers are as follows:

Changes Necessary

- Solid surfaces on carousel accumulator
- Sides on belt-return
- Disperse silverware and service ware throughout facility

Benefits

- Decreased food waste
- Decreased resource use (water and energy)
- Decreased dishroom chemical use
- Improved customer satisfaction and public relations
- Decreased food and beverage costs
- Improved meal choices by students

Complications

- Complaints
- Decreased dining room cleanliness

Recommendations

- Involve students
- Market the benefits

- Complete waste audits
- Communicate the change

Best Practices

- Quantify the waste
- Marketing campaign
- Involve and communicate with students
- Implement beginning of fall semester

Objective 14: Evaluate the operational feasibility of implementing a trayfree dining program at Van Zile Dining Center.

In addition to the information gained via the telephone interviews with twenty-four foodservice professionals, two student focus groups were utilized. Eleven students participated in the discussion focusing on trayfree dining at Van Zile Dining Center. A general summary of the focus group discussion points are as follows:

Concerns

- Serving area congestion
- Increased spills and breakage
- Lack of space on plates to keep food items from intermixing

Suggestions

- Use of divided “school lunch” type trays
- Alter dish return carousel to prevent spillage
- Avoid unnecessary changes to their habits
- Relocate silverware to server and dining rooms
- Implement at beginning of fall semester

- Advertise the change during prior semester

The students showed very little concern about the implementation of trayfree dining in the discussion portion of the focus groups. However, the survey administered indicated only slightly higher than neutral (3.00) level of support for the change ($M = 3.18$, $SD = 0.60$). This level of support improved following the trayfree experience indicating they more than agreed (4.00) that they would support the implementation of trayfree dining at Van Zile ($M = 4.29$, $SD = 0.76$). Students rated their level of agreement that trayfree dining can aid in decreasing food waste at higher than neutral (3.00) both prior to ($M = 4.27$, $SD = 0.66$), and following their trial experience with trayfree dining ($M = 4.71$, $SD = 0.49$). The level of agreement with suggested serviceware changes increased from the pre to post-experience survey. Following their trial experience with trayfree dining the students more than agreed (4.00) that larger glasses ($M = 4.79$, $SD = 0.39$), larger plates and/or bowls ($M = 4.00$, $SD = 1.00$), and relocating silverware to the dining room ($M = 4.29$, $SD = 0.95$) would assist in making trayfree successful at Van Zile.

Overall, the focus group participants showed positive support for the implementation of trayfree dining at Van Zile. Their recommendations for minor changes mirrored those discussed by the foodservice managers in the best practice review.

Considering the positive benefits and limited negative outcomes of trayfree dining indicated by other foodservice professionals, and the open-mindedness and desire for involvement from the students, it is recommended that it is operationally feasible for trayfree dining to be implemented at Van Zile dining center.

The removal of dining trays from this facility would likely stimulate a decrease in the amount of edible food items being disposed of. It is likely that food costs would decrease in response to the need for less production. A second benefit of this decrease in food taken is the

health-benefits gained by the students. Improved awareness of serving sizes and more informed food choices were indicated by multiple managers as positive outcomes of trayfree dining. It is recommended to educate the students on the health benefits trayfree dining may provide.

Sustainability is important to many students and focusing on the positive outcomes of this change may be alluring. Demonstrating the amounts of waste produced by students prior-to and following the implementation of trayfree dining is recommended for maximum impact. Finally, it is recommended that waste and expense audits be performed prior to and throughout the implementation of trayfree dining. This will provide financial data for continued support of such a change.

Limitations and Future Research

This study, like others, had limitations. The first component of this study investigated multiple factors and their impact on food waste behaviors of college students. One limitation of this study was the sample is limited to students participating in meal plans at Kansas State University Dining Services. This limits the ability to generalize the findings to other foodservice operations such as hospitals, restaurants, prisons, and military facilities. Additionally, these results cannot be generalized to other residence hall dining facilities at Kansas State University or on other campuses. Future research focused on the food waste behaviors of industry specific consumers may provide some insight into the consumer's role in food waste.

The setting of this research allowed all participants the opportunity to view and discuss both the prompt and feedback-based messages, and the research project in their dining hall. This made it difficult to distinguish the true impact of the second message intervention. Therefore, analysis was based on evaluating behaviors and beliefs at the various time periods of the study. This allowed the introduction of each message to be evaluated separately. Comparisons of each

time period allowed us to evaluate whether the feedback-based message had an impact above and beyond the improvement seen following the prompt-type message. It is not known whether the feedback-based message would have stimulated a change had it been introduced prior to the prompt-type intervention.

Because students were asked to volunteer their trays to be coded, it is impossible to know if the study itself had any impact on their food waste behaviors. In order to evaluate waste behaviors in relationship to various demographic factors and personal beliefs, it was essential that trays be coded with a personal identifier. The repeated nuisance of being asked to participate may have lowered the level of student involvement. Identifying methods of individual tray tracking via the use of technology would assist in researchers' ability to monitor waste without triggering any behavioral responses from the students.

Another limitation of the first component was the response rate of student surveys. Surveys were administered at meal times and it was discovered that asking for participation at the dining center entrance provided little feedback. Students themselves recommended the researchers approach them once they had been seated. Students' willingness to complete surveys was greater in the dining rooms. This allowed discussion between students to occur and may have altered student responses due to peer interaction. Because three identical surveys were administered throughout the six-week study, students often felt they had already been involved and much time was spent explaining the purpose of three similar surveys. Demographic data and student acceptance of various service changes could have been evaluated with a single survey allowing less student resistance. However, the need for student belief ratings reinforced the necessity of a repeated measure survey.

Component two involved telephone interviews of foodservice professionals. Data collection can present challenges if the foodservice professionals are too busy to schedule interviews. Due to spring break and other campus events, response rates were lower than anticipated. Regional facilities were contacted, however, none replied agreeing to participate. It is unknown if Midwest-based operators would have had any suggestions or discussion points beyond those gathered from the NACUFS professionals. Timing of this study prevented site visits from being included in the review. Implementing the review of facility layout in future research would provide general architectural suggestions to facilities considering the implementation of trayfree dining.

Additional points of interest surfaced throughout the process of the interviews. This resulted in more in-depth discussions with the participants. Although not vital to this study, the information was useful and could have been applied to the report being formatted for the management team of Van Zile Dining Center. Future studies should focus on the financial aspect of trayfree dining to include purchasing of service ware, marketing needs, and publicity would provide additional resources to managers.

Student focus groups, while providing some useful input, often diverted to additional topics. The group atmosphere often triggered discussions and debates among the students. This may have caused peer influence on the students' true opinions regarding the implementation of trayfree dining. If individual input is warranted, the focus group setting may not be the best format. It is recommended to include student input in the format of individual interviews.

Future work should focus on evaluating methods of communication and student education that can best benefit the implementation and continued success of trayfree dining. While past research, as well as the current study, demonstrate the environmental and financial

benefits of trayfree dining, evaluating the continued impact and success of such a change is recommended. It is equally important to evaluate the student perceptions of trayfree dining and the perceptions of the environmental impact of such a change. Determining whether introducing this form of environmentally friendly service impacts students selection and evaluation of academic institutions may be beneficial. Since student recruitment and retention are vital to the success of an organization, the next logical step would be to evaluate what other methods of sustainable improvement entice student choices.

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Appendix A - Pilot Test Questionnaire

This is a survey about your beliefs and practices related to food waste.

This is not a test, there are no wrong answers. Please answer honestly.

Part I: Beliefs Towards Environmental Sustainability

The following set of statements measures your beliefs and perception of food waste and environmental sustainability. For each statement please circle the number on the scale that best represents your honest opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. My understanding of environmental sustainability is excellent.	1	2	3	4	5
2. Environmental sustainability is very important to me.	1	2	3	4	5
3. Leaving uneaten food on my dining tray has a negative effect on the environment.	1	2	3	4	5
4. I feel the dining center has a large amount of food thrown out on student trays.	1	2	3	4	5
5. I believe it is wrong to waste food when there are so many hungry people in the world.	1	2	3	4	5
6. I feel one person's food waste can have a negative impact on the environment.	1	2	3	4	5
7. I feel one person's efforts to decrease food waste can assist in improving world hunger.	1	2	3	4	5
8. I believe the dining center should implement more programs on environmental sustainability	1	2	3	4	5

Part II: Options for Decreasing Food Waste

The following are ways to reduce edible food waste in our dining center. Please evaluate if you would find these changes acceptable. For each statement please circle the number on the scale that best represents your honest opinion.

In an effort to decrease food waste:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9. Allowing only one <u>entrée</u> per trip through the serving line would be acceptable to me.	1	2	3	4	5
10. Limiting the number of <u>side dishes</u> to two per visit through the serving line would be acceptable to me.	1	2	3	4	5
11. Eliminating self-serve areas would be acceptable to me.	1	2	3	4	5

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
12. No longer providing trays to carry my food items on would be acceptable to me.	1	2	3	4	5
13. Paying for food items individually (a la carte) would be acceptable to me.	1	2	3	4	5

Part III: Demographic Information.

Please circle the correct answer to the following questions.

14. What is your sex?
- a. Male
 - b. Female
15. Which college are you affiliated with?
- a. College of Agriculture
 - b. College of Architecture, Planning, and Design
 - c. College of Arts and Sciences
 - d. College of Business Administration
 - e. College of Education
 - f. College of Engineering
 - g. College of Human Ecology
 - h. College of Veterinary Medicine
 - i. Other, please specify _____
 - j.
16. Which of the following best describes your hometown?
- a. Rural Area (less than 2,500 people)
 - b. Suburb or Urban Place (2,500 to 49,999 people)
 - c. Medium Urban Area (50,000 to 250,000 people)
 - d. Large Urban Area (more than 250,000 people)
 - e.
17. Which of the following best describes you?
- a. Freshman (including ESL)
 - b. Sophomore
 - c. Junior
 - d. Senior
 - e. Graduate Student
 - f. Faculty/Staff
 - g. Other, please specify _____
18. Which of the following best describes the location of your permanent residence?
- a. Kansas
 - b. Missouri
 - c. Other state in the United States
 - d. Country other than the United States

Appendix B - **Pilot Test Survey Cover Letter**

December 13, 2010

Dear Dining Participant:

We are conducting a pilot study to evaluate a survey that will be administered spring semester to students participating in meal plans. The purpose of the survey is to learn more about K-State students' beliefs and practices related to food waste in the dining center. We need your assistance in completing the survey and providing us feedback on the wording, flow, and estimated time required to complete the attached survey. We would also like your feedback on the cover letter. It should only take you five minutes to complete the survey and the evaluation form.

Completing the survey involves no risk to you. Your participation is completely voluntary. Refusing to participate will involve no penalty and you may discontinue participation at any time. Individual responses will be completely anonymous. Please be assured that your responses will be confidential and all results will be reported as group data. If you are under 18 years of age, you cannot participate in this study unless you obtain parental consent.

Your participation is essential to the study's success. We truly appreciate your time and assistance. If you have any questions about the study, please contact Dr. Carol Shanklin at (785)532-7927 or Kelly Whitehair at (785)395-2233. If you have any questions about your research subject's rights or about the process of this study, you may contact the University Research Compliance Office at (785)532-3224.

Thank you for participating.

Sincerely,

Kelly J. Whitehair, MS, RD, LD
Assistant Unit Director, Van Zile
PhD Candidate

Dr. Carol Shanklin, PhD, RD
Dean of Graduate School

Appendix C - Pilot Study Feedback Form

Pilot Test

Summary and Content Clarity

Please provide any insight you may have about the clarity or content of the questionnaire.

Did any of the questions have content you did not understand?

- a. No
- b. Yes. Please specify: _____

Were any of the questions unclear to you?

- a. No
- b. Yes. Please indicate which questions and any suggestions you may have: _____

Do you have any suggestions on how we can improve the cover letter or survey before administering it to other dining center participants?

- a. No
- c. Yes. Please share your ideas: _____

Thank you for your time. We truly appreciate your help.

Appendix D - **Final Instrument**

This is a survey about your beliefs and practices related to food waste.

This is not a test, there are no wrong answers. Please answer honestly.

Part I: Beliefs Towards Environmental Sustainability

The following set of statements measures your beliefs and perception of food waste and environmental sustainability. For each statement please circle the number on the scale that best represents your honest opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. My understanding of environmental sustainability is excellent.	1	2	3	4	5
2. Environmental sustainability is very important to me.	1	2	3	4	5
3. Leaving uneaten food on my dining tray has a negative effect on the environment.	1	2	3	4	5
4. I feel the dining center has a large amount of food thrown out on student trays.	1	2	3	4	5
5. I believe it is wrong to waste food when there are so many hungry people in the world.	1	2	3	4	5
6. I feel one person's food waste can have a negative impact on the environment.	1	2	3	4	5
7. I feel one person's efforts to decrease food waste can assist in improving world hunger.	1	2	3	4	5
8. I believe the dining center should implement more programs on environmental sustainability	1	2	3	4	5

Part II: Options for Decreasing Food Waste

The following are ways to reduce edible food waste in our dining center. Please evaluate if you would find these changes acceptable. For each statement please circle the number on the scale that best represents your honest opinion.

In an effort to decrease food waste:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9. Allowing only one <u>entrée</u> per trip through the serving line would be acceptable to me.	1	2	3	4	5
10. Limiting the number of <u>side dishes</u> to two per visit through the serving line would be acceptable to me.	1	2	3	4	5
11. Eliminating self-serve areas would be acceptable to me.	1	2	3	4	5

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
12. No longer providing trays to carry my food items on would be acceptable to me.	1	2	3	4	5
13. Paying for food items individually (a la carte) would be acceptable to me.	1	2	3	4	5

Part III: Demographic Information.

Please circle the correct answer to the following questions.

14. What is your sex?
- c. Male
 - d. Female
15. Which college are you affiliated with?
- k. College of Agriculture
 - l. College of Architecture, Planning, and Design
 - m. College of Arts and Sciences
 - n. College of Business Administration
 - o. College of Education
 - p. College of Engineering
 - q. College of Human Ecology
 - r. College of Veterinary Medicine
 - s. Other, please specify _____
16. Which of the following best describes you?
- h. Freshman (including ESL)
 - i. Sophomore
 - j. Junior
 - k. Senior
 - l. Graduate Student
 - m. Faculty/Staff
 - n. Other, please specify _____
17. Which of the following best describes the location of your permanent residence?
- a. Kansas
 - b. Missouri
 - c. Other state in the United States
 - d. Country other than the United States
18. Which of the following best describes your hometown?
- f. Rural Area (less than 2,500 people)
 - g. Suburb or Urban Place (2,500 to 49,999 people)
 - h. Medium Urban Area (50,000 to 250,000 people)
 - i. Large Urban Area (more than 250,000 people)

Appendix E - **Prompt-type Message**



Eat What You Take

Don't Waste Food

Appendix F - **Feedback-based Message**

Appendix G - **Final Instrument Cover Letter**

Dear Van Zile Dining Participant:

We are conducting a study to evaluate the impact various poster messages have on beliefs and behaviors related to edible food waste and environmental sustainability among university students dining at Van Zile. It should only take you five minutes to complete the survey.

Completing the survey involves no risk to you. Your participation is completely voluntary. Refusing to participate will involve no penalty and you may discontinue participation at any time. Individual responses will be completely anonymous. Please be assured that your responses will be confidential and all results will be reported as group data. If you are under 18 years of age, you cannot participate in this study unless you obtain parental consent.

Your participation is essential to the study's success. We truly appreciate your time and assistance. If you have any questions about the study, please contact Dr. Carol Shanklin at (785)532-7927 or Kelly Whitehair at (785)395-2233. If you have any questions about your research subject's rights or about the process of this study, you may contact the University Research Compliance Office at (785)532-3224.

Thank you for participating.

Sincerely,

Kelly J. Whitehair, MS, RD, LD
Assistant Unit Director, Van Zile
PhD Candidate

Dr. Carol Shanklin, PhD, RD
Dean of Graduate School

Appendix H - Telephone Interview Guide

Telephone Interview Guide

Hello. This is <<Interviewer's Name>> from Kansas State University. May I please speak to <<Primary contact's name>>.

- Hi, I am calling from the Hospitality Management and Dietetics Program at Kansas State University.
- We are conducting a study to identify best practices in implementing a trayfree dining program. We are contacting all <<NACUFS members or regional universities>> who have implemented trayfree dining. You received an e-mail about this within the last week.
- Do you have 15 minutes now to respond to a few questions?
 - If yes – Do you mind if I record this conversation for clarity? All of your responses will remain anonymous.
 - If yes – ask questions #1-#5.
 - If within 250 miles of Manhattan: ask if the researcher would be able to come for a site visit to see the layout of the facility.
 - If NOT within 250 miles of Manhattan: ask if they would be willing to share a copy of their facility layout since, due to travel distance, we are unable to come for a site visit.
 - If no – when can I call you back later today? (Schedule a specific time and note the details.)
- Thank you for your time and participation. If you are interested in the results of this study, please e-mail me at stirtz@ksu.edu.

Date	Time	Interviewer	Results						
			No Answer	Unavailable	Will Return (Note name and time to contact)	Refused (Note when and why)	Call Completed	Partially Completed (Note when call ended and why)	Wrong Number
Notes:									

Phone Interview Questions:

1. When did you implement your trayfree dining program?
2. How many meals do you serve in this facility?
3. What changes to your facility did you have to make prior to the implementation?
4. What complications or problems have you encountered along the way? How did you resolve the problems or address the complications?
5. What benefits have you seen from the implementation of trayfree system?
6. What recommendations or advice do you have for university dining centers who are exploring trayfree dining?
7. What one best practice would you advise others to follow when investigating the feasibility of trayfree dining?

Appendix I - **Introductory E-mail**

Dear NACUFS Member:

We are asking for your assistance in a study to investigate the operational feasibility of implementing a trayfree dining program. We realize many organizations have been successful at implementing this system, however, very little is known as to the proper steps to take for the transition to go smoothly. We know your organization has experience with this and would like to ask you a few questions regarding the process of developing, implementing, maintaining, and evaluating this popular service system. To ensure the success of the study, we would appreciate any time you may have to offer us. Results will be used to identify best practices in implementing and maintaining trayfree dining.

We are e-mailing in advance to ask for your participation. If you or a member of your team would be willing to participate, please respond to this e-mail with the name of the primary contact person, e-mail address, and a telephone number. We realize that time is a valuable asset so please indicate if there are particular times of the day that you prefer we not call. Our telephone discussion will take approximately fifteen minutes. We may also ask for additional information you may be willing to share and will provide you with an e-mail contact to contribute further thoughts you may have.

Your participation is voluntary, refusal to participate will involve no penalty, and you may ask to discontinue your participation at any time. All discussion responses will be completely anonymous. Should we happen to call at an inconvenient time, please let us know and we will schedule a more convenient time to contact you. You will be provided a summary of best practices for participating in the telephone interview.

Your participation is essential to the study's success. We truly appreciate your time and assistance. If you have any questions about the study, please contact Dr. Carol Shanklin at (785)532-7927 or Kelly Whitehair at (785)395-2233. If you have any questions about your research subject's rights or about the process of this study, you may contact the University Research Compliance Office at (785) 532-3224.

Thank you.

Sincerely,

Kelly J. Whitehair, MS, RD, LD
Assistant Unit Director, Van Zile
Kansas State University Dining Services
PhD Candidate

Dr. Carol Shanklin, PhD, RD
Dean of Graduate School
Kansas State University

Appendix J - **Focus Group Informed Consent**

Focus Group Informed Consent Form

PROJECT TITLE: Investigation of Strategies to Decrease Food Waste in College and University Foodservice

CONTACT INFO: If you have any questions about the study, please contact Kelly Whitehair at (785)395-2233 or Dr. Carol Shanklin at (785)532-7927. If you have any questions about your research subject’s rights or about the process of this study, you may contact the University Research Compliance Office at (785) 532-3224.

PURPOSE OF THE RESEARCH: This phase of the study investigates the operational feasibility of implementing a trayfree dining program at Van Zile Dining Center. This involves gaining insight into students’ thoughts, ideas, and opinions on a program such as this.

STUDY PROCEDURE: Focus Group (two-1 hour sessions) and voluntary participation in a trayfree dining experience. We will discuss your thoughts on implementing a trayfree system in Van Zile and have you complete a short survey. We will then ask you to try dining without a tray a few times over the next week. We will get together again next week and discuss your thoughts, what problems you encountered, and any ideas you may have on making a system such as this a success in Van Zile.

RISKS ANTICIPATED: No known risks.

EXTENT OF CONFIDENTIALITY: Discussions will remain confidential and anonymous. Participant name and individual responses will not be identified.

TERMS OF PARTICIPATION: I understand this project is research, and that my participation is completely voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating without any explanation, penalty, or loss of benefits.

I verify that my signature below indicates that I have read and understand this consent form. I willingly agree to participate in this study under the terms described. My signature acknowledges that I have received a signed and dated copy of the consent form.

Participant Name: _____

Participant Signature: _____

Date: _____

Witness to Signature: _____

Date: _____

Appendix K - **Researcher's Focus Group Guide**

Researcher's Focus Group Guide

Purpose: This portion of our study aims to investigate the operational feasibility of implementing a trayfree dining program at Van Zile Dining Center. This involves gaining insight into student thoughts, ideas, and opinions on a program such as this.

Introduction:

Welcome everyone. Please come in and make yourself comfortable. Help yourself to drinks and snacks. I would like to thank you for participating in this focus group. My name is Kelly Whitehair, I am the assistant director at Van Zile Dining Center, as well as a graduate student here at K-State. We are conducting a study to explore the feasibility of implementing a trayfree dining program in Van Zile. Trayfree dining is basically the removal of trays from the serving area of the dining center. In other words, all plates, utensils, and cups have to be transported by hand to your dining tables. Trayfree dining has become very popular because many foodservice operations have found it to decrease food waste and decrease resources required to clean and sanitize trays and dishes used in their dining centers. However, little is known as to the costs associated with implementing a system such as this or what the students think.

Our purpose today is to discuss trayfree dining and its place here at K-State. We are asking your input, thoughts, and opinions on various aspects of this system and any benefits or barriers you may foresee. This discussion will take about an hour. We will then ask that you try it out. Try not using a dining tray for a couple of days over the next week. When we get together again next week we'd love to learn about your experience with experimenting with trayfree dining. What problems did you run into, what solutions do you see, and can we make it work? You will also complete a short written survey each time we get together.

Disclosure:

The purpose of this focus group is find out what you think about the concept of trayfree dining and your exposure with using trayfree dining. Your identity and responses will all be kept anonymous. You can stop your participation at any time, without penalty or hard feelings. If you have any questions regarding this project, you may contact the principle investigator (Dr. Carol Shanklin), myself (Kelly Whitehair), or the University Research Compliance office. All of the numbers are on the form in front of you. This form provides you with the purpose of the study, the procedure, and your rights as a participant. Throughout the session I will be taking notes to prevent us from missing any of your comments. We will also be recording this session to capture all important information you share. Your responses will not be linked to you. When the results are summarized only aggregate data will be shared. If you are willing to participate, please sign and return the consent form. A second copy has been provided for your records.

Guidelines:

How this is going to work is that I will ask a question and you will give me your thoughts and ideas. Feel free to jump in with questions of your own or build off of someone else's comments. There are no wrong or unimportant comments, only different points of view. Feel free to say what you think, even if it differs from what others may say. Please try to let one individual speak at a time. Everything is important and I don't want to miss anything. Does anyone have any questions before we begin?

Debriefing and Closing:

Thanks for your help with this study. Results of our focus group will be summarized and used to determine various aspects that need to be evaluated when considering the implementation of a trayfree dining system. Your input will help us evaluate the feasibility of implementing a trayfree system at Van Zile. If you are interested in the results of our feasibility study, feel free to contact me. I will share a summary of the focus group at a future hall meeting. Have a great rest of your day, and feel free to give me a call or send me an e-mail if you think of anything else.

Focus Group Questions

1. Trayfree dining is simply the removal of dining trays from the dining center. This means you would be carrying all items by hand to your tables. What are your thoughts about going trayfree?
2. I am going to ask that you now complete this short survey before we continue.
3. Have you ever eaten at facility that was “trayfree”? If yes continue with questions below.
 - a. What did you think of that experience?
 - b. Was there anything that you found difficult?
 - c. Was there anything that you especially liked about it?
4. You are all familiar with Van Zile and the layout. What things about our building do you think will make it easy to implement a trayfree service system?
5. If we were to take the trays away today, what obstacles do you foresee?
6. What things about our serviceware (cups, plates, etc.) do you think we would have to change to make this work?
7. What things about our service style would we need to change?
8. Can you think of anything about our facility layout that would make this transition difficult?
9. What other sustainable actions do you think we could implement here at Van Zile to improve our stance in “green living”?

If not mentioned suggest the following topics to the table:

- Location of the beverages
- Location of silverware
- Location of condiment counter
- Size of the glasses
- Keeping food hot or cold
- Making multiple trips (salads, soup, entrees, desserts, beverages, etc.)

Appendix L - **Focus Group Written Survey**

Focus Group Survey

Please circle the option that best represents your honest opinion.
This is not a test, there are no wrong answers.

How many semesters have you been dining at Van Zile Dining Center? _____

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I feel trayfree dining can aid in decreasing the amount of food disposed of as waste.	1	2	3	4	5
2. I would support implementing trayfree dining at Van Zile.	1	2	3	4	5
3. I feel that having larger glasses would assist in making trayfree successful.					
4. I feel that larger plates and/or bowls would assist in making trayfree successful.	1	2	3	4	5
5. I feel that having silverware available in the dining rooms would assist in making trayfree successful.	1	2	3	4	5

Appendix M - IRB Approval



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Lower Mezzanine
Manhattan, KS 66506-1103
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TO: Carol Shanklin
HMD
103 Fairchild

Proposal Number: 5613

FROM: Rick Scheidt, Chair 
Committee on Research Involving Human Subjects

DATE: October 15, 2010

RE: Proposal Entitled, "Investigation of Strategies to Decrease Food Waste in College and University Foodservice"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written - and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

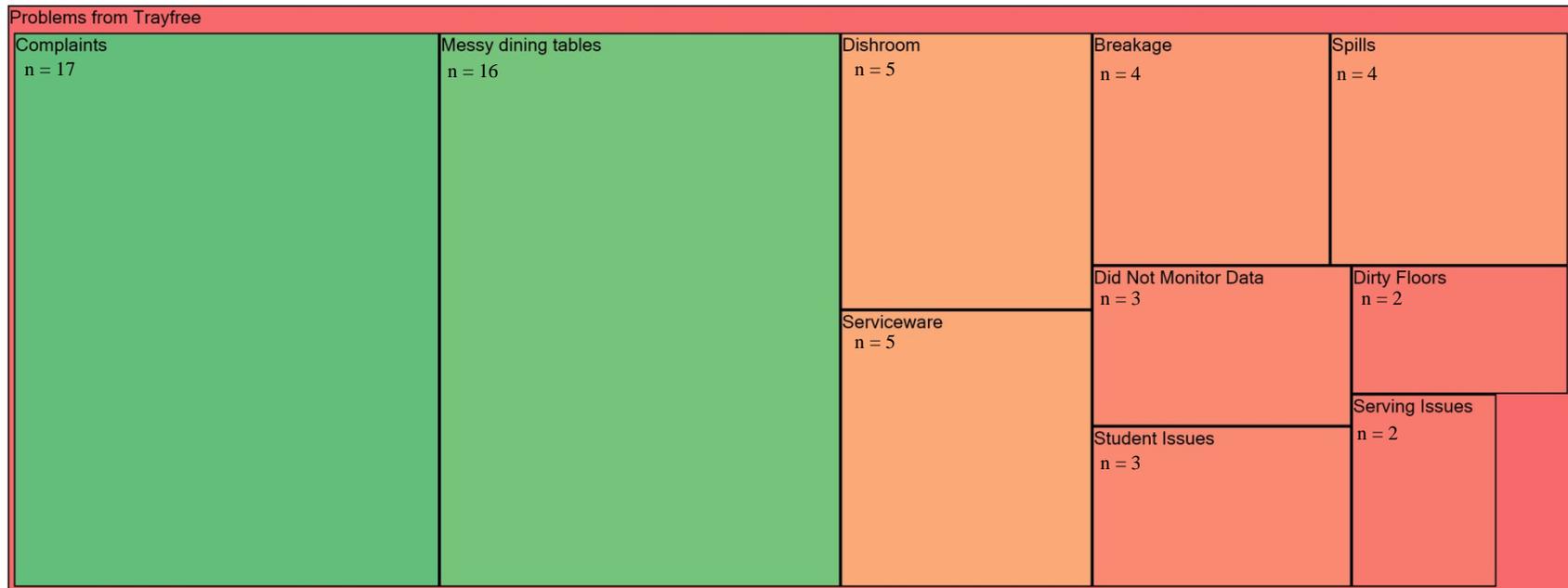
Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.



Appendix N - **Tree Map of Benefits of Trayfree Dining**

Benefits from Trayfree					
Decreased Waste n = 20	Decreased Water Use n = 13	Decreased Food Cost n = 10	Improved Service-Satisfaction n = 7	Good PR n = 6	
	Decreased Chemicals n = 10	Dishroom Efficiency n = 9	Health Benefits n = 5		Decreased Energy n = 4
			Decreased Bev. Cost n = 4	Less Napkins n = 2	Change n = 1

Appendix O - Tree Map of Problems of Trayfree Dining



Appendix P - **Tree Map of Recommendations for Trayfree Dining**

Recommendations				
Involvement Students n = 16	Market-Educate n = 15	Waste Analysis n = 10	Cold Turkey n = 5	Implement Fall n = 5
		Communicate n = 9	Evaluate n = 4	Ease Into It n = 2
				Involvement Adults n = 1
				Larger Plans n = 1
				Plan Ahead n = 1
				Stand Your Ground n = 1
				Consider Disabilities n = 1

Appendix Q - Tree Map of Best Practices for Trayfree Dining

Best Practices						
Quantify It n = 7	Market-Educate n = 5	Communicate n = 3	Focus on Env, not Money n = 3	Involve Admin. n = 2	Stand Your Ground n = 2	
	Involve Students n = 4	Demonstrate Waste n = 3	Start Begin. Semester n = 3	Use Savings on Students n = 2		Ease Into n = 1
				Waste Trials n = 2		